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C O N T E N T S

FACTORS INFLUENCING THE TRAINING NEEDS OF FARMERS IN SHEEP AND GOAT PRODUCTION MANAGEMENT PRACTICES IN EKITI STATE, NIGERIA

Olabode Stephen ALABI[1], Victor Ogbonnaya OKORIE[2], Tiwalola Oyeyinka ALABI[3], Adedayo Olufemi AJAYI[4]

[1]Federal University of Agriculture, Department of Agricultural Administration, Abeokuta, Nigeria, Phone: +2347032666007, Email: adekunleagbeja@gmail.com
[2]Northwest University, Department of Politics and International Relations, Maffikein, South Africa Phone: +27731793909, Email: vicokoria@yahoo.com
[3]Ogun State Agricultural Development Project, Abeokuta, Nigeria Phone: +2347033100927, Email: tiwalolaakinsola@yahoo.com
[4]Obafemi Awolowo University, Department of Agricultural Extension and Rural Development, Ile-Ife, Nigeria Phone: +2348034092337, Email: dayoajayi218@yahoo.com

Corresponding author: adekunleagbeja@gmail.com

Abstract

The study considered the training needs of sheep and goat farmers in Ekiti state, Nigeria. Specifically, the study profiled the socio-economic characteristics of sheep and goat farmers, assessed their knowledge and skill in small ruminant production management practices, determined the productivity of their management practices, identified their training needs and isolated factors influencing it. A total of 183 respondents for the study were selected via a multi-stage sampling procedure. Data for the study was collected using interview schedule and analysed using appropriate descriptive and inferential statistical tools. The average age of the farmers was 50 years and 88.0 per cent of them were literate. The average yearly income from small ruminant production was ₦9, 041. Farmers' level of knowledge was highest in identification of sick animals (x =9.1) but lowest in vaccination (x =1.3). The level of skill of farmers was highest in feeding of animals (x =4.3) but lowest in health management (x =2.5). The average productivity for goat in the study area was ₦29, 642 with many (62.8%) of the farmers producing below the group average value. Also, the average productivity for sheep was ₦50, 066 with 53.0 per cent of the farmers producing below the group average. Construction of modern houses and health management practices are some of the identified training needs of the farmers. Furthermore, age of farmers, their contact with extension agents and level of skill were some of the factors influencing their training needs. The study recommended that the identified training needs should be emphasized in any capacity building programme aimed at improving the productivity of small ruminant farmers in the study area.

Key words: *small ruminant, farmer, training needs, productivity, production management practices*

INTRODUCTION

Animal production is a major aspect of the family farming business in a typical rural economy. It is as old as crop production and it ensures substantial contribution to alleviate household poverty and enhance nutritional status through increased household income. Literature is full on the important roles that livestock play in the economies of semi-arid Africa. According to [10] the early literature centred on the cosmological aspects of cattle and other livestock in many African societies, on their influence in the generation of prestige, and on the aesthetics of possessing large herds. The continuing importance of livestock is still very prominent in the value system of many different communities in Africa. For instance, it is reported that in various parts of Burkina Faso, the cattle not the monetary equivalent remain the important aspect of bride price payment. This is equally true among the Yoruba in Southwest Nigeria where goat and not the cash equivalent remain the important component of bride price payment in the rural setting.

According to [20] livestock production in the rural areas is of two major significance. The first one is the socio-economic role and the other, biological role. The biological role of livestock ensure the provision of animal protein that runs the *chemical-wheel of life* through such animal products as eggs, milk, cheese, meat and other animal products. From the socio-economic stand point, livestock plays the visible roles of wealth creation, income generation and provides a good opportunity to utilize lands not suitable for crop production. According to them, as part of mixed farming practices in the set of effective combinations of enterprises, livestock plays the roles of enhancing productivity and farm incomes as well as ensuring minimization of production risks and uncertainty.

Livestock basically can be categorized into ruminants and non-ruminant animals. The ruminant animals possess complex stomachs and are able to digest grasses and shrubs in large quantities. Non-ruminants on the other hand are without rumen in their digestive tract. Furthermore, ruminant can be further categorised into large and small ruminants. Example of large ruminant is cattle while sheep and goat fall into small ruminant category. Pig, poultry and rabbit belong to the non-ruminant category [12] [7]. It is an age long hypothesis that farm families raise livestock as a buffer to insulate their consumption fluctuations in income. African livestock farmers rarely kill their animals for meat consumption, rather, they prefer to sell the animal and settle whatever the pressing need of the moment is. Livestock affords farmers a ready source of cash for such domestic expenses like clothing, food, taxes, school fees and marriage expenses. Instead of marketable produce or a paying job, many farmers rely on their livestock during the dry season [14] [10]. [5] reported that small ruminants form a major part of the social life and the farming enterprises of the people in the southwest region of Nigeria. Furthermore, sheep and goat production generates additional incomes for the rural people and thereby serves as a buffer against uncertainties in the crop production aspect of the family farming business. It is equally a plan for financial reserve for farmers [8] [1] [17]. Over the years, livestock production and specifically small ruminant production in the rural areas has been with a woman face in the sense that majority of the people in it are of the female gender. [14] reported that seventy-five percent of the semi-intensive livestock raising practiced by farmers in villages is carried out by women and that hundred percent of rural women raise small animals. This he practically concluded to be their only method of saving. To him, such money is important in helping women to be independent. Though livestock production adds to women's already heavy workload of running the home, it is a means of empowerment and an established security for women. Despite the much potential of small ruminants to improve the economy of the rural farm families in Nigeria, it has been recorded that the level of domestic production still lags behind the demand [15] [18] [5]. This low production is rooted in many factors like genetic composition of the local breeds of animals that is not as efficient like the exotic breeds, the ecological environment of tropical Africa which is full of many kinds of weeds, microbes and insect pests causing and transmitting serious animal diseases and inefficient management practices that deals with housing, feeding, vaccination among others [20] [13] [21] [5].

There is therefore, need for sheep and goat farmers to improve their knowledge and skill in small ruminant production management practices thereby boosting their competence in small ruminant production. They need improved knowledge on good foundation stock animals and also skills in modern and improved rearing methods and other production management practices needed for standard desired performance. Furthermore, they need to develop positive attitude towards the adoption of time tested proven methods of livestock production and also start to see small ruminant production as a worthy business venture, not just an addendum to crop production. All these could be achieved through capacity development programmes. Capacity development can be ensured via training and re-training of the farmers. Training is the acquisition of skill, knowledge and behavioural change that is needed in a specific job situation to give a better performance in terms of effectiveness, efficiency and overall quality output [3]. It is not just cramming information into the heads of trainees but it involves interaction between the trainer and trainees through which the trainees becomes proficient in applying the acquired knowledge and skill [4]. For training to be effective, it must be based on identified training needs established using carefully selected and appropriate analytical tools. This study therefore seeks to determine the training needs of farmers in sheep and goat production management practices in Ekiti State, Nigeria with a view to understanding the crucial factors influencing it.

Objectives of the study

The specific objectives of the study were to:
(i)profile the socio-economic characteristics of sheep and goat farmers in the study area;
(ii)assess the sheep and goat farmers' levels of knowledge and skill in small ruminant production management practices;
(iii)ascertain the productivity of sheep and goat farmers production management practices in the study area;
(iv)determine the training needs of sheep and goat farmers in the study area based on 2 above;
(v)identify the factors influencing the training needs of farmers in sheep and goat production management practices in the study area.

MATERIALS AND METHODS

The study was conducted in Ekiti State in southwest geopolitical zone of Nigeria. The population of the state according to 2006 population census was put at 2, 398, 957 people. Also, the state has a land mass of 5, 435 km^2 [13]. The Ekiti people are culturally homogeneous and speak a dialect of Yoruba language known as Ekiti. Agriculture is the main occupation of majority of the residents in the state. Notable among the crops grown in the state are: Oil Palm; Cocoa and Kolanut while notable food crops grown in the state include Yam, Maize, Cocoyam, Pepper and Tomato among others. The state is one of the rice producing states in the Nigeria. Many of the men and women in the state keep small ruminants. Agricultural Development Project (a government parastatal domiciled in each state of the Federation to see to Agricultural Extension Service delivery) divided the state into two zones for proper coordination: Aramoko and Ikole zones. Respondents for the study were selected using a multi-stage sampling procedure. The first stage involved a purposive selection of 2 Local Government Areas (LGAs) each from the two ADP zones based on the findings of a reconnaissance survey. This gave a total of four LGAs. The second stage involved the proportionate selection of 25 per cent of the communities in each of the four LGAs to give a total of 15 communities. The third stage involved a random selection of sheep and goat farmers from the communities based on the size of the communities. In all, a total of 183 sheep and goat farmers were selected for the study. Data for the study was collected via duly validated interview schedule. Selected socio-economic characteristics like age, number of year of formal education, year of experience in small ruminant production, size of flock, contact with extension agent and income from small ruminant production were measured in their actual numbers. Farmers' level of knowledge in sheep and goat production management practices was measured on a checklist while their level of skill was measured on a 5 point Likert scale. Small ruminant farmers' level of knowledge in the various production management practices was classified into high and low categories using the equal interval approach [19][5]. Furthermore, farmers skill in sheep and goat production management practices was categorised into high and low using 3.05 as the cut point: 0-3.05 was categorised as low while 3.05-5.0 was categorised as high [2][5]. Small ruminant farmer's flock size for goat and sheep was also measured in their actual numbers. The number of male and female animals above the weaning age was recorded while the number of male and female animals below the weaning age was also recorded. These were multiplied by the average prices in the established small ruminant markets for each category. The productivity for the production management practices was calculated by the product of the number of the animal in each of the four groups with the current market prices for each group. The average was therefore, calculated for the total respondents. Respondent who score above the group mean was considered high productivity while respondent who score below the group mean value is considered low productivity [5]. Skill and knowledge gap model was used to determine the training needs of sheep and goat farmers. Relevant descriptive statistics was used in summarizing the data collected and Multiple Regression Analysis was done to determine the factors influencing the training needs of the small ruminant farmers in the study area.

The regression model for the study was given as

$$Y=a+b_1x_1+b_2x_2+b_3x_3+\ldots b_{14}x_{14}$$

where:
x_1 = age of farmers,
x_2 = year of formal education,
x_3 = household size of farmers,
x_4 = household assistance in livestock production,
x_5 = organization membership score,
x_6 = number of year in small ruminant production,
x_7 = number of goat kept,
x_8= number of sheep kept,
x_9= income from small ruminant,
x_{10}= information sources utilized,
x_{11} = cosmopoliteness of farmers,
x_{12} = level of skill,
x_{13} = level of knowledge and
x_{14} = number of contact with extension agent.

RESULTS AND DISCUSSIONS

Selected socio-economic characteristics of the respondents

Results presented in Table 1 reveal that the average age of the small ruminant farmers was 50.4 years and that 78.7 per cent of them are males. Also from the table, a majority (83.6%) of the small ruminant farmers had one level or the other of formal education. This implies that small ruminant farmers in the study area are literate. This characteristic could help the farmers in accessing production information in various formats ranging from verbal communication to the use of print media and via the increasing social media platforms. The mean family size of the sheep and goat farmers is 6. This finding is in line with [9] who earlier established the average family size in rural Nigeria to be 6. Many (54.1%) of the farmers had family size between 6 and 10 members. Majority (80.9%) of the sheep and goat farmers are married. This could serve as a buffer against social pressure and also help provide necessary assistance in ensuring the welfare of the animals.

Table 1. Distribution of respondents by their socio-economic characteristics

Variables	**Frequency**	**Percentage**	**Cent. Tendency**
Age in years			
< 35	13	7.1	X= 50.4 SD = 10.0
36-45	42	23.0	
46-55	74	40.4	
56-65	43	23.5	
66+	11	6.0	
Sex			
Female	39	21.3	
Male	144	78.7	
Educational level			
No formal education	30	16.4	
Primary education	51	27.9	
Modern school	16	8.7	
Secondary education	37	20.2	
BSc/HND	31	17.0	
MSc/PhD	18	9.8	
Family size			
Up to 5	81	44.3	X= 6.0 SD = 2.3
6-10	99	54.1	
11+	3	1.6	
Marital status			
Single	4	2.2	
Married	148	80.9	
Divorced	4	2.2	
Widowed	24	13.1	
Separated	3	1.6	
[x]Organisational membership			
Religious organization	97	53.0	
Cooperative society	106	57.9	
Esusu group	59	32.2	
Voluntary organization	22	12.0	
Contact with Extension Agent			
Once per month	20	10.9	
Fortnightly	106	57.9	
Weekly	13	7.1	
Not at all	44	24.0	

[x] multiple responses, X = Mean, SD = Standard deviation, Source: Field survey, 2010.

Also from the table, majority (91.8%) of the small ruminant farmers had up to five of their family members assisting in small ruminant management practices. As seen from the table, all the sheep and goat farmers are members of one social group or association. This characteristic could be leveraged for information dissemination on sheep and goat production [6] and also could be useful in marketing of small ruminant products.

About 57.9 per cent of the farmers had contact with extension agents fortnightly while 24.0 per cent of them had no contact with extension agent at all. Farmers contact with the extension agents could help facilitate their capacity development in small ruminant production management practices.

Results in Table 2 reveal that the average year of experience of the sheep and goat farmers is 13.3 years. Almost half (47.5%) of them had up to 10 years' experience in sheep and goat production. This reveals that small ruminant production is not a new venture although its popularity seems to be improving per day due to increased awareness and more demand. Majority (78.1%) of the small ruminant farmers bought their foundation stock while 9.8 per cent and 10.9 per cent got theirs through gift and inheritance respectively. The average flock size for goat and sheep in the study area is 6 and 3 respectively. This established a ratio 1:2 for sheep and goat population in the study area. This according to [11] could be as a result of the higher demand for goat meat in everyday life among the people in both the rural and urban centres in southwest geopolitical zone of Nigeria.

Also, it could be due to the preference for goat for sacrificial and various other traditional rites and festivals among the Yoruba in the southwest geopolitical zone of Nigeria. Also from the table, the average annual income from small ruminant production was ₦9, 041 with 63.9 per cent of the farmers making less than or equal to ₦10,000 yearly from small ruminant production.

Considering the vast potential of sheep and goat production, the average yearly returns of the farmers seems too low. This might not be unconnected with the fact that most farmers do not consider raising small ruminant as a business that should generate profit.

Table 2. Distribution of respondents by small ruminant production characteristics

Variables	Frequency	Percentage	Cent. Tendency
Experience in small ruminant production (year)			
Up to 10	87	47.5	X = 13.3 SD = 2.82
11-20	66	36.1	
21-30	25	13.7	
31+	5	2.7	
Source of foundation stock			
Gift	18	9.8	
Purchase	143	78.1	
Inheritance	20	10.9	
Special programme	2	1.1	
Number of goats owned			
Up to 5	81	44.3	X= 6.0 SD. = 2.0
6-10	101	55.2	
11+	1	0.5	
Number of sheep owned			
Up to 5	163	89.1	X = 3.0 SD = 2.3
6-10	19	10.4	
11+	1	0.5	
Income from small ruminant production in naira (annual)			
< 10, 000	117	63.9	X = 9, 041 SD = 7, 478
10, 001-20, 000	56	30.6	
20, 001-60, 000	10	5.5	
[x]Source of information on small ruminant production			
Friends and neighbor	71	38.8	
Extension agent	131	71.6	
Radio	50	27.3	
Television	37	20.2	
Printed materials	5	2.7	
Cooperative meeting	3	1.6	

[x] multiple responses, X = Mean, SD = Standard deviation
Source: Source: Field survey, 2010.

As seen in Table 3, extension agents (71.6%), friends and neighbor (38.8%), Radio (27.3%) and Television (20.2%) are the leading sources of information on sheep and goat production utilized by the farmers in the study area. Although many of the farmers are educated, yet they did not readily access production information via printed materials. This may be due to limited availability of useful printed materials in various aspects of sheep and goat production.

Farmers Levels of Knowledge and Skill in Small Ruminant Production Management Practices

The weighted mean scores of knowledge and skill in the various production management practices studied were presented in Table 3. Results in Table 3 reveal that farmers knowledge in sheep and goat production was highest in identification of sick animals (x = 9.1). This was followed by selection of foundation stock (x = 6.5) and housing of animals (x = 5.9).

Table 3. Rank-order of respondents weighted mean scores on knowledge and skill in selected small ruminant production management practices

Small ruminant production management practice	Mean	Remark
	Knowledge	
Vaccination	1.3	Low
Record keeping	1.7	Low
Drug selection and administration	2.4	Low
Care of newborn	4.0	High
General routine management	4.1	High
Feeding of animals	4.0	High
Housing of animals	5.9	High
Selection of foundation stock	6.5	High
Identification of sick animal	9.1	High
	Skill	
Health management	2.5	Low
Selection of drugs	2.6	Low
Administration of drugs	2.6	Low
Diagnosis of sick animals	2.7	Low
Slaughtering and dressing of animals	2.9	Low
Construction of modern sheep and goat houses	2.9	Low
Care of newborn	3.2	High
Compounding of small ruminant feeds	3.2	High
Treatment of common diseases	3.5	High
Identification of sick animals	3.7	High
Use of local methods and resources	3.8	High
Feeding of animals	4.3	High

Source: Field Survey, 2010.

Also from the table, small ruminant farmers recorded low knowledge in the following management practices: drug selection and administration (x = 2.4), record keeping (x = 1.7) and vaccination of animals (x = 1.3). Furthermore, results in the table reveal that sheep and goat farmers skill in small ruminant production management practices was highest in feeding of animals (x = 4.3) followed by their use of local methods and resources in production (x = 3.8) and identification of sick animals (x = 3.7). The farmers skill was low in diagnosis of sick animals (x = 2.7), selection of drugs (x = 2.7) and health management (x = 2.5) among others. The high knowledge and skill of the small ruminant farmers in some of the management practices could be attributable to their level of participation in those practices which in turn might help boost their experience in those practices whereas the low levels of knowledge and skill in the remaining management practices could be due to the complex nature of those practices and the technical know-how expected in carrying them out [6].

Productivity of Small Ruminant Farmers Production Management Practices

Results presented in Table 4 show the productivity of farmers' management practices measured in monetary terms for both sheep and goat. The average productivity (worth of the flock in monetary value) for goat is ₦29, 642 with a standard deviation of ₦8, 232 while that of sheep is ₦50, 066 with a standard deviation of ₦11, 388. The findings of the study showed that 62.8 per cent of the sheep and goat farmers had low productivity in goat production while 53.0 per cent of them had low productivity in sheep production. This implies that the productivity of the management practices of the farmers in both sheep and goat production are below average value in the study area. However, the productivity of sheep is relatively higher than that of goat despite that goat population doubled that of the sheep population in the study area.

Table 4. Distribution showing productivity level of management practices of small ruminant farmers

	Frequency	Percentage	Central tendency
Goat			
< ₦30,000	116	62.8	
₦30, 000 – ₦60, 000	65	35.6	Mean = ₦29, 642
Above ₦60, 000	2	1.6	Std. dev. = ₦20, 232
Productivity level			
Low productivity	115	62.8	
High productivity	68	37.2	
Sheep			
< ₦30, 000	50	27.3	
₦30, 000 – ₦60, 000	60	32.8	Mean = ₦50, 066
₦60, 000 – ₦100, 000	59	32.2	Std. dev. = ₦39, 388.1
Above ₦100, 000	14	7.7	
Productivity level			
Low productivity	97	53.0	
High productivity	86	47.0	

Source: Field survey, 2010.

Identified Training Needs of Farmers' in Sheep and Goat Production

The training needs of the small ruminant farmers' in sheep and goat production were identified from the results presented in Table 3 above. Based on knowledge and skill gap analysis, the production management practices with low mean scores in knowledge and or skill presented the areas of training needs. These are the areas that promise better returns on the productivity of sheep and goat farmers if they learn new ways or methods of doing them. The identified areas of training needs included slaughtering and dressing of animals (2.9), construction of modern sheep and goat houses (2.9), diagnosis of sick animals (2.7), drug selection and administration (2.6), and health management (2.5). This corroborates the findings of [2] who identified feeding of animals, selection and administration of drugs as some of the training needs of women farmers in Oyo state, Nigeria. The management practices above could be seen to be somehow abstract, complex, technical or highly specialized in nature according to [5]. These might account for the observed low levels of knowledge and skill in the said management practices.

Factors influencing farmers Training Needs in small ruminant production management practices

Table 5. Result of Multiple Regression Analysis

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	50.572	9.454		5.349	.000
age of respondent in years	.284	.075	.377	3.798	.000
year spent in school	2.056E-03	.119	.002	.017	.986
household size of respondent	-1.083	.321	-.325	-3.377	.001
household assistance in livestock	-3.924E-02	.394	-.009	-.100	.921
organizational membership score	-.407	.359	-.088	-1.133	.259
number of year in small ruminant production	-.142	.083	-.155	-1.721	.087
number of goat owned	.208	.290	.054	.717	.475
number of sheep owned	-.812	.255	-.248	-3.186	.002
income from small ruminant	1.117E-05	.000	.011	.135	.893
income from major occupation	4.369E-06	.000	.131	1.660	.099
total income	-1.172E-06	.000	-.013	-.135	.893
information sources utilized	-.390	.977	-.031	-.399	.690
number of training attended in the past	.209	.545	.030	.383	.702
cosmopoliteness	.298	.237	.099	1.256	.211
level of skill	.153	.063	.189	2.438	.016
perception on small ruminant	.176	.145	.090	1.212	.227
communication pattern	.254	.266	.080	.955	.341
research extension role	-1.245	.509	-.188	-2.443	.016
government policy	.129	.543	.017	.237	.813
reason for keeping sheep and goat	.192	.170	.087	1.135	.258

R = 0.538, R^2 = 0.290, Adjusted R^2 = 0.197, Std. Error of the Estimate = 6.76245, F = 3.131, Sig. = 0.000

Results of the multiple regression analysis carried out (Table 5) reveal that the F statistics was significant.

This implies that the regression model is fit for explaining the variance in the training needs of farmers in sheep and goat production management practices in the study area. The result revealed a medium relationship (R = 0.538) between the training needs of farmers in sheep and goat production management practices and the various independent variables of the study. Also, the result revealed that the regression model explained 29.0 per cent (R^2 = 0.290) of the variance in the training needs of farmers in sheep and goat production management practices. The result presented in Table 4 also showed the coefficients of the various independent variables of the study. As seen from the table, age of farmers (b=0.284), household size of farmers (b=-1.083), number of sheep kept (b=-0.812) at 0.01 level were significant. Furthermore, level of skill of the farmers (b=0.153) and number of contact with extension agents (b=-1.245) at 0.05 level were also significant.

This finding establishes these variables as the key factors influencing the training needs of farmers in small ruminant production management practices.

CONCLUSIONS

Empirical facts from the study led to the following conclusions. The small ruminant farmers were in their middle ages and majority of them were literate and belonged to at least one social or religious association. Also, income accrued to farmers from small ruminant production was very low and farmers', despite being literate do not get information on sheep and goat production via printed materials. The study concluded further, that farmers' knowledge and skill was low in some of the small ruminant production management practices. Furthermore, the productivity of the sheep and goat farmers was higher in sheep production than goat production and many of the farmers need to improve on the productivity of their management practices. The training needs of small ruminant farmers were in the management practices that are somehow abstract, technical or highly specialized. Furthermore, age of farmers, number of sheep kept, contact with extension agent, and farmers' household size together with their level of skill were the crucial factors influencing their training needs in small ruminant production management practices. Based on these conclusions, the study recommends that the training needs identified should be prioritised whenever any programme that will improve the competence of farmers in small ruminant production is being considered. Emphasizing these production management practices in any intervention programme towards improving livestock husbandry will boost sustainable small ruminant production and also improve the productivity of farmers' production management practices in sheep and goat production. Furthermore, the study also recommends that adequate information be supplied to the farmers so as to see small ruminant production as a key business with huge financial potential and not just a hobby nor an addendum to the family farming business.

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ROMANIAN VEGETABLE SECTOR A STUDY ON ITS CURRENT DEVELOPMENT

Cornelia ALBOIU

Institute of Agricultural Economics, The Romanian Academy Bucharest, Calea 13 Septembrie no. 13, District 5, 050711464, Bucharest, Romania, Phone: +40213182411, Fax:+40213182411, Mobile:+40721379120, Email:coraalboiu@yahoo.com

Corresponding author: coraalboiu@yahoo.com

Abstract

The accession to the European Union has not brought about significant structural changes of the vegetables chain, this continuing to be highly fragmented, with an extremely great number of individual producers (over 85%), a relatively small number of industrial processors with high concentration level, and a well-developed retail sector that has significantly grown recently. The low organization level of vegetable farmers into producer groups/organizations/cooperatives completes this picture and reveals a reduced level of integration and contractualization. In these conditions, the question is how well-prepared the vegetable sector is to cope with the consequences of a possible accession to the euro area.

Key words: *structural change, vegetable supply chain*

INTRODUCTION

At present, the modernization and expansion of the agricultural sector in developing countries is taking place in the context of relevant structural changes in the agri-food industry. In the past, in many developing countries, agricultural production was based on activities carried out within the family farms, while in recent years, it is directed to larger firms that are more integrated in the agricultural production and distribution chain (Boehlje, 2000) [1]. In addition to this situation it can be noticed a trend of reforming the markets that has taken place recently as a means of liberalizing world trade which has lead to more cooperation and globalized markets (Barrett & Li, 2002) [2]. In particular, the structural adjustment programs that have recently taken place in developing countries, have resulted in greater integration of world agricultural markets (Reardon & Barrett, 2000) [9]. According to the result of a research study carried out by Suri and Sushil (2006) [12], strong relationships among companies are very often met in the commercial world but rarely noticed among governmental organizations for agricultural development . Based on a definition by Mighell and Jones (1963) [6], it is conceptualized that the market price, contracting and cooperation and vertical integration, either in a single manner or all together, are some of the alternative means of coordination of the agricultural value chain. Having the root on this definition, the concept of vertical coordination has been analyzed by Hobbs and Young, (2001) [5], who concluded that it refers to a variety of market mix possibilities, starting from open markets and local transactions and reaching to total vertical integration, but also going even further to strategic alliances and joint ventures.

The same concepts were used also by Hann et all [4] when studying the pork processing industry in China. According to a study by Goodhue Rachael et all, (2010) [3] contractualization and other type of vertical cooperation represent considerable components of the supply chain for various agricultural products. At the same time, in order to enhance the life of the small agricultural producers and rural areas Singh et all (2009), [10] have developed a few models taking into consideration local context and several variables referring to local territories.

Demand for enhanced vertical coordination in the agrifood system is examined by Myers et all (2010) [8] as a mean of satisfying increasingly various consumer preferences who are changing the background the participants to supply chain has to cope with. Moschini, Menapace and Pick (2008) [7] argues on the idea that the economics of geographical indications (GIs) is evaluated within a product based on a vertical structural differentiation which comes along with the competitive organization of agriculture.

Regarding the vegetable supply chain, Singh and Mishra [11], made a review of literature in the field of vegetable supply chain by providing a comprehensive research study on this concept.

In Romania vegetable supply chain is quite wick and several variables which led to this situation were analyzed in the research studies presented above reflecting different realities in different countries but also suggesting the trends in the agrifood world. In the following paragraphs some of the above concepts are analyzed and in addition to that, the impact of Common Agricultural Policy is briefly reviewed, along with an indicator of competitiveness namely gross added value.

MATERIALS AND METHODS

The objective of this research study is to identify the main trends of the vegetable supply chain in the recent years. For this purpose a quantitative and qualitative research was employed. Specific statistical indicators such as: gross value added, gross value added per annual work unit and prices were used. Comparative analysis is also used to rank Romanian vegetable sector within European Union sector. The data source is represented by various databases such as tempo on-line INS, Eurostat, FAO.

RESULTS AND DISCUSSIONS

The farm structure and productive structure along the chain is analysed in the following paragraphs.

At farm level, out of the total number of vegetable farms, 85% are smaller than 5 ha, 10 % have 5 – 10 ha, and only 5% have more than 10 ha. From the economic point of view, the farms with a standard output under 2,000 euro have the highest share, i.e. 42%, followed by those with a standard output from 2,000 to 3,999 euro (27%). Only 1% of farms have a standard output from 15,000 to 24,900 euro per year. At the opposite pole, the concentration level of processing firms and of the retail sector is much higher than in the primary vegetable sector. The market share of the first 5 processing companies in Romania is 55% (in the European Union represents 56%), whereas the market share of the first 5 large retailers exceeds 60%. Although Romania has a high horticultural potential, ranking 10th in terms of vegetable production in the European Union in the year 2016 (9th in in the year 2007), the vegetable sector is still characterized by low productivity (yields are 3-4 times lower than the EU average in cabbages, for instance, or there are even much larger gaps in tomatoes, for instance). This results in an insufficient domestic supply of vegetables, under fresh form and mainly for agro-processing, self-supply in the period 2007-2016 largely fluctuating from 78 to 87%, to reach a maximum of 93% in 2011.

Cooperatives

The primary vegetable sector is facing important logistic problems (precarious infrastructure, insufficient storage facilities) as well as an acute lack of organization of the chain, which leads to difficulties in selling the production, low contracting level, low bargaining power of farmers and a poor adaptation to consumers' needs. At present, out of total 107 producer groups in agriculture, 24 producer groups are in the sector of vegetables, i.e. 25%. Practically only 1% of farms in the vegetable growing sector belong to a producer group. The consequence of this situation is the very low contracting level of production and a poor participation and understanding of the vegetable market organization measures in the EU by farmers. Hence the EU market organization regulations in the vegetables sector are not applied in Romania, except for only one producer organization, as most farmers do not know them and they can be accessed only through producer organizations.

Prices

In the EU, food prices have increased more than the prices of other consumer goods, due to the increase of consumer demand and of input prices, which resulted in inflation growth. Two important aspects are worth noting, in relation to the evolution of prices along the chain: the extremely high price volatility and the asymmetry of their transmission along the chain. The prices of vegetables in Romania have constantly had values smaller than the EU average, yet they are highly volatile. Price volatility is higher at farmer level (tomatoes have the highest volatility) and lower at consumer level. The sector of vegetables has the highest price volatility at the level of farmers (9-10%) compared to the EU average (4-5%), mainly due to the high volatility of yields; EU membership has slightly moderated their volatility, mainly in the winter period.

Gross value added

The processing industry and preservation of vegetables and fruit represents a low percentage of the value added in the food sector, i.e. about 3%, next to the sector of meat and meat preparations, flour products and dairy. At the level of agriculture, the share is also relatively low, under 3%, and GVA/AWU in the horticultural sector is extremely low compared to other European Union countries (both the old and the new member states, Table 1). The distribution of the value added along the chain is unbalanced mainly due to the lack of price transparency on the market and to the low contractualization level.

Table 1. Value added/AWU in the horticultural sector (Thousand euros)

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Romania	6	3	3.3	2.6	2.5	4.3	2.3	1.6	2.7
Poland	7.4	7.2	8	7	7.5	8.6	9.2	10.7	8.4
Hungary	12.8	7.7	14.3	11.6	13	14.8	12.4	14.7	14
France	21.2	20.2	24.4	21.2	24.7	23.5	23.1	27.8	28.8
Spain	18	19.5	22	15	19	19.1	19.2	22.7	18.7
Bulgaria	3.3	2.9	2	2.1	2.3	2.4	4.1	3.4	3.9
Greece	13.2	12.2	13.4	10	10	10	13.4	12.6	11.2
Nether lands	35	33	47.3	40.2	44	44.4	46.3	54.2	5.7

Source: FADN database, 2018

Although the supply of vegetables is quite diversified, this has quite a low value added, mainly due to the precarious organization of farmers (about 1% organization level compared to 45% the EU average). The consequence of this situation implies insufficient marketing activities meant to provide attractiveness and food safety for consumers, and an insufficiently developed logistic and storage system.

CAP impact on the vegetable sector

Lower access to and lower absorption of the financial support coming from NRDP 2007 – 2014 funds by the horticultural sector can be noticed, as compared to the other agricultural sub-sectors. At the same time, the access and absorption of funds from CAP Pillar I for setting up producer groups in the vegetable sector had the lowest level (23 mil. Euro – absorbed European funds) compared to the other EU New Member States where the absorption was much higher (for instance, in Hungary, the level of absorbed funds from Pillar 1 was double compared to Romania), which contributed to maintaining a poor organization of the vegetable market.

As regards the absorption under the current NRDP (2013-2020), although a stimulation of investments in the horticultural sector was desired compared to the other agricultural sub-sectors, the figures at the level of the year 2017 reveal a very low absorption, the investments under Measure 04 (investments in physical assets) representing 1.1%, while under Measure 06 (Development of farms and enterprises) 11%.

In Romania's vegetable sector, the low yields and the weak organization of the chain are also reflected in the comercial balance.

The fluctuating trend of self-supply after 2007, the very low organization level of the chain and the deficit in the balance of trade show that CAP impact on this sector is modest and the sector has not succeeded in capitalizing on the financial opportunities provided by CAP, mainly those offered under Pillar I for chain organization through producer groups and producer organizations.

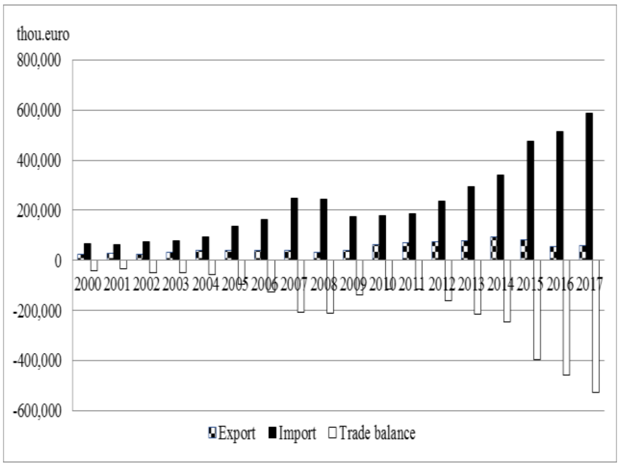

Fig. 1. Balance of trade in the group *Vegetables, roots and tuber crops*
Source: http://trade.ec.europa.eu/tradehelp/

CONCLUSIONS

In the European Union, the Common Market Organization provides support to the setting up producer groups and other association forms in the vegetable sector. While in Netherlands the organization level is 104%, and the EU average is 34%, in Romania the producer organization level is extremely low, under 1%, which is reflected in a negative balance of trade and low level of integration and contractualization on the supply chain. In order to improve this situation, a solution would be to provide fiscal facilities for the farmers who are organized into producer groups and especially to offer consultancy for a period of at least 5 year from the moment of setting up the producers group so that the group learns from the bottom how its business can work and what are the advantages and the support offered by the EU for the group's functioning and also in a case of occurrence of a possible safety crisis on the vegetable sector. In addition to this, there is a strong need for improving the contractualization level in the Romanian vegetable supply chain.

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BEST PRACTICES IN THE EUROPEAN COUNTRIES FOR COMPLYING THE NAGOYA PROTOCOL

Maria-Mihaela ANTOFIE, Camelia SAND SAVA

University "Lucian Blaga" of Sibiu, Faculty of Agricultural Sciences, Food Engineering and Environment Protection, 7-9 Dr. Ioan Rațiu, 550012, Sibiu, Sibiu county Romania
E-mails: mihaela.antofie@ulbsibiu.ro, camelia.sand@ulbsibiu.ro

Corresponding author: mihaela.antofie@ulbsibiu.ro

Abstract

By adopting the Nagoya Protocol, the international community is responding to the 3rd objective of the Convention on Biological Diversity (CBD). It refers to the fair and equitable sharing of benefits resulting from the biodiversity use and it is the intention of the parties to the CBD to creates innovative financial mechanisms working for its conservation. For the regional level the EU adopted the Regulation (CE) no. 511/2014 for providing the harmonizing framework in the implementation of the Protocol. For the year 2017, 15 Member States' reported to the Secretariat of the CBD on the state of implementation of the Protocol on voluntary basis. The purpose of this article is to identify best practices in managing new topics for Romania in this field, such as synthetic biology, digital sequence information, biopiracy related to patenting, traditional knowledge and local communities for further development in agriculture. These subjects have also been addressed during the meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 22) which take place in 2018. Relevant stakeholders for Romania were identified and they should to be involved in the general debate on these subjects. The national consultancy is of outmost importance for developing the legislative framework in Romania by taking into account the financial costs of implying the full implementation of the Nagoya Protocol.

Key words: *synthetic biology, biopiracy, best practices, digital sequence information on genetic resources, traditional knowledge, local communities, Nagoya Protocol*

INTRODUCTION

Biodiversity is at the heart of world economy since the origin of humankind and starting with 1992, the year of the Convention on biological diversity (CBD) adoption, it is more than ever acknowledged the relevance of its impact on our sustainable development [15]. After 1992 a myriad of subjects and their attributes or characteristics have been identified and defined for supporting our future sustainable development. Among these subjects, agro-biodiversity as a concept was under constant negotiations and new attributes were given in direct connection with bio-economy. Interconnecting biodiversity with socio-cultural and economic values was very well captured in the text of the Convention [39]. If species and ecosystems were easy to be evaluated, for genetic resources took almost 18 years up to the momentum when the Protocol was adopted [27]. The Protocol is interconnecting a broad range of research fields and it is supporting among others the conservation of traditional knowledge (TK) as a cultural value related to indigenous local communities (ILCs) or local communities (LCs) in line with Art. 8 j) of the CBD. TK is relevant for agriculture development. This can be also associated to local knowledge in case of rural communities. This knowledge is relevant for biodiversity conservation as well as access to genetic resources. We further need to define TK in our regulatory framework.

Principles, defining global legal frameworks, under which national regulatory frameworks for Nagoya Protocol implementation can be developed are already setting all over the world innovative financial mechanisms in scattered and different maturity grade. Not all screened countries were ready after 2010 to foster the development of their own regulatory framework for implementing the Protocol. However, the experience in different subjects generated by the Protocol can be identified almost in all studied countries at a certain extent depending on their political vision.

European Union (EU) was a leading group for finalizing the negotiation and adoption of the Protocol. Thus, in the regional context Romania as well as all Member States should implement the Protocol in a harmonized way. At the EU level, it was adopted the Regulation (EU) No 511/2014 (Regulation) for harmonizing among the EU member states the implementation of the Nagoya Protocol. As the process is too complex it was needed to develop and adopt another supplementary legal act namely the Regulation (EU) 2015/1866 for laying down detailed rules regarding the register of collections, monitoring user compliance and best practices. Standards and standardization process were needed for harmonizing the data collection from all member states. The level of compliance of the Member States towards the requirements imposed at the global level can be understood by accessing the portal of Access and Benefit-Sharing (ABS) Clearing-House (ABSCH) [2]. After three years of entering into force of the Protocol (i.e. 2017), all parties were invited to first report its implementation. 15 national reports and one of the EU have been submitted to the ABSCH by 2017. Generally, the EU countries do not encounter important problems in reporting together the implementation of the Nagoya Protocol [1].

For the national level, there are no harmonized access measures established at the EU level, especially due to different regulatory frameworks working for example for patenting as well as under the regulatory framework for intellectual property rights. Another issue is related to defining and harmonizing the checkpoints on the ABS chain of activities at the EU level. Based on the Regulation a major check-point is defined in the Art. 4 of the Regulation. Other checkpoints can be depicted when considering gathering due diligence declarations. Such declarations are meant only when on the market will be placed products after accessing genetic resources and associated (TK). These issues related to checkpoints were first mentioned in 2011 [10]. Romania as Member States into the EU makes efforts in complying the provisions of the Protocol as well as of the current EU Regulatory framework. However, the novelties of the subject in managing certain subjects defined by the Protocol are delaying the taken into action at the national level. The scope of this article is to emphasize best practices related to specific subjects encountered during the Nagoya Protocol implementation for all the 15 Member States that reported to the ABSCH to provide a better understanding regarding the expertise needed for experience exchange inside the EU. The targeted subjects are as following: synthetic biology (SB), biopiracy, TK and LCs in close connectivity to agriculture development. These subjects are matters international negotiation for further developing procedures and they were intensely discussed during the 22nd meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 22) from 2-7 July 2018 followed by the meeting of the Subsidiary Body on Implementation (SBI 2) that took place between 9-13 July 2018 [3].

MATERIALS AND METHODS

This paper follows a top-down approach [24] to identify and discuss potential subjects relevant for our country in the implementation of the "*Nagoya Protocol Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization*". The Protocol implementation is harmonized at the European Union level between the members states based on the "*Regulation (EU) No 511/2014 of the European Parliament and of the Council of 16 April 2014 on compliance measures for users from the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization in the Union*". The identified subjects are discussed for the 15 EU countries that reported to the Secretariat of the ABSCH for emphasizing their expertise. The identified countries are as following: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Malta, Netherland, Poland, Slovakia, and Cyprus. The identified subjects are as following: SB, biopiracy, TK and local communities. Such subjects need to be address appropriately by the national legislation I harmony with the EU Regulatory framework. In this regard we mention that according to the Regulation (EU) No 511/2014 the key elements needing a major attention were clear: a) the legislative frame for the user's compliance (Art.4), b) the way defined to register and access the collections (Art.5), c) the focal points with the list of the competent authorities of the Member State (Art. 6), d) the monitoring of the user compliance (Art. 7) and e) surveillance (check) on user compliance (Art. 9). All these regulatory issues should be included in a chain Plan-Do-Check-Act as in a Deming wheel which transposes a quality management method PDCA in this case applied to the genetic resources [43]. According to the provisions of paragraph 2 of the Preamble, Art. 5 and 8 of the Regulation, "*all members states must provide information for voluntary tools, namely registered collections and best practices, to assist users in complying with their due diligence"* and these obligations are framed under the provisions of Art. 4. To support this approach the EC published a portal for providing complete information regarding the ABS regime also based on public consultation published in 2016 [31].

RESULTS AND DISCUSSIONS

International aspects. Among the concluding remarks of the SBSTTA, working under the CBD, it can be underlined the strong development of SB such as: broadening the organisms that can be modified, the access to new tools and technologies, the novelty in environmental risks associated with living modified organisms release. Also, it is imposed the development of tools dedicated to detection and monitoring into the environment of organisms, component derived thereof and products of SB. Such measures should be followed by news risk management rules and procedures. The impact of SB on economic growth should be connected to environmental protection to be in line with Brundtland Report [9]. Some of the above-mentioned subjects discussed by SBSTTA are already addressed by experts from the European Union countries. Thus, these countries will be analysed in this paper as potential sources of expertise to be accessed for Romania when should consider capacity building needs in this area. In this regard, new potential resources belonging to genetic resources that may be interesting for agriculture should be further discussed.

European Union designated the European Commission (EC) as the regional focal point for reporting at the regional level the status of implementation of Nagoya Protocol. We underline that the philosophy of the European Union is that countries have sovereign rights over their own genetic resources found on their territory. This will imply all genetic resources (i.e. the access to DSI and biomolecules as new resources) found *in situ* or into *ex situ* collections. For this the economic principle according to which any benefit arising from their access should be shared in a fair and equitable manner with the country providing these resources, is applied [10; 37].

Austria it is recognized among the leading countries relevant in the long process of negotiation for adopting the Protocol, and based on their report published in 2017 the Division on International Environmental Affairs of the Federal Ministry of Agriculture, Forestry, Environment and Water Management is in charge with its implementation at the national level, in the European and international contexts. According to their report harmonizing between the nine regional regulatory frameworks is the most challenging from administrative point of view. TK was not a subject of the current regulatory framework like all western European countries. Among the major goals of Austria, we may mention their interest in tracking patents such as that related to antiparasitic compounds extracted from the African plant species *Aframomum aulacocarpos* [30]. Companies in Austria are also interested in accessing digital sequence information (DSI) related to genetic resources [25].

Belgium nominated at the federal level the General Directorate for Environment of the Federal Public Service of Health, Food Chain Security and the implementation falls under the Federal, Regions and communities' levels. The authorities published a national study which underline that the implementation of the Protocol should be realized step-by-step, gradually based on a proactive approach [12]. Belgium proves it's interested in speeding the implementation of the Regulation [44] and promoting SB in different universities such as Ghent University [21]. An excellent review regarding DSI and SB was published by Belgium experts during 2013 in close cooperation with Norway [46].

Bulgaria nominated the competent authority for environment as the ABS National Focal Point NFP, responsible for managing due diligence declarations of users. This is closely working with competent authorities for agriculture and economy. At least one case is documented for Bulgaria that already applied a specific procedure of the Protocol: Prior Informed Consent (PIC). This was related to procedures developed for an animal case, in to generate Internationally Recognized Certificate of Compliance (IRCC) [25]. Bulgaria developed also a penalties system for non-compliance cases that should be a valuable expertise [35].

Czech Republic. The Ministry of the Environment as well is the ABS NFP. They are advanced in creating and developing their national framework for Nagoya Protocol implementation. Thus, starting with 2015 researchers studied ways and means to comply with Nagoya Protocol provisions regarding the use of microorganisms and in this case the use of bacteriophages for antibiotics production [4]. The use of quinoa (*Chenopodium quinoa* Willd.), for food production in European countries including the Czech Republic, was already documented for Nagoya Protocol compliance considering that the species is originating from South America and is not listed under the Plant Treaty [7].

Denmark proved a great leadership in implementing the negotiation and adoption of Nagoya Protocol aside Germany, France, Netherland, UK, Finland, Austria, Belgium, and other European members states [22]. A significant contribution to the development of the Nagoya Protocol's text was given by these EU countries aside Norway [38]. Based on these authors their interests are major and their concerns were mostly oriented to share the benefit arising from the ABS. As an NFP was nominated the Danish Environmental Protection Agency working under the Ministry of Environment and Food. According to the national legal framework, Denmark requires first a notification system implementation for ABS. At the very general level all users are required to send a standard notification to competent authority when they are bioprospecting for sampling Danish genetic resources especially for clarifying their intention in the scope (i.e. non-commercial and potential commercial use). By applying the due diligence principles regarding the former experience in ABS, Danish legislation is forbidding the access to users not complying this requirement. Also, they take care of defining the TK in connection to the ABS by applying the same principle. They are using in the estimation of the penalties and fines the potential economic benefits that may arise through the violation of the legislation in a similar way with Malt, Bulgaria, Portugal for the EU and Norway and Switzerland [35]. In this regard, the users not complying with the current regulatory framework can be even imprisoned for two years. Well defined are the checkpoints of the ABS chain that are relevant for the monitoring system as a basis for enforcement of the ABS regulation. Danish experts extended their knowledge and expertise to other countries such as Australia [35] or India [34]. The interests of Denmark are also well related to patenting as they revised the patenting legislation with specific provisions regarding the disclosure of genetic resources in patent applications like Norway or Sweden. Denmark and Sweden rank higher among the EU counties for patenting [38].

Estonia. The competent authority for environment as well is the NFP for the Nagoya Protocol. The legal framework was assessed for collecting from the wild [23]. The cooperation in the Baltic Sea with Nordic countries will make easier the process of harmonizing the implementation of the Regulation [19; 45]. The cooperation between the competent authoriy for environment with those of agriculture, education and research provides new insights for the vision of the country for crops and livestock improvement for the future.

Finland is part of the leading countries for the negotiation and adoption of the Nagoya Protocol as well. The direct connection between the Finnish Environment Institute, Natural Resources Institute and the competent authority for environment shows the strong orientation and clear vision towards focusing on research and education up to SB [6] and beyond [42] for accessing genetic resources outside the country as well.

France is one of the best examples in the negotiation for the Protocol related to biodiversity not established in Europe but belonging to countries from the EU. The interest of France is also grounded by its contribution to the Nagoya Implementation Fund managed by the Global Environment Facility (GEF) together with Norway, Switzerland and Japan [28]. Their interests go for patenting life for plants, animals, medicine, and research as well [11]. Excellent knowledge is recognized in the domain of biopiracy, in some case studies related to TK and the ABS generally [8; 5]. In this regard, it should be underlined that TK related to genetic resources was recognized in French Guyana and not in France up to 2014 [13]. Also, in France, it is established a close cooperation between Ministry for an Ecological and Solidarity Transition and the Ministry for Higher Education, Research and Innovation. French and Belgium experts published a review related to SB and its economic impact during 2016 [14].

Germany as a leading EU country in the negotiation and implementation of Nagoya Protocol has established new procedures published also in English on the website of the Federal Agency for Nature Conservation closely working with the ministerial division entitled *Competent National Authority for the Nagoya Protocol*. In Germany it was only recognized the *access to genetic resources*, and TK was not considered into the domestic legislation up to 2014 [29]. Germany has now an extensive expertise on legal issues related to biopiracy and patenting. One famous case is related to a patent based on the access to *Pelargonium sidoides* by a German phytopharmaceutical company in 2010 [29]. New concepts and innovative future development strategies are defined for the promotion of domestic bio-economy and conservation [32].

Hungary is trusting the National Inspectorate for Environment, Nature and Water with the Nagoya Protocol issues based on the first interim report published in 2017. Hungary developed already controlling activities in different ABS checkpoints and is granting access to all genetic resources for research [40]. Hungary may provide expertise for TK conceptualization and integration into the domestic legislation based on the first judgment case recorded in 1997 of intellectual property rights: Gabcikovo-Nagymaros, Hungary versus Slovakia [33].

Malta through the Plant Health Directorate was also involved with other countries in developing collection standards under the Plant Treaty [17]. Malt was also involved in the conceptualization of the CHM under the United Nations in 1967 [18] and has interests in research developments.

Netherlands is recognized internationally for their active involvement in the negotiation of the Nagoya Protocol. They are implementing the Protocol with the support of the competent authority for economic affairs, revealing among lot of countries their willingness to fully implement the sustainable principles defined by the Brundtland Report in 1987. Netherlands showed its interests in developing specific domestic legislation for access of all genetic resources and furthermore, broadened the group of experts providing expertise on the subject [12; 28]. It is worthy to mention the proactive governmental policy document *Sources of Existence* adopted in 2002 which encompasses a policy of free access to all genetic resources occurring in all Dutch. They also defined the bio-cultural heritage in direct connection with LCs and their efforts in the conservation and breeding. The ownership towards their local genetic resources it is well established based on the Dutch Civil Code. The today interest in implementing the ABS regime is going behind plant pathogens [36], bio-control [26] human and animal health [25].

Poland is represented in the Nagoya Protocol implementation by the competent authority for environment and developed procedures to develop research in the domain [16; 41].

The Slovak Republic nominated as a national focal point the Slovak Environmental Inspectorate and developed expertise in biopiracy and research [20].

Cyprus is running ABS procedures through the Department of Environment from the competent authority covering agriculture, rural development and environment. Among other different countries, Cyprus was already assessed for capacity building related plant bioprospecting from the wild [23].

Romania. The national focal point for Romania is nominated for the competent authority for environment and for the implementation of the Regulation was nominated the National Environmental Protection Agency. However, the ABS regulatory framework is not yet published on the websites and do not generated the report to the CBS-CHM. Romania do not reported under ABSCH for 2017. The conclusions of a forum run by the EC and implying 25 major stakeholders supported in 2016 the development of guidelines documents. 10 of these were governmental bodies and 15 belongs to industry and non-profit organizations. For 7 organizations there exists no membership for our country or organizations from our country and most of them may fall under agriculture interest for the country. At least 12 other organizations include our country either as public or private organizations. The list may provide an image of the type of stakeholders that need to be addresses on the subject in our country to further define the checkpoints relevant for the country (Table no 1).

By analysing the list of stakeholders, and some of the above-mentioned expertise already proved at the EU members states, it can be considered the need to further continue documentations related to some subjects. Only the University of Agricultural Sciences and Veterinary Medicine from Bucharest represented their interest for the topics proving their major impact in this domain. This expertise may be broadening in the network of the same type of public universities.

Related to biopiracy and intellectual property rights protection we need to take into consideration the need to further evaluate the impact of SB and DSI on the appropriate implementation of the Nagoya Protocol.

Table 1. EU Forum Participants and identified potential Romanian stakeholders

Crt. no.	Forum participants
1	*Arche Noah* through ADEPT Foundation
2	*Association of the European Self-Medication Industry* through RASCI Romanian Association of the Self-Care Industry
3	*BGCI (Botanic Gardens Conservation International)* through the Association of Romanian Botanic Gardens (AGBR)
4	*DNR (German League for Nature)* through 2Celsius
5	*EU Specialty Food Ingredients Group (AMFEP/EFFCA)* through: Alinda Ro srl, Azur SA and Frutarom Etol Ro SRL. *DuPont* through Pioneer Hi-Bred Seeds Agro SRL and DuPont Romania S.R.L.
6	*European Association of Bio-Industries* through companies having branches in Romania
7	*European Federation Pharmaceutical Industries & Assoc*. through pharmaceutical industry associations in Romania
8	*European Forum of Farm Animal Breeders* – not yet accessed.
9	*European Regional Focal Point for animal GR* through the University of Agronomic Sciences and Veterinary Medicine Bucharest
10	*European Seed Association* through AISR (Romanian Seed Industry Alliance) and AMSEM (Romanian Association of Breeders, Producers and Traders of Seed and Propagating Material)
11	*FoodDrinkEurope Group* (incl. COFALEC and EFFA) through ROMALIMENTA – Romanian Patronal Federation from Food Industry
12	*International Biocontrol Manufacturers* Association - not yet accessed.
13	*International Chamber of Commerce* – through - ICC Romania.
14	*International Federation for Animal Health* - not yet accessed.
15	*International Fragrances Association/UNITIS* - not yet accessed.

Source: original table based on the information available
at http://ec.europa.eu/transparency/regexpert/index.cfm ?do=groupDetail.groupDetailDoc&id=31024&no=3

The future vision of national public research needs to take into considerations these subjects that are valuable for patenting and furthermore to be integrated into the next economic policy vision at the European and global level. It is also relevant to discuss other subjects of socio-cultural importance such as TK and local communities. If TK is not yet defined by our current regulatory framework it can be further considered for its relevance to be defined as a subject related to genetic resources in the context of biological diversity conservation and mainly connected to rural communities and further agriculture development. Moreover, it should be analysed for further possibilities to connect local knowledge to the cultural identity that it is recognized according to Art. 6 of the Romanian Constitution. This would be the very first step ahead to link LCs to the proper implementation of art. 8 j of the CBD in our country to ensure for long term the conservation and sustainable use of biodiversity. Thus, TK and LCs may be defined for the first time for their integrative role for the support of biodiversity conservation and sustainable use. The presence of competent authorities for international affairs and economy would be of outmost importance in understanding the value of ABS as well as of funding new innovative financial mechanisms for agriculture especially.

CONCLUSIONS

Implementing in Romania the Nagoya Protocol is not an easy exercise. A series of subjects such as SB, DSI, biopiracy as well as TK and LCs need to be analysed and defined for the peculiarities of the country. It can be considered that an enormous amount of scientific literature was already published and covers these subjects that have been addressed also for the 22nd SBSTTA meeting and the 2nd SBI meeting under the CBD. At least 15 EU countries reported to the ABSCH during 2017 and each of them may provide excellent expertise in all identified subjects. In terms of capacity building, most of the countries included the Ministry of Agriculture among the major stakeholders aside Ministry of Environment. Therefore, agriculture should occupy a central role in Romania for further development and implementation of Nagoya Protocol. Countries such as Austria, Belgium, Denmark, Finland, France, Germany and Netherlands may provide excellent expertise in further developing domestic regulatory acts connected to implementing the Protocol as well as on SB and all related subjects. Also, Bulgaria and Hungary may provide their experience in biopiracy as well as in ABS checkpoint development under the current regulatory framework. An appropriate regulatory framework may be further developed with the full support of all stakeholders. Some of them are already identified and others are easy to be invited for an ABS forum on the subject. For the future, it will be relevant to analyse subject by subject all recommendations adopted under SBSTTA negotiations for their country's economic impact, capacity building needs, the socio-cultural impact for further harmonizing the implementation of the Regulation 511/2014 at the EU level. Furthermore, by taking into account the relevance of these subjects under the EU biodiversity conservation policy vision it should take care of information control and validation in order to increase data management quality as a step by step process under continuous development.

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THE INCIDENCE OF APPLE POWDERY MILDEW IN TRADITIONAL ORCHARDS OF FÂNTÂNELE

Maria-Mihaela ANTOFIE, Ion BARBU, Camelia SAND SAVA

University "Lucian Blaga" of Sibiu, Faculty of Agricultural Sciences, Food Engineering and Environment Protection, 7-9 Dr. Ioan Ratiu, 550012, Sibiu, Sibiu county Romania
E-mails: mihaela.antofie@ulbsibiu.ro, ion.barbu@ulbsibiu.ro, camelia.sand@ulbsibiu.ro

Abstract

The resistance of apple tree cultivars (Malus domestica Borkh.) towards different pests and diseases is relevant for the today breeding programmes. In this respect it is important to access genetic resources from gene banks as well as from traditional apple pools. In Romania such orchards are not very often today but certain remains from the XVIII century can be found especially in Transylvania. The scope of this article is to present the incidence of infestation with apple powdery mildew (i.e. Podosphaera leucotricha) for 24 old apple varieties found in Fântânele, Sibiu County. Among the 937 investigated apple specimens, in four different landscape subunits for a three consecutive years (i.e. 2014, 2015, and 2016) three varieties proved to be extremely sensitive (i.e. Golden delicious' 'Grosse Casseler Reinette' and 'Jonathan'). On contrary local varieties proved to be resistant. Also 'Boiken', London Pepping', 'Edelborsdorfer', 'Reinette Ananas', 'Gustav', 'Astrachan Rouge' , and 'Red Delicious' proved to resist to the attack of apple powdery mildew.

Key words**:** *old apple varieties, Podosphaera leucotricha, apple, breeding programme, varieties under conservation, landscape*

INTRODUCTION

Apple powdery mildew (APM) is due to apple (*Malus domestica* Borkh.) infection with the fungus *Podosphaera leucotricha* and it is recognized among relevant diseases caused by other pathogens (i.e. *Venturia inaequalis*, *Erwinia amylovora*, and *Marssonina coronaria*) affecting both fruit productivity and quality [22]. It is considered today that it attacks especially commercial apple varieties of culinary interest [4; 17]. Once such a disease appears it is well known that generally the producers are interested in developing management solutions for controlling its outbreak especially by using pesticides [8]. Due to commercial constraints, sensitive and resistant apple varieties were long time studied. It was accepted that the resistance against APM is a genetic quantitative trait [17]. Today it is considered that the use of resistant apple cultivars is the best way of maintaining productivity but still climate change effects can do more damage and the diversity of cultivars inside an orchard should re-evaluated [3]. We consider that resources of valuable importance in this regard are traditional orchards that comprises old varieties and old specimens established for more than 80 years of existing in the same landscape. The age of a specific genotype may express or not different apple resistance responses towards the fungus [12]. Different strategies for fighting against this disease were published [13; 24]. It was also proved that the high diversity of apple varieties, the diversity of species inhabiting the orchard agro-ecosystems, and the diversity inside the landscape may further limit the outbreak and spreading of disease [7]. The scope of this article is to evaluate the incidence of APM in traditional orchards of Fântânele from Sibiu county, Romania that can be considered as a pool of genetic diversity for the future breeding programmes. The investigated orchards have been already described as comprising old apple varieties specimens elder than 80 years [1].

MATERIALS AND METHODS

Place of investigations: the traditional orchards of Fântânele (45°45'23" N and 23°55'28" E) positioned in Sibiu county, Romania, where investigated apple trees found into four landscape sub-units such as:

forest area (800 m altitude), mountain area (1000 m altitude), village area (700 m altitude) and creek area (500 m alt) (Fig.1).

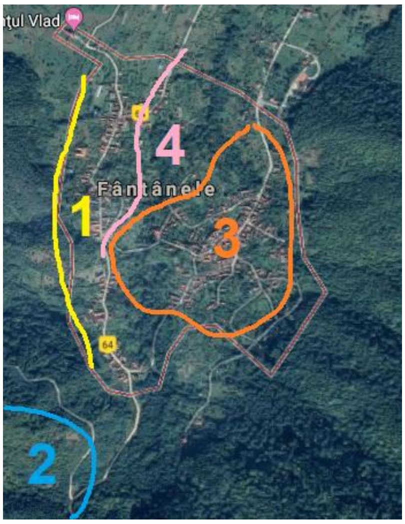

Fig. 1. The landscape sub-units of Fântânele positioned between 700 and 800 m altitude : 1- along the forest, 2- in the mountain at 1000 m, 3 – inside the village and 4 – along the creek (image obtained from www.google map modified by authors).

Method of investigation. Apple powdery mildew (APM) caused by *Podosphaera leucotricha* is easy to be investigated during the wet spring and summer time. The signs are the covering of the new twigs with a white mycelium followed by the falling of leaves (Fig. 2). All apple trees present in the four landscape sub-units have been investigated for the incidence of APM starting with the late May 2014, a wet season of the year up to 2016 (i.e. three consecutive years).

Fig. 2. The general appearance of apple twigs infested by the apple powdery mildew, 'Golden delicious' (original).

RESULTS AND DISCUSSIONS

In the apple pool of Fântânele, 937 specimens of 24 old apple varieties have been investigated for the potential infection with APM as well as for the position of identified apple specimens in the landscape of Fântânele.

'Belle de Boskoop'. All 84 investigated specimens do not presented signs of infection during the end of May proving they are not sensitive no matter where they are located. Thus, these apple trees were located either in village area either in the border of the creek of the village in close connection with a forest either over 1000 m in the mountain area. Such a large distribution of this variety proves that this cultivar might be relevant as a genetic resource for being further studied for its resistance towards PAM that is in line with other studies [20] (Fig. 2).

'London Pepping'. Only three specimens have been found (Lat: 45.761154 and Long: 23.925619) that where not infected (Fig. 4). We mention that the specimens were present in the wet areas such as the border of the forest and along the creek of the village. It can be considered as well as moderate resistant considering some previous studies [2]. The narrow distributions of the existing specimens in the area compared to other varieties may further suggest that probably the former specimens have been removed by the outbreak of different other disease.

'Winter Pearmain'. 44 trees have been found on site also located in different landscapes units such as inside the village or near the creek and the forest of the village. This old apple variety can also be integrated into future commercial orchards (Fig. 5). No infection occurred, or it was too weak to be identified. It is well known that this variety is susceptible for being infected [11] but probability the weather conditions were not favourable for the disease outbreak in this apple pool.

'Batul-Alma' or **'Pomme de Transylvanie'** is among the most popular apple tree in this area and eleven genotypes have already been described [15] (Fig. 6). There have been found 155 specimens in all landscape sub-units of the Fântânele village (i.e. inside village, near the creek and near the surrounding forest).

Fig. 3. Apple variety 'Belle de Boskoop'(original)

Fig. 4. Apple variety 'London Pepping'(original).

Fig. 5.Apple variety 'Winter Pearmain'(original).

Fig. 6. Apple variety 'Batul Alma'(original).

Fig. 7. Apple variety 'Boiken'(original).

Fig. 8. Apple variety 'Edelborsdorfer'(original).

Fig. 9. Apple variety 'Yellow Bellflower'(original).

Fig. 10. Apple variety 'Reinette Bauomann'(original).

Fig. 11. Apple variety 'Reinette Ananas'(original).

Fig. 12. Apple variety 'Gustav'(original).


Fig. 13. Apple variety ‘Astrachan Rouge’(original).


Fig. 14. Apple variety ‘Red Delicious’(original).


Fig. 15. Apple variety ‘Nemes Sovari Alma’(original).


Fig. 16. Apple variety ‘Poynik alma’(original).


Fig. 17. Apple variety ‘Reinette du Canada’(original).


Fig. 18. Apple variety ‘Starkrimson’(original).


Fig. 19. Apple variety ‘Roter Stettiner’(original).


Fig. 20. Apple variety ‘Locale d'ete’(original).


Fig. 21. Apple variety ‘Jonathan’(original).


Fig. 22. Apple variety ‘Local Florin’(original).

All specimens, identified in all four landscape sub-units, appear to be resistant to APM supporting other studies results [19].

'Boiken' Only 18 specimens have been identified, inside the village and all of them free of the pathogen (Fig. 7). This variety was located in different landscape sub-units of the village. However, the variety is known as susceptible [6] and their restrained habitat may be due to the loss during its history of cultivation in the region or due to the large diversity in varieties in this apple pool.

'Edelborsdorfer' is a moderate popular old variety for Fântânele also and 29 specimens have been identified all of them not infected (Fig. 8). Also, these specimens have been located in different landscape sub-units (i.e. inside the village, close to the forest and close to the creek). They may be considered as not sensitive to the APM as it was long time before considered as a resistant variety [5].

'Yellow Bellflower' was identified in the mountain area as well as in the nearby forest area of the village. Of 10 specimens no one was found to be infected (Fig. 9). The variety is sterile and is of economic interest for long time even it was considered as being susceptible towards the APM [10].

'Reinette Bauomann' is a popular apple tree variety in this village and found in all landscape sub-units from the village to the creek, forest and to higher altitude in the mountain area. 61 specimens have been identified and no one was infected, or not visible infection was found (Fig. 10). This variety can be considered as resistant towards APM attack for local conditions and is in line with other studies in Transylvania [21].

'Reinette Ananas'. Only two specimens have been identified in the creek area of the village. However, these apple threes were not infested even they were identified in a warm wet climate (Fig. 11). In Serbia this variety was considerate as moderate resistant [2].

'Gustav'. 28 specimens have been identified and no infection was observed during our investigations (Fig. 12). These were spread in all landscape sub-units such as from the mountain through the village along the creeks and close to the forest. However it is considered as moderate resistant towards the APM based on previous results [21].

'Astrachan Rouge' is another rare old variety and only one specimen was found in the area of the village. However, it was not infected (Fig. 13). Other 4 specimens were found in Sibiel and Vale (two neighbouring villages positioned in the northern part of Fântânele) and also free of the pathogen. The variety is considered as moderate resistant towards APM [2].

'Red Delicious'. 27 specimens have been found in all village subunits from the mountain area inside the village, along the creek and near the forest (Fig. 14). No one was infected and proved to be moderate resistant in line with previous studies [21].

'Nemes Sovari Alma' or **'Noble de Sovar'** is a popular old variety. 49 specimens have been identified spread in all screened orchards and identified landscape sub-units (Fig. 15). No one was infected proving a moderate resistance according to previous studies [21].

'Ponyik alma' is a very popular old variety. 86 specimens have been identified and all of them of high vigour (Fig. 16). No one was infected even they are occupying all types of landscape sub-units. The variety was not yet characterized for its resistance against APM being characteristic for Transylvania [18].

'Reinette Canada' is a rare old variety 13 specimens have been identified in all landscape sub-units (Fig. 17). No infection was observed and support previous studies considering it as a moderate resistant variety [21].

'Starkrimson' is a rare popular old variety (Fig. 18). Only 21 specimens have been identified spread in all landscape sub-units. No infection was identified supporting previous studies results obtained in Transylvania [21].

'Roter Stettiner' or **'Rouge de Stetin'** is also a popular old variety (Fig. 19). 42 specimens have been identified in all landscape sub-units (mountain, forest, village and creek). No infection was found and it support previous results [23].

'Locale d'ete'. Not very popular old apple landrace (Fig. 20). One specimen that was not infected was found in the village area.

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Fig. 23. Apple variety 'Local of Cacova'(original).

Fig. 24. Apple variety 'Local Baia Mare'(original).

Fig. 25. Apple variety 'Golden delicious'(original).

Fig. 26. Apple variety *'Grosse Casseler Reinette'*(original).

'Jonathan'. It was the most popular old variety (Fig. 21). 205 specimens were identified and all of them were infected. Also, this variety was identified in all landscape sub-units of the region. This old variety is most susceptible to be infected to the *Podosphaera leucotricha* and it is in line with previous studies [9; 14; 21].

'Local Florin' is a popular local apple variety (Fig. 22). 29 specimens have been identified in all landscape sub-units and no infection was found.

'Local of Cacova' is a local variety not very popular but producing small red apple fruits. Only two specimens have been found that proved to be not infected (Fig. 23).

'Local Baia Mare' were not very popular (Fig. 24). 10 specimens have been identified in all types of landscapes sub-units and they proved not to be infected.

'Golden delicious' is a rare old variety for the area (Fig. 25). 21 specimens have been found in all landscape sub-units of the village. This was also identified in Sibiel village. However, 100% of the identified specimens have been infected being in line with previous studies [16; 21].

'Grosse Casseler Reinette' is a very rare old apple variety (Fig. 26). Only 3 specimens have been identified inside the village and all of them have been infected proving their low resistance [10].

CONCLUSIONS

The analysis of these results shows that three old apple varieties, over 80 years old, were infected with APM such as the following: 'Jonathan', 'Golden delicious', and 'Grosse Casseler Reinette'. All local apples varieties showed resistance towards the pathogen. Some moderate sensitive varieties such as 'Boiken', London Pepping', 'Edelborsdorfer', 'Reinette Ananas', 'Gustav', 'Astrachan Rouge' , and 'Red Delicious' proved to have good conditions to fight against this disease. The high diversity in cultivars as well as in the landscape, probably are relevant factors in supporting the fight balance between the apple three and pathogens. All these old varieties should be red listed for their relevance in the conservation of genetic resources. These results further support the need for official preservation of traditional orchards in Romania for the future apple breeding programme.

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ABOUT THE MELLIFEROUS RESOURCES OF THE SIBIU COUNTY. APOLDUL DE JOS - A CASE STUDY

Iuliana ANTONIE

"Lucian Blaga" University, The Faculty of Agricultural Sciences, Food Industry and the Protection of the Environment, Sibiu, 7-9 Dr. Ion Raţiu, 550012, Sibiu, Romania, Phone: +40 269 211338, Fax: + 40 269 213381, E-mail: iuliana_antonie@yahoo.com

Corresponding author: iuliana_antonie@yahoo.com

Abstract

Our study has as a purpose to identify the main melliferous plants from the locality Apoldul de Jos and its surroundings. In this paper we want to complete our researches in the Sibiu county in order to turn to the best account the melliferous resources of the studied habitat and to complete the melliferous base with the new data. In order to be accomplished the purpose, there were applied the following methods of study: the utilization of the information from the specialized literature, the direct observation in the field, the collecting of the botanical material in this area and its identification in laboratory. After this study there were identified 19 Families of plants, with 46 species, mainly in the spontaneous and sub-spontaneous flora, with obvious implications in the beekeeping. The melliferous resources of the zone were grouped together from the point of view of the importance in apiculture, into four groups. Year by year, in the last period, more and more farmers tended towards the activity of the beekeeping. So, the knowledge of the flowery potential of the county, proved to be the success key in the beekeeping.

Key words**:** *Melliferous base, Apoldul de Jos (Sibiu county)*

INTRODUCTION

Among all insects, the most important are the bees; for a good reason, our special admiration is directed to them, as they were created for the sake of humanity [17].

The Mythographian specialists agree that the first and the greatest beekeeper in Antiquity was Aristeu. He was the son of the Cyrene nymph and Apollo. He received a high education, having as teachers the centaur Chiron, the nymphs and Proteu. All of them teached him the animal breeding and first of all the beekeeping; The result was the spreading the beekeeping in all Ellada. It was of a panhellenic notoriousness, that under the name of Aristeu were to be understood, in many places, Apollo, Dionysos or even Zeus, "they being worshiped as Gods both by the barbarian Thracians and by the civilized Greeks "[10].

The honey was a part of the Gods' menu. Zeus himself was nourished with the goat's milk and honey. With this substantial food, Zeus strengthened quickly his body; among his first braveries was to break the goat's horn, who gave him milk and to offer it to the nymph Amaltea, with the promise that the horn was to be forever filled with all kind of fruits; it is to be known as "The horn of plenty".

The exceptional qualities of the honey was the reason for embalming the Macedonian king Alexander the Great in a golden sarcophagus filled with honey. The sarcophagus was transported to Egypt under the command of Ptolemeu. In Egypt the golden sarcophagus was robbed and substituted for another one, of glass, its trace being lost. So, the great conqueror nowhere could find his place for the eternal rest.

The bee was so appreciated, that it was represented even on Napoleon's imperial mantle, underlining thus the multiple heraldic meanings.

On the Traian's Column is certified the beekeeping in the Geto-Dacian area, that is a proof that the hyperborean people were connected to Aristeu's world later, the honey produced in the Romanian areal sweetened without interruption, the life of the adjacent Empires.

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The magic of beekeeping is a mystery that concerns also the soul and the mind of the candidate to retirement, who dreams to spend his old age in the silence of an apiary and to enjoy to live in harmony with the little creatures, understanding each other better than with his fellowmen from the community he left at his retirement.

MATERIALS AND METHODS

The investigations took place in the locality Apoldul de Jos in the Sibiu county in the period 2016-2018. In order to identify the melliferous base in the studied habitat, the following steps were taken into consideration:
- Making use of the specialized literature
-The observations in the field with the purpose for identification and inventorying of the melliferous flora in the perimeter of the locality Apoldul de Jos.
-The utilization of the direct method of collecting the plants in this zone.
-The identification in lab of the collected botanical material and the elaboration of the floristic list with the main melliferous species. [4,9,13-16, 20].

RESULTS AND DISCUSSIONS

There is a close connection between plants and bees. The bees have an important role in quantitative and qualitative increase of the fruit and seeds harvests, in the same time with getting an increased honey production [5]; the plants provide bees with nectar and pollen, the food for the different development stages of the bees, adult and larvas.
In order to turn to best account more rationally the melliferous resources in Sibiu county [11,12], it is necessary to know closer the main melliferous plants of this habitat.
In the present paper we want to complete, with new data, our studies made in the Sibiu county in the localities Vurpar, Avrig, Saliste [1-3, 21, 22].
The commune Apoldul de Jos is localized in the western part of the Sibiu county (Fig.1), at the southern part of the Transylvanian Plateau and at the South-East of the Secaselor Plateau, building together the Apold-Miercurea Depression [23].

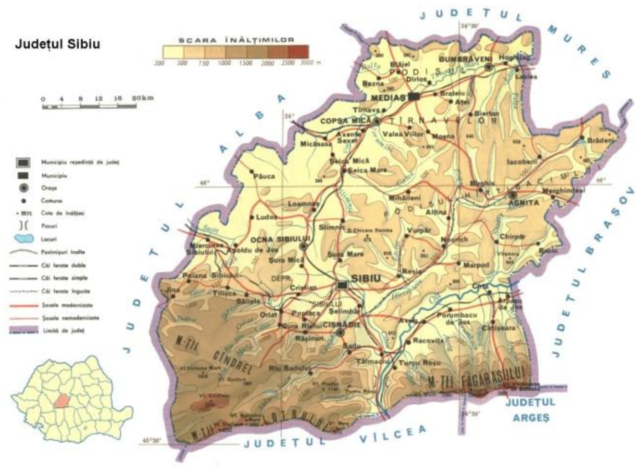

Fig. 1. The localization of Apoldul de Jos locality in Sibiu County
Source: https://pe-harta.ro/sibiu/

The region is characterized by a zone with low hills, 400-500 m. high and a continental temperate climate with an yearly average temperature of 8.7^{o} C and abundant rainfalls. The zone is characterized by the presence of the cultivated plots of land (mainly vegetables, potatoes, vineyards), of the meadows with mezzo-xerophiles species, leafy trees forests (oak trees, hornbeams, maples, acacia and the presence of the numerous shrubs species (hazelnut trees, elder trees, hiprose trees, flowering ash) [11,12,24].
The floristic potential of the zone was analized by many specialists and it was the subject of many studies [6-8,19]. In 2003, the botanist dr. biol. Constantin Dragulescu identified in his book "Cormoflora jud. Sibiu", a number of 105 species for the locality Apoldul de Jos. The information is evidencing only 10%-20% of the floristic potential of this zone [8].
For a better systematization and knowledge of the melliferous plants in the studied habitat, we approached the botanical classification system, where the melliferous plants were grouped on Families (Table 1).
By analyzing the flora in the Apoldul de Jos zone, in the Sibiu county (Table 1) we highlighted a number of 46 melliferous species that belong to 19 botanical families.

Table 1. The melliferous plants species from the Apoldul dr Jos (Sibiu county) and their specific beekeeping weight (power).

Nr. crt	Plant family	Species	Bee keeping importance	Observations
1	Fagaceae	*Querqus robur* L.	Medium	Arboricol species which grows in the hilly-mountainous level. It is also considered a medicinal plant.
2	Aceraceae	*Acer platanoides* L.	Medium	Valuable melliferous tree.
3	Oleaceae	*Fraxinus ornus* L.	Medium	It is a small tree, with flowers, in great demand for bees. It furnishes a good harvest in springtime.
4	Betulaceae	*Corylus avellana* L.	Medium	The male flowers represent a rich source of pollen in earlier springtime with the role in the maintenance and the development of the bees families.
5	Adoxaceae	*Sambucus nigra* L.	Medium	Bushy species, in the hilly-mountainous level and in a great demand for bees for nectar and pollen.
6	Ranunculaceae	*Adonis vernalis* L.	Medium	A perennial herbaceous plant, sporadic in the hilly zone. It furnishes pollen and nectar in the earlier springtime. It takes part of the category of the medicinal toxic herbs.
7	Polygonaceae	*Polygonum aviculare* L.	Small	It is an yearly herbaceaous plant in the spontaneous flora, frequent in the hilly-mountainous zone.
		Polygonum hydropiper L.	Medium	Frequent in the hilly-mountainous level. It is also a medicinal herb.
8	Rosaceae	*Filipendula vulgaris* Mnch.	Small	It is a perennial plant in the spontaneous flora, in the hilly-mountainous zone.
		Prunus spinosa L.	Medium	Bushes in the spontaneous flora, frequent in the hilly-mountainous level, a medicinal herb. It is frequently visited by bees
		Rosa canina L.	Medium	A common bush in the hilly-mountainous level.
		Rubus idaeus L.	Large	It is in a hilly-mountainous level. It is one of the most valuable melliferous bushes. Its nectar secretion is intense during all period of flowering.
		Malus silvestris (L.) Mill.	Medium	It is sporadic in the hilly-mountainous level. It is an important source of pollen and nectar.
		Pyrus pyraster (L.)Burgsd	Medium	Sporadic, in the hilly-mountainous level.
9	Fabaceae	*Amorpha fruticosa* L.	Medium	In the hilly-mountainous zone. It is toxic, it has a decorative value.
		Lotus corniculatus L.	Medium	It is a good fodder plant in the hilly-subalpine zone.
		Medicago falcata L.	Medium	It is frequent in the hilly-mountainous level. It is a valuable fodder plant.
		Melilotus officinalis (L.) Pall.	Medium	It is a medicinal herb, frequent species in the hilly-mountainous zone.
		Trifolium campestre Schreb.	Medium	It is frequent in the hilly-mountainous level.
		Trifolium hybridum L.	Medium	It is intensely visited by bees and a very good fodder plant.
		Trifolium pratense L.	Medium	It is frequent in the hilly-mountainous zone, an excellent fodder plant.
		Trifolium repens L.	Large	An excellent fodder plant.
		Robinia pseudoacacia L.	Very large	It is more frequent in the hilly level. It is the most important melliferous plant during the springtime main harvest.
10	Apiaceae	*Carum carvi* L.	Medium	A plant with medicinal and fodder values
		Eryngium campestre L.	Medium	It is frequent in the hilly-mountainous level; it has a medicinal value.
		Heracleum spondylium L.	Small	It could be found in the hilly-mountainous level; it has a characteristic flavoured odor.
		Pimpinella saxifraga L.	Small	A medicinal and fodder species of reduced value.
11	Malvaceae	*Althaea pallida* W. et K.	Small	It is sporadic in the hilly level. It is known also as a medicinal herb.
12	Violaceae	*Viola odorata* L.	Medium	It is frequent in the hilly-mountainous level.
13	Primulaceae	*Primula veris* L.em.Huds.	Medium	It is frequent in the hilly-mountainous level, intensely visited by bees and bumble bees, especially for their pollen. It is a medicinal herb.
14	*Convolvulaceae*	*Calystegia sepium* (L)R.BR.	Medium	It is frequent at the altitude between 280-700m.
15	Boraginaceae	*Anchusa officinalis* L.	Medium	Species in the hilly-mountainous level, with medicinal and

				fodder values. It is considered as a contaminant of the alfalfa cultures.
		Symphytum officinale L. *ssp.officinale*	Medium	With medicinal qualities, it is frequent in the hilly-mountainous level.
16	Lamiaceae	*Mentha longifolia* (L.) Nath,*ssp.longifolia*	Medium	It is frequent in the hilly-mountainous level.
		Prunella vulgaris L.	Medium	A common species in the hilly-sub-Alpine zone.
		Salvia pratensis L.	Medium	It is frequent in the meadows of hills ascending till in the inferior mountainous level. It was identified also at the borders of the roads or ploughings. It furnishes nectar and pollen for the bees families during a long period of time of 4 months.
		Teucrium chamaedrys L.	Medium	It is considered also a medicinal herb, frequent in the hilly-mountainous level.
17	Rubiaceae	*Galium verum* L.	Small	It has a double role both as a melliferos species and also as medicinal herb. It is frequent in zone.
18	Dipsacaceae	*Dipsacus laciniatus* L.	Medium	It is a weed in the hilly level.
		Scabiosa ochroleuca L.	Medium	It is relatively frequent in the hilly-mountainous level. It blossoms all summer and it is very visited by bees and butterflies.
19	Asteraceae	*Arctium lappa* L.	Medium	A herb spread in the hilly-mountainous level. It is considered as a food plant.
		Centaurea scabiosa L.	Medium	It is relatively frequent in the hilly-mountainous level.
		Cichorium intybus L.,	Medium	It is a fodder as an inferior quality and also a medicinal herb. It is frequent in the hilly-mountainous level
		Cirsium vulgare (Savi)Ten.	Medium	It is a perennial melliferous species, frequent in the hilly-mountainous level. The flowers are a rich source of nectar for bees and butterflies.
		Inula britannica L.	Small	The species with medicinal qualities, is spread in the hilly-mountainous level.
		Taraxacum officinale Weber	Medium	The species is in the hilly-mountainous level, on the limits of roads, in non-cultivated zones. It is very valuable, mainly in the springtime and autumn for the pollen and nectar harvest. It is also a medicinal herb.

Source: own concept.

These species could be classified in:

Families with a single representative: Fagaceae (*Querqus robur* L.); Aceraceae (*Acer platanoides* L.); Oleaceae (*Fraxinus ornus* L.); Betulaceae (*Corylus avellana* L.); Adoxaceae (*Sambucus nigra* L.); Ranunculaceae (*Adonis vernalis* L.); Malvaceae (*Althaea pallida* W. et K.); Violaceae (*Viola odorata* L.); Primulaceae (*Primula veris* L.em. Huds.; Convolvulaceae (*Calystegia sepium* (L.) R.BR.); Rubiaceae (*Galium verum* L.).

Families with two representatives: Polygonaceae (*Polygonum aviculare* L., *P.hydropiper* L.; Boraginaceae (*Anchusa officinalis* L., *Symphytum officinale* L. ssp. officinale); Dipsacaceae (*Dipsacus laciniatus* L., *Scabiosa ochroleuca* L.).

Families with four representatives: Apiaceae (*Carum carvi* L., *Centaurea scabiosa* L., *Heracleum spondylium* L., *Pimpinella saxifraga* L.); Lamiaceae (*Mentha Longifolia* (L.) Nath. *ssp longifolia*, *Prunella vulgaris* L., *Salvia pratensis* L., *Teucrium chamaedrys* L.)

Families with six representatives: Rosaceae (*Filipendula vulgaris* Mnch., *Prunus spinosa* L., *Rosa canina* L., *Rubus idaeus* L., *Malus silvestris* (L.) Mill., *Pyrus pyraster* (l.) Burgsd): Asteraceae (*Arctium lappa* L., *Centaurea scabiosa* L., *Cichorium intybus* L., *Cirsium vulgare* (Savi) Ten., *Inula britannica* L., *Taraxacum officinale* Weber).

Families with nine representatives: Fabaceae (*Amorpha fruticosa* L., *Lotus corniculatus* L., *Medicago falcata* L., *Melilotus officinalis* (L.) Pall, *Trifolium campestre* Schreb., *Trifolium hybridum* L., *Trifolium pratense* L., *Trifolium repens* L., *Robinia pseudacacia* L.).

In our country there were identified 398 melliferous plants in the spontaneous and sub-spontaneous flora, being distributed in four groups, considering their apiarian economical importance: a very large, large, medium and small importance [18].

Among the 105 identified species in the studied habitat [8], 46 species (43.80%) belong to the melliferous resources of the locality Apoldul de Jos (Table 1.). They are grouped in function of their apiarian importance in 4 categories:

(i)The plants of a very large apiarian importance (2.17%) This category includes only the species *Robinia pseudacacia* L. that represents the most important melliferous species that furnishes the main springtime harvest.

(ii)The plants of a large apiarian importance (4.34%). In this category are included the species *Rubus idaeus* L. and *Trifolium repens* L. The raspberry bush grows spontaneous in zone. During the flourishing period, the secretion of nectar is very intense, the flowers are visited by bees from the first hours in the morning till the sunset.

The white trefoil (clover) is the species among the trefoils with the largest nectaripherous capacity.

(iii)The plants of a medium apiarian importance (78.26%).

In this category we can found the majority of the identified taxons, 36: *Querqus robur* L., *Acer platanoides* L., *Fraxinus ornus* L., *Corylus avellana* L., *Sambucus nigra* L., *Adonis vernalis* L.,*Polygonum hydropiper* L.,*Prunus spinosa* L., *Rosa canina* L., *Malus silvestris* (L.) Mill., *Pyrus pyrasyter* (L.) Burgsd., *Amorpha fruticosa* L., *Lotus corniculatus* L., *Medicago falcata* L., *Melilotus officinalis* (L) Pall, *Trifolium campestre* Schreb., *T. hybridum* L., *T. pratense* L., *Carum carvi* L., *Eryngium campestre* L., *Viola odorata* L., *Primula veris* L.em.Huds., *Calystegia sepium* (L.) R.BR., *Anchusa officinalis* L., *Symphytum officinale* L. ssp. *officinale*, *Mentha longifolia* (L.) Nath ssp. *longifolia*, *Prunella vulgaris* L., *Salvia pratensis* L., *Teucrium chamaedrys* L., *Dipsacus laciniatus* L., *Scabiosa ochroleuca* L., *Arctium lappa* L., *Centaurea scabiosa* L., *Cichorium intybus* L., *Cirsium vulgare* (Savi) Ten. and *Taraxacum officinale* Weber.

(iv)The plants of a small apiarian importance (15.23%). In this category are included seven species: *Polygonum aviculare* L., *Filipendula vulgaris* Mnch., *Heracleum spondylium* L., *Pimpinella saxifraga* L., *Althaea pallida* W.et K., *Galium verum* L., *Inula britannica* L.

CONCLUSIONS

In time, the localities of the Sibiu county were differently investigated from botanical point of view. Apoldul de jos is among 40 localities in the Sibiu county, where the floristic potential was studied only in a small proportion, of 10-20%.

In the Apoldul de Jos zone they were identified 46 vegetal taxons with obvious implications in the beekeeping. These belong to 19 botanical families: Fam. Fabaceae (9 taxons), Fam. Rosaceae and Asteraceae (6 taxons each of them), Apiaceae, Lamiaceae (4 taxons each of them), Polygonaceae, Boraginaceae, Dipsacaceae (2 taxons each of them).

A number of 11 botanical families have only one representative: *Fagaceae, Aceraceae, Oleaceae, Betulaceae, Adoxaceae, Ranunculaceae, Malvaceae, Violaceae, Primulaceae, Convolvulaceae* and *Rubiaceae*.

The botanical study certified that the melliferous base of the studied area is built by taxons in the spontaneous and sub-spontaneous flora.

From the point of view of the apiarian importance, the melliferous species identified in this area belong to the four categories: species with a very large apiarian importance, (2.17%), species with a large apiarian importance (4.34%), species with a medium apiarian importance (78.26%) and species with a small apiarian importance (15.23%).

The floristic potential of zone could be found in the proportion of 84.77% in the first three categories, a fact that encourages the inhabitants towards the activity of beekeeping.

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ADVANTAGES AND DEFICIENCIES IN THE USE OF CRM IN HOTELS

Veselina ATANASOVA

University "Prof. Dr. Asen Zlatarov", Bulgaria, Bourgas, Email: vesiatanasova1980@abv.bg

Corresponding author: vesiatanasova1980@abv.bg

Abstract

Over the last decades, the dominant trend of globalization has led to extremely dynamic changes in two major areas - market and technology. The changing conditions of modern tourism development pose new challenges to the tourism business. Adhering to the preferences of modern tourists in their desire to turn them into real customers, each tourist enterprise should seek out the right marketing solutions to respond to global change. This gives grounds for a change in the model of business relations in tourism, determines the topicality of this problem and the scientific interest of the author in studying and exploring the relations with clients in the tourism industry. The actuality of the problem is complemented by an essential feature related to the application of the marketing management approach - the result is the achievement of a competitive advantage in the contemporary dynamic market environment. Based on a survey of hoteliers, analysis and evaluation, some advantages and disadvantages have been outlined about the application of CRM in the hotel industry.

Key words: *marketing, relationship management in tourism, advantages, disadvantages.*

INTRODUCTION

The Modern Marketing Approach Managing Relationships with Customers in Tourism is becoming more and more relevant for several reasons:

Competitive struggle between destinations and businesses is sharpened in the modern tourist business environment, which requires the use of innovative marketing approaches and the establishment of destination management organizations aimed at developing sustainable forms of tourism [1].

Tourism development can take into account the preservation of cultural heritage, the promotion of tourist attractions, investments, diversification of activities, service and staff quality [4].

A tremendous trend towards customized innovations in the supply of tourism products globally. Market competition creates incentives for using more advanced technologies, improving professional qualifications, improving work organization, speeding up the transfer of science and technology, which favors the extensive type of economic growth [5].

Changing user requirements and behavior, including increasing their reorientation capabilities, finding information, improving methods and purchasing methods, and more.

The avalanche use of electronic technologies as a result of globalization in creating and realizing market relations. The lag of elasticity in the product towards the changing user desires and the customer seeking for flexibility form the foundation for various innovations in the hotel industry [2].

The facilitated information and communication system determines the ability to quickly, accurately and cost effectively collect, process, distribute and store market information. Moreover, the uncertain and rapidly changing global macroeconomic environment (economic growth rate, unemployment rate, inflation rate, etc.) leads to a distortion of economic information and uncertainty in the taking and implementation of economic decisions by firms. [6].

All these preconditions change the pattern of business relationships in tourism, determine the relevance of the problem and the scientific interest of the author in studying and exploring the relationships with customers in the tourism industry. The actuality of the problem is complemented by an essential feature related to the application of the marketing management approach - the result is the achievement of a competitive advantage

in the contemporary dynamic market environment. The economic system is a complex system of many variables and different relationships between them, which poses many challenges to strategic management and firm performance [7].
The benefit of the utility and the necessity of the development is the lack of serious and purposeful research in this field in our country.

MATERIALS AND METHODS

For the purposes of this study, it is appropriate to conduct a deep (free) interview as a variety of qualitative data collection methods that take place on pre-established thematic areas that are explored with open questions. In line with the subject of the study and the objectives set, an appropriate common questionnaire was designed to explore the opinion of hotel managers on their attitude towards the application of CRM in the hospitality industry. In-depth interviewing is a flexible method of collecting data because:
-Provides opportunities to explore managers' views of online business in an extremely complex, dynamic and competitive environment;
-reveals positive and negative assessments on major research issues;
-justifies and justifies personal comments;
-broadly extends the scope of analysis of CRM application issues in hospitality.
In order to achieve the depth of the information they have in the interview is included specifying and expanding issues and issues, which require comparison
comparison with local and regional competitors international tourist market.

RESULTS AND DISCUSSIONS

Against the background of the above results and conclusions, the answers of the hoteliers to the question are optimistic, will the expansion of the use of CRM in the hotel industry (Figure 1).

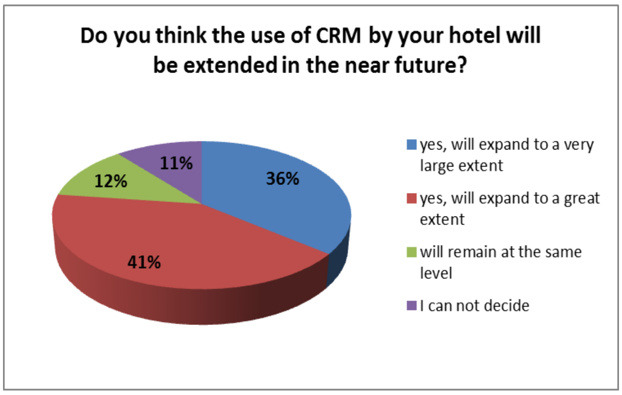

Fig. 1. Reporting hotelier opinion on how to use CRM in the future.
Source: Own determination.

The survey reveals that more than 35% of hoteliers surveyed are convinced that in the coming period CRM will expand to a very large extent and 41.3% see large expansion. Only 12% say that development and application will remain at the current level, while 10.9% can not judge. Regardless of the hoteliers' optimistic views on the use of CRM in a future period, we must point out that such a forecast must necessarily be linked to overcoming the already mentioned difficulties in this regard.
After an empirical survey, we can point out the following advantages and disadvantages regarding the application of CRM in the hospitality industry:

Benefits and advantages:

-every employee in the company has access to the data and the contacts made with the client;
-provides an opportunity for an integrated analysis environment;
-leads to widening the range of daily operations;
-provides in-depth understanding of the customer base and helps to evaluate consumer expectations;
-an opportunity to assess the value of each client and measure its profitability and long-term value for the company;
-supports the sale of additional specific services;
-possibility of detailed study of customer database with detailed and accurate information,
-convenience through customized profiling of messages;

-allows to create a unified environment for the automation of the planning, reporting, analysis and control activities of the enterprise's core business processes;
-identifying the most lucrative target markets and adapting product offers to interactions with each customer;
-data is automatically imported into an individual client's operational dossier and so all available customer information is unified and organized;
-provides information on segmentation, customer targeting and feedback;
-with the help of CRM, the hotel organization has the opportunity to optimize its business processes and maximize the benefits of the business;
-every employee in the company has access to the data and the contacts made with the client;
-improves the quality of customer interaction and consolidation of data for analysis;
-creates efficient, immediate and low cost communication with the client;
-the opportunity to manage the future situation and improve profits;
-personalize the organization's relationships with the environment;
-provide access to one (logical) data store for customers;
-synchronization and operational support of the central customer point of marketing, sales and services;
-integrates all communication channels between the client and the company;
-merging and evaluating all customer information;
-serves to support the operational processes of all areas that have direct contact with the client - mainly marketing, sales and customer service;
-automation of the sales process;
-automation of services;
-better experience for the client;
-possibility of offering specific products;
-real-time information;
-improving overall customer satisfaction;
-a single database;
-optimizes work processes;
-maximizing business benefits;
-increasing the value of the company by integrating data, increasing loyalty and customer retention, attracting new customers, and ensuring an adequate response to competition on the market.

The main activities related to the CRM system for the development of the clients and the increase of the share in the client portfolio of the tourist enterprises are stated as follows:
-the high level and level of detail in collecting customer information;
-contains a complete history of the relationship with each tourist;
-provides the ability to sort and classify customers according to different criteria;
-a two-way connection provided;
-possibility for personalized service;
-possibility to retain the client in the long term;

Deficiencies and limitations:
-the cooperation of all departments in the company that will use the system;
-Strategic innovation as a result of innovation;
-the application is aimed at a larger business, as the investment is large and the return is after a prolonged period;
-is connected with the implementation of technological resources;
-payment of a price for software and hardware provisioning;
-need for trained specialists;
-in implementing a CRM system, there are costs associated with purchasing a system or developing it, installing the system, training employees for the application;
-inability to capture a set of very specific business areas;
-the company is responsible for the maintenance and evolution of its application;
-necessary integration, if a company wants to make the creation of proposals in real orders, the sales department must have access to the status of each order and also be able to make changes and follow up;
-the application is time-consuming to allow the organization to identify the benefits of the CRM solution in its full capacity; customers also need time to see change and increase their participation in the business process;
-business change and transition to the client is required to enable a business to use a given CRM solution is a right transition to a CRM-centric business that always focuses first and

last on customers and their satisfaction and then on the company itself;
-need for training and professional training of employees.

Based on the advantages and disadvantages of applying CRM in hotel management, we can say that the benefits are a strong argument and a good opportunity for the successful development of the relationship between the client and the particular tourist enterprise.

CONCLUSIONS

The study and analysis of the survey conducted with the hoteliers from the hotels in the city of Burgas gives us grounds for a number of findings, conclusions and recommendations for their activities related to the application of CRM in the hotel industry.

First: Because of the lack of knowledge and lack of staff with the appropriate training and the necessary professional experience in the field of electronic technologies, hoteliers in Burgas use limited CRM.

Second: Due to lack of professional experience, which is also verified in other studies in the field of hotel industry [3], hoteliers do not know and do not take into account the main impacts of CRM on the competitiveness of their business.

Third: There is no systematic monitoring of the costs and potential benefits of using CRM, which makes it difficult to determine its usefulness.

Fourthly, hoteliers understand the need for CRM, but they are still struggling to overcome existing problems and difficulties in applying them to their site.

Despite the findings of the survey on the application of CRM in the hospitality industry, the surveyed respondents appreciate to a very high degree the satisfaction of the client as an indicator of building mutual positive relations. On the basis of this assessment the conclusions are as follows:

First and foremost, in order to help service personnel conduct customer-centric behavior, the organization should work towards developing an appropriate service-oriented work environment. Inevitably, all organization resources need to be integrated to successfully implement CRM.

In addition, CRM can influence future marketing and price-related marketing decisions. In this way, the hotel has the ability to flexibly determine prices against the information gathered for its customers.

Another effect that hoteliers emphasize from customer relationship management is that it allows for customization of communication and overall customer attitude, unlike traditional classical marketing, where the same message is used for all customers. Hoteliers understand that this process of "personalization" is one of the founding principles of a positive relationship.

Accepting one of the benefits of managing customer relationships, namely - better understanding customer needs, hoteliers claim that the overall service can be improved and thus deepen the relationship with visitors.

Hoteliers are aware that they can use CRM to accurately identify beneficial customers, focus their efforts on getting more active at them, and personalizing supply to meet the current needs of visitors.

In addition to the above, it is also important to note that CRM success requires not only technological quality or systems, but also an effective service concept, as well as appropriate operational procedures directly related to the active employee involvement in the organization . Consequently, changing companies is not only necessary from a technological point of view, but also in the way they organize their business processes aimed not only at customers but also at their employees.

Hoteliers are well aware that customer management by offering tailor-made special offers and constant contact is a prerequisite for achieving customer satisfaction, loyalty and commitment to the particular tourist organization. Shared customer feedback and feedback should not be taken as a personal attitude but as an opportunity for professional decisions.

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EFFECTS OF THE LIBERALIZATION OF EUROPEAN SUGAR MARKET IN ROMANIA

Daniela Nicoleta BĂDAN, Ionuț Laurențiu PETRE

Research Institute for Agriculture Economy and Rural Development, 61 Mărăști Boulevard, District 1, 011464, Bucharest, Romania, Phone: +40213136087, Emails: badan.daniela@iceadr.ro, petre.ionut@iceadr.ro

Corresponding author: badan.daniela@iceadr.ro

Abstract

In this paper, it was analysed the sugar market in the context of the liberalization of the European market, taking into account both the situation at national and at European level. Also, there were analysed the evolution of the areas under sugar beet and sugar cane, sugar production, prices and sugar consumption. It was also demonstrated the economic theory affirming that: by reducing the price level of a particular food, the quantity bought is higher than consumed, thus resulting in the stocks. Studying the evolution of all elements of the sugar market, there were identified the main effects of the quotas elimination on this market. The conlusion was that the liberalization of the sugar market and the abolition of quotas in fall 2017 will lead to the increase of sugar beet and sugar production, to a decline of sugar price and to higher stocks of sugar as consumption is not expected to raise.

Key words**:** *sugar market, consumption, prices, supply, liberalization*

INTRODUCTION

Agricultural markets have a growing interest lately, because the world population is increasing focus on issues such as food and nutrition security. Agricultural markets can also be highlighted by other concerns, namely global warming, but also the difficulties that these commodity markets have encountered. From these markets is also part the sugar one, this changing frequently, sugar being among the products with high volatility. [6]
Worldwide, at present, sugar is produced either from cane or from beet, in over 130 countries.
Continent that produces the largest quantity of sugar beet is Europe, which owns half of the world production of sugar beet. But most of the world's sugar is obtained from sugar cane, about 80% of total sugar production.
Worldwide, the largest sugar-producing countries are Brazil, Thailand, India and China, (Romania 64^{th}), and in Europe: France, Germany, Poland, and Romania ranked 15th with 232 tonnes (2014).
European sugar production in 2016 accounted for 9.17% (15.47 million tonnes of sugar from world sugar production of 168.587 million tonnes), this percentage being explained above, respectively Europe producing half of the production of sugar beet in the world, accounting for only 20% of world sugar production.[12]
At international level, sugar trade reaches almost 60 million tons / year, of which about 60% of international trade is represented by raw sugar.
According to ISO data, world sugar production has increased from one year to the next, managing to exceed demand, which means that sugar stocks have risen, reaching a record high of 78.89 million tonnes (2015).[1]
By liberalizing the sugar market in the autumn of 2017, there may be more long-term and medium-term effects. Thus, by this approach, the first socio-economic effect is the increase in sugar supply which will be analysed in the continuation of the paper.
By increasing supply on the sugar market, as economic theory says, the next easy-to-anticipate effect is that of lowering prices, a beneficial effect for sugar consumers. As a result of the increase in the supply and the price reduction, the third effect can also be expected, namely the increase in sugar consumption. [2][5]
These three major effects are the main analysis hypothesis of this paper. Thus, the

abolition of sugar quotas can substantially alter the main elements of the sugar market in Romania (which is not stable) but also at the European level.

MATERIALS AND METHODS

In order to identify the main effects of the liberalization of the sugar market in Romania, in the first part of the paper in order to create an overview will be analysed the market and the components. It will analyse the evolution of cane and beef production, total sugar production, prices and consumption evolution with the help of statistical data taken from national, European and international databases in quantitative and qualitative terms.

Following this analysis of the sugar market developments, one can observe the trends generated by market liberalization and the associations between this phenomenon and the dynamics of the main indicators. Thus, one or more effects could be established following the withdrawal of the quota system for sugar.

RESULTS AND DISCUSSIONS

Europe occupies the first place in the world at sugar beet production, owning half of world production. It should be noted that beet sugar represent 20% of total sugar production and Europe owns about 10% of production in the sugar market.

Starting from this point, we will be analysed the surface and production of sugar beet of the national level and the European level.

Table 1. Evolution and productions areas of sugar beet areas in the European Union during 2014-2018

EU 28	2014	2015	2016	2017	2018
Area (1000 ha)	1,632.4	1,420.3	1,498.7	1,750.3	1,715.3
Production (1000 t)	131,021.8	101,872.1	112,404.0	142,787.3	(P) 143,058.5
Yield (t/ha)	80.3	71.7	75.0	81.6	83.4

Source: ec.europa.eu, Eurostat

According to Eurostat data, there may be significant changes in the area planted with sugar beet in the 2014-2018 period, thus, a reduction in surface area may be noted in the first half of the period, but in the second half there is an increase in surface area. On average we can talk about an increase in sugar beet area in the EU, with an annual average rate of 1.24%.

As regards the total production obtained from these areas, the European Commission foresaw this production for 2018. It can be noticed that the total European Union sugar beet production maintains the trend of the cultivated surfaces, but in 2018 there can be seen an increase compared to 2017, which on the indicator the cultivated area is a decrease, here it can intervene the effect of withdrawing sugar quotas, thus increasing production. Total production recorded an average growth rate of 2.22% on average, being higher than that of the cultivated area, which shows, as can be seen from the third indicator, the average yield per hectare, an intensive increase of in the sector.

The average yield per ha was calculated by the production obtained on the cultivated area, so we can observe oscillations from one year to the next, given the dependence of this sector on external factors (climate, soil, etc.). Thus, in the weaker years, from the point of view of production, a lower yield (2015, 2015) can be observed, being 71.7 tons per ha, but in the last year it can record a yield of up to 83.4 tons per ha. The average annual growth rate for this indicator is lower than the other, at 0.96%.

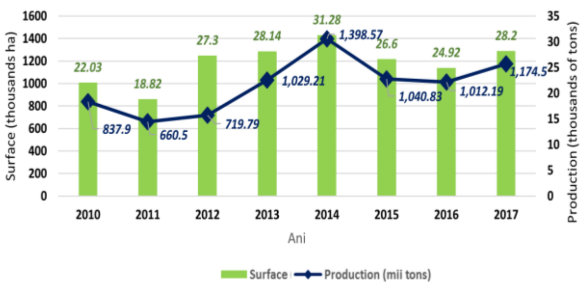

Fig. 1. The sugar beet areas and sugar production in Romania during 2010-2017
Source: own processing based on ec.europa.eu data, Eurostat [10]

The agricultural area used in agricultural holdings in Romania represents approximately 55.9% of the total area of the country (23.8 million ha), of which about 9.3

million hectares represent the arable land. The surface cultivated with sugar beet in 2017 is 28.7 thousand hectares, representing 0.303% of the arable land.

Analysing Figure 1, it can be noticed that the areas cultivated with sugar beet had a fluctuating evolution reaching a maximum of 31.28 thousand hectares in 2014, with a slight decrease of approximately 10% in the following years cultivated until 2017.

Sugar beet production fluctuated with cultivated areas, reaching a peak of 1398.57 thousand tons in 2014, being 40% higher than the first year of 2010 (837.9 thousand tons). The smallest production was registered in 2010 and 2011, which was 28.66% and 43.76% lower than in the last year analysed in 2017, due to the climatic conditions registered in that period, and in 2013, beet production to grow slightly. The growth rate of sugar beet production over the analysed period was 4.64%. The production yield per hectare ranged from 26.4 t / ha (2012) to 41.6 t / ha (2014), with an average of 37.83 tons / ha.

According to FAO data, there are two countries in Europe that grow sugar cane, namely Portugal and Spain, but according to these data the areas are very small, even negligible when referring to the European level.

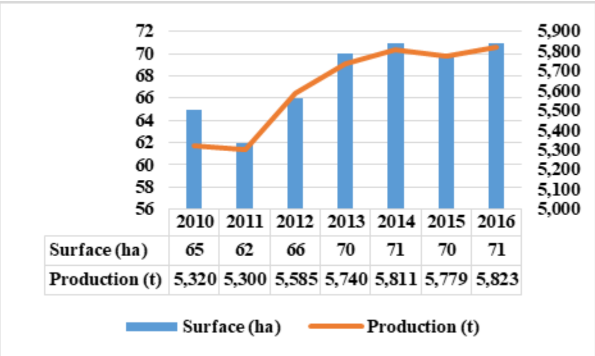

Fig. 2. Determination of surface and cane production
Source: own processing based on FAO data

In period 2010-2016, in Europe was grown an average of about 68 hectares of sugar cane. As can be seen in Figure 2, the areas recorded overall increases, with the largest area of 62 hectares in 2011, and in 2011 this was 71 hectares. If we spread these areas to the two reed rearing countries, we account for almost 90% for Portugal and 10% for Spain.[9]

Regarding the production obtained, on average it was about 5622 tonnes of sugar cane, and it can be observed that it follows the tendency of cultivated areas. The smallest production was recorded in the year with the smallest area (2011) of 5.3 thousand tons, and the highest in the last year of 5823 tons. Distributing the average production over the entire period to the producing countries in Europe, it will be noticed that Portugal obtained about 94.3% of production, 4.3 percentage points more than in the case of areas, and Spain has contributed to this total production of 5.7%. This shows that in Portugal the average yield per hectare may be higher given the pedo-climatic conditions in this country favourable to this crop.

Figure 3 shows the evolution of global sugar production, but also its forecast for the current year and for 2019.

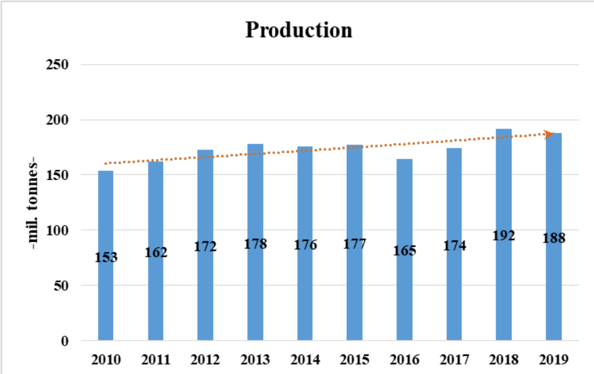

Fig. 3. Determination of the evolution of world sugar production
Source: own processing based on data available on Statistica.com

As we can see, sugar production over the analysed period followed an upward trend, with an annual growth rate of 2.30%. The forecasts for 2018 and 2019 for world sugar production show that production is growing steadily, 192 million tonnes and 188 million tonnes respectively, which are above the threshold of about 10.25% after the liberalization of the sugar market.[4]

National sugar production in Romania has been increasing over the period under review, reaching 472.9 million tonnes in 2016, 1.66 times higher than in 2011 (283.9 million tonnes). The annual growth rate of sugar production is 3.95%.[3]

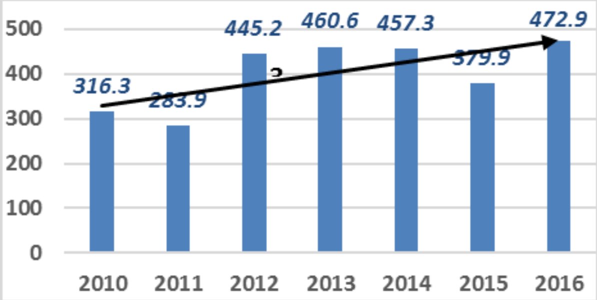

Fig. 4. Determining the evolution of national sugar production (Romania)
Source: own processing based on MADR data

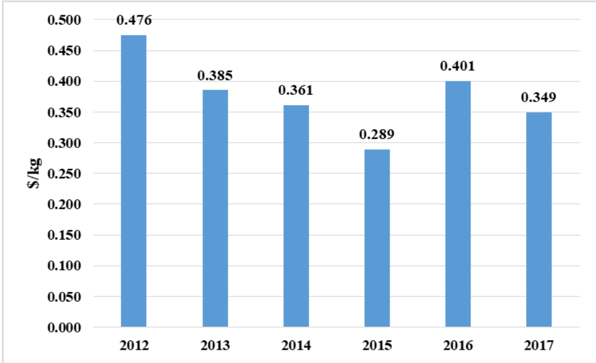

Fig. 5. Determination of sugar price evolution
Source: own processing based on http://macrotrends.net data

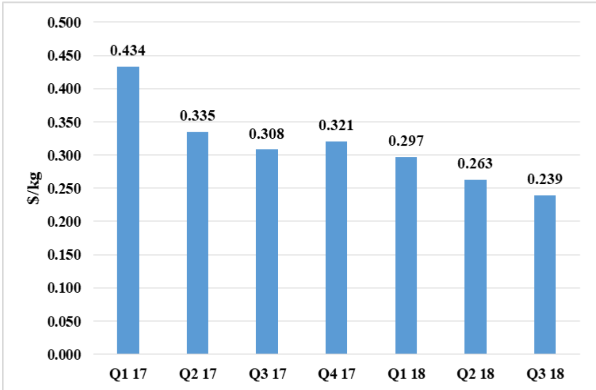

Fig. 6. Determination of price evolution per quarter 2017-2018
Source: own processing based on http://macrotrends.net data

If Romania had 33 sugar factories in the early 1990s, only the Agrana and Tereos groups are currently active, with Austrian and French majority capital. Local sugar production has gone through three decades through major changes by shutting down dozens of sugar factories, the main problems being based on the abolition of EU sugar production quotas which leads to overproduction by European countries holding the majority (such as Poland, France) on the sugar market, thus lowering the price.

By analysing only the supply components on this market, we can say that the average trend of these indicators is increasing, given that both sugar beet and raw sugar production increased in 2018 compared to 2017 market liberalization), the most significant difference being recorded in world sugar production.

Depending on the first results, the increase of the market supply, a "snowball" effect may be that of price (reduction) change. In order to assess this effect, we propose in the next part the analysis of the sugar price evolution.

As can be seen in Figure 5, the price of sugar recorded a downward trend in the market in 2012-2015, followed by a rise in 2016, when it exceeded 0.4 $ per kilogram, and will fall next year to 0,35$ per kilogram.

In Figure no. 6, it can be noticed that with the prices are getting lower because of the increase of the supply sugar. In 2017, in the first quarter, the sugar price was 0.434 $ per kg following a downward trend.

The average quarterly rate over the past two years is -9.5%, reaching in the penultimate quarter of 2018 a record low of $ 0.239 per kilogram.

Next, we propose to evaluate the possible effects of the withdrawal of sugar quotas in the sphere of demand, analysing the consumption of sugar.

As can be seen in Table 2, the average annual consumption of sugar per capita registered a slightly decreasing trend during the analysed period, averaging 0.2% each year, and extrapolating to the total population, which is and this decreasing, there is a more pronounced fall of up to 0.68% per year.

By comparing the first quarter of 2017 to 2018, we can see that the consumption fell by 5.86% per capita and the total by 6.18% per capita. [8]

But also by analysing the quantities of sugar purchased, there is still a decreasing trend in the period 2010-2017, with an average annual rate of -0.14%.

Table 2. The consumption of sugar in Romania

Specifications	2010	2011	2012	2013	2014	2015	2016	2017	Q1 2017	Q1 2018
Average annual consumption per person (kg / person)	9.05	8.89	8.78	8.94	9.11	9.20	8.95	8.92	8.39	7.90
Total annual consumption (tons)	183,193	179,153	176,209	178,699	181,399	182,444	176,413	174,648	164,305	154,159
Quantity bought per person per year (kg / person)	9.46	9.08	8.90	9.31	9.74	9.78	9.37	9.36	8.06	8.08
Total quantity purchased (tons)	191,454	183,021	178,616	186,135	194,066	193,862	184,690	183,345	157,959	157,673
Stocks (t)	8,261	3,868	2,407	7,436	12,667	11,418	8,277	8,697	-6,347	3,514

Source: own processing based on www.insse.ro data[13]

Comparing the first quarter of 2018 with the same period in the previous year, we can see that there has been an increase in the amount of sugar bought by one person. The quantity purchased annually in the first quarter of 2018 covers annual average consumption requirements exceeding 2.27%, a situation not seen in the same period of the previous year when consumption requirements exceeded the quantity purchased by one person.

Considering sugar a perishable product, the difference between the total amount of sugar bought and the total consumption considered as stocks was made.

CONCLUSIONS

In the present study, we wanted to analyze the consequences of the phenomenon of liberalization of the sugar market, the main action being the abolition of quotas in autumn 2017.

During the analysed period 2010-2017, both at national and European level, has been observed an increase in sugar beet production, resulting in an increase in sugar production. It can be predicted that in 2018 there will be an increase in production by 10% more than in the previous year. (following the withdrawal of quotas).

Another possible effect, following the increase in supply, is the fall in sugar prices, making it an affordable food for every person; in the first three quarters of 2018, the lowest prices in the last years.

Even if sugar consumption didn't increase, even decreasing in some periods, a link could be made between the quantity of sugar purchased and the price drop, because in the 1st quarter of 2017 the quantity bought was over the consumed, and the next year during the same period, the quantity bought was higher than the one consumed by inventories, a fact known in economic theory when the price of basic foods is lower.

Concluding, we can say that, following the eliminations of quotas, short-term effects were: increased sugar production, a significant drop in prices and the creation of sugar stocks by the population.

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ECONOMIC ANALYSIS OF SOYBEANS MARKETING IN BILLIRI LOCAL GOVERNMENT AREA OF GOMBE STATE, NIGERIA

Salihu Umaru BIYE[1], Ladan Yakubu MU'AZU[2], Bako Bulus DANLADI[1]

[1]Federal University of Kashere, Faculty of Agriculture, Department of Agricultural Economics & Extension, P.M.B. 0182, Gombe, Gombe State, Nigeria, Mobile: +2348060516813, +2348024321262, Email: salihubnumarbiye@yahoo.com
[2]Federal Road Safety Commission, Adamawa Sector Command Numan road Jimeta, Yola, Adamawa State, Email: abuahamadjahuni@gmail.com

Corresponding author: salihubnumarbiye@yahoo.com

Abstract

The study analyzes economics of soybeans marketing in Billiri local government area of Gombe State. The rationale behind it were to; describe the socio-economic characteristics of the soybeans marketers in Billiri; determine the profitability of soybeans marketing; determine the marketing efficiency of soybeans; describe the constraints associated with soybeans marketing in Billiri and to determine the relationship between the marketing variables. Data were elicited from 97 respondents spread across six prominent soybeans markets in the area with the aid of structured interview schedule. Respondents were selected using purposive and simple random sampling techniques. The data obtained were subjected to analysis using multiple regression and gross margin analysis. Majority of the marketers were aged between 21 and 60 years (89.7%), and were male (70.10%). 61.9% of the respondents were married, 84.51% had at least 10 years of marketing experience in the area, with a ME = 74.19% . more than half of the respondents (52.6%) had attended secondary school. Soybeans marketing in the area were profitable, which was evident from the gross margin of ₦ 4,123.88 per marketer on average every week. Major constraints encountered by the soybeans marketers include; lack of capital, scarcity and high price of soybeans at lean period, high cost of transportation, risk of buying low quality soybeans, poor packaging material, and high Interest rate charged on loans which narrow their profit.

Key words: *soybeans, marketing, Billiri, Gombe State, Nigeria*

INTRODUCTION

Although Nigeria is one of the largest soybeans producers in sub-Saharan Africa, the size of the crop is relatively, small-less than 500 thousand metric tons (TMT) compared to 8,000-10,000 for corn and 4,000-5,000 for (TMT) for sorghum. This is primarily due to lack of adequate market liquidity, providing a limited incentive to
farmer to grow this crop. The demand is constrained by inadequate soy crushing capacity, which in turn is limited by low demand from the animal feed industry, the primary user of soy in Nigeria [1]. Soybean (*Glycine max L.*) is one of the major leguminous crops cultivated all over the world today with Nigeria as the largest producer in both Western and Central Africa, since its introduction in the early twentieth century [2]. Soybean is widely known to be cheap, easily available and a good source of protein compared with expensive animal protein when purchased, as Soybeans is only about 10-20% of the cost of protein from meat, eggs, fish or milk. Soybean is now widely consumed and readily used in the production of crude vegetable oil, soymilk, soy yoghurt and *daddawa*. In addition to that, a local but good seasoning is also produced from soybean.
Agriculture is the principal source of food and livelihood in Nigeria, making it a critical component of programs that seek to reduce poverty and attain food security in Nigeria [7]. As a result, raising agricultural productivity is an important policy goal for concerned governments and development agencies. According to [6], expanding cultivated area is a feasible option for increasing production. However, understanding how producers make decisions to allocate land among crops and how decisions about land use are affected by changes in prices and their instability is

essential for predicting the supply of staple crops and, consequently, evaluating the global food supply situation [3]. Responsiveness of farmers to economic incentives such as price could influence contribution of agriculture to the economy [8]. This could be attributed to crucial roles played by agricultural prices in achieving efficient allocation of production resources [9].

Objectives of the Study

The specific objectives of the study were to:
(i)describe the socio-economic characteristics of the soybeans marketing in Billiri;
(ii)determine the profitability of soybeans marketing;
(iii)determine the marketing efficiency of soybeans;
(iv)describe the constraints of soybeans marketing in Billiri.
(v)determine the relationship between the marketing variables.

MATERIALS AND METHODS

Both primary and secondary sourced data were collected by administering well-structured questionnaires interview schedules. A total of ninety seven soybeans marketers were successfully elicited for information for the study.

Sample Size and Sampling Technique

The study covered six important markets where soybean marketing is mostly observed. These markets include; Billiri main market, Bore market in Tal village, Bangange market, Tudu kwaya market, Bacha market, Shela market all in Billiri local Government in Gombe state. A total number of one hundred and twenty marketers were selected via purposive and simple random sampling techniques. The questionnaire were distributed across the six selected markets in the study, but fifty percent of the questionnaire were distributed among the marketers of Billiri main market because its size.

Analytical Techniques

Descriptive statistics which include simple percentage and frequency distribution was used to describe the socio-economic characteristics of respondents and problems associated with soybean marketing. Inferential statistic such as Gross margin (GM) and regression analysis were used to determine the profitability, relationship of the soybeans marketing in the study area respectively. This is based on the assumption that fixed cost component of marketing is negligible as applied by [4] and [5]. The gross margin is expressed as:

$$GM = TR - TVC \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where:
GM = Gross Margin in Naira per 80 kg bag of soybeans.
TR = Total Revenue/Income in Naira per 50 kg bag of soybeans.
TVC = Total Variable Cost
Marketing Efficiency (ME) estimate of soybeans were determined as opined by [10] and is expressed as:

$$ME = \text{Value added by marketing} \times 100\% \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

An enterprise is considered profitable, if its gross margin is positive and considered non-profitable if otherwise.
Regression (R) allows you examine how multiple independent variables are related to a dependent variable. Once you have identified how these multiple independent variable related to your dependent variable, you can take information about all of the independent variable and use it to make more powerful and accurate prediction about why things are.

$$L_nY = \beta_o + \beta_1 L_nX_1 + \beta_2 L_nX_2 + \beta_3 L_nX_3 + \beta_4 L_nX_4 + \beta_5 L_nX_5 + \beta_6 L_nX_6 + \beta_7 L_nX_7 + \beta_8 L_nX_8 + \beta_9 L_nX_9 + \beta_{10} L_nX_{10} + \beta_{11} L_nX_{11} \ldots\ldots\ldots\ldots\ldots (3)$$

where:
Y = income, X_1 = buying price,
X_2 = selling price, X_3 = on-loading cost,
X_4 = off-loading cost
X_5 = storage cost, X_6 = telephone cost,
X_7 = transport cost, X_8 = commission fee
X_9 = packaging cost, X_{10} = cost of packaging materials, X_{11} = marketing experience.

RESULTS AND DISCUSSIONS

Age of the respondents

The result in Table 1 showed that 49.5% the marketers of soybeans in the study area were aged between 21 to 40 years, followed by 40.2% of those with ages 41 – 60years. The high percentage of young men indicated that greater proportion of the marketers' possess the vigour and can withstand marketing stress.

Table 1. Age distribution of the respondents

Age	Frequency	Percentage
<20	1	1.0
21-40	48	49.5
41-60	39	40.2
> 60	9	9.3
Total	**97**	**100**

Source: Field, Survey, 2018.

Sex of the respondent

The responses on sex in Table 2 revealed that more than half of the respondents (70.10%) were male and (29.9%) respondents were female. This implies that male is dominant over female in terms of marketing of soybeans in the study area. This may be due to the fact that marketing of this crop involve a lot of activities that required the use of energy and also due to the tradition of the people in the area that mostly men partake in such activities. This implies that the labor demands of soybeans marketing can be adequately met by the males thereby capturing the marketing management associated with such activities.

Table 2. Sex distribution of the respondents

Sex	Frequency	Percentage
Male	68	70.10
Female	29	29.9
Total:	**97**	**100**

Source: Field, Survey, 2018.

Marital Status of the Respondents

Table 3. Distribution of the respondents according to Marital Status

Marital Status	Frequency	Percentage
Single	28	28.9
Married	60	61.9
Widow	5	5.2
Divorce	4	4.1
Total	**97**	**100**

Source: Field Survey, 2018

The result of the Table 3 revealed that 61.9% of the respondents were married, and 28.9% were single, 5.2% were widows and 4.1% were divorced. Majority of them were married because it was a cultural practice.

Educational level of the respondents

The result on the educational level of the respondents is presented on the Table 4. The result revealed that 52.6% of the respondents had secondary education while 35.1% had primary education. This shows that most of the marketers were privileged to be literate and technical information can comprehend and adopt faster than their counterparts that are not educated [6]. The education attainment of the soybeans marketers showed that all the marketers had one form of education or the other. This implies that the marketers are educated and can read and comprehend agricultural information sent to them, due to the educational level attained.

Table 4. Educational Level Distribution of the Respondents

Educational Level	Frequency	Percentage
Primary	34	35.1
Secondary	51	52.6
Tertiary	6	6.2
Qur'anic	5	5.2
Adult education	1	1.0
Total	**97**	**100**

Source: Field, Survey, 2018.

Marketing Experience of the Respondents

Result in Table 5 revealed that 44.33% of the respondents had marketing experience of 10-20 years while 4.12% had more than 30years. This shows that majority of the respondents were experienced and can handle their marketing activities more efficiently in view of their vast experience in the business. Those who have spent more years in marketing are usually more convenient with the marketing system and are therefore more experienced.

Experience is shaped by the characteristics of the customer and those of the product, company or brand. [2] explain that "all *actions and processes* that are involved, such as physical actions and perceptual and cognitive processes (e.g. perceiving, exploring, using, remembering, comparing, and understanding), will contribute to the experience".

Table 5. Distribution of Marketing Experience of the Respondents

Marketing experience	Frequency	Percentage
<10	11	11.34
10 – 20	43	44.33
21 – 30	39	40.21
>30	4	4.12
Total	**97**	**100**

Source: Field Survey, 2018.

Occupation of the Respondents

Table 6 showed the occupational distribution of the respondents in the study area. Majority of the respondents were found to be those whose occupations were business 50.5%, this followed by those who engage in farming activities 45.4%, while others were engaged in civil service in the study area 4.1%. The result indicated the way and manner in which business men/women and civil servant were engaged in soybeans marketing when compared with farmers whose ultimate goal was more of soybeans production marketing of soybeans.

Table 6. Occupation Distribution of the Respondents

Occupation	Frequency	Percentage
Business	49	50.5
Farming	44	45.4
Civil servant	4	4.1
Total	**97**	**100**

Source: Field Survey, 2018.

Cost and Return Associated with Soybeans Marketing in Billiri

GM = TR – TVC
= ₦20,877,800.00 – ₦76,950.00
GM = ₦20,800,850 (for the entire marketers).
GM = 20,800,850 ÷ 97 = ₦214, 441.75 (per marker/annum) or (₦214, 441.75 ÷ 52) =₦ 4, 123.88 per marketer/week

The estimated profitability level of soybeans marketing is presented in Table 7. The revenue from soybeans marketing (per 80kg bag) for the entire marketers (97) was estimated at ₦20,877,800, while the total variable cost was estimated at ₦76,950.00 Thus the average Gross Margin was found to be ₦20,800,850 or (per marker). Hence one can conclude that soybean marketing in the area was profitable since every single marketer stands to gain on the average, ₦214, 441.75. The total revenue was greater than the total variable cost of the product. The gross margin was then obtained by deducting the total variable cost from the total revenue of the, whole marketers in the study area.

Table 7. Cost and Return Associated with Soybeans Marketing in Billiri

Variables	Value (₦)/80kg
Total Variable cost(TVC)	76,950
Total Revenue(TR)	20,877,800
Gross Margin(GM)	20,800,850

Source: Field Survey, 2018.

Marketing Efficiency per Bag

ME = Input/output×100
ME = 11,500/15,500×100 = 74.19%

Table 8 showed the performance or the marketing efficiency. The higher the efficiency ratio the higher is the marketing efficiency, any change in marketing process which reduces the input cost of accomplishing a particular marketing services without reducing the consumer satisfaction will certainly lead to an improvement in marketing. Marketing of soybeans in this research was found to be efficient due to the positive value, and high marketing efficiency percentage obtained, which was in agreement with [10].

Table 8. Marketing Efficiency per Bag

Items (average)	Value(₦/80kg)
Gross revenue (GR) output	15,500
Total cost (TC) input	11,500
Marketing efficiency (M.E)	74.19

Source: Field Survey, 2018

Regression Analysis

The result of the regression analysis is presented in the Table 9. The result shows that buying price and revenue were inversely related in soybeans marketing in the study area. The result shows that the coefficient of the buying price was -.259 and was significant at 5% confidence interval. This implies that a unit increase in buying price will result into decrease of revenue by ₦259.The coefficient of selling price was 159 and was insignificant at 5% confidence interval. This shows that a unit increase in selling price will result to increase of income in the marketing by₦159.The coefficient of the on-loading cost was -.033 and was insignificant at 10% confidence interval. This shows that a unit increase in on-loading cost will result to decrease of income in the marketing by ₦.033.The coefficient of off-loading cost was .058 and was insignificant at 5% confidence level. This implies that a unit increase in off-loading cost will result to increase of revenue by ₦.058.The coefficient of storage cost was -.027 and was insignificant at 5% confidence level. This implies that a unit increase in storage cost will result to decrease of revenue ₦.027.The coefficient of telephone cost was .178 and was significant at 10% confidence level. This shows that a unit increase in telephone cost will result to increase in income by ₦178.

The coefficient of transportation cost was 0.172 and was significant at 10% confidence level. This indicated that a unit increase in transportation cost will result to increase in revenue by ₦172.The coefficient of commission fee was -.030 and was insignificant at 10% confidence level. This shows that a unit increase in commission fee will lead to decrease in marketing income by ₦0.030.The coefficient of packaging cost was ₦-0.49 and was insignificant at 10% confidence level. This implies that a unit increase in packaging cost will result to decrease in income by ₦.049

The coefficient of packaging materials was -.071 and was insignificant at 10% confidence level. This shows that a unit increase in packaging materials cost will result to decrease in marketing income by ₦.071.The coefficient of marketing experience was .005 and was insignificant at 10% confidence level. This implies that a unit increase in marketing experience will result to increase in the marketing income.

The coefficient of determination (R^2) was 0.115, which shows that the influence of the all independent variables on dependent variables is 12% and this indicated that there is a weak relationship between the independent variable and dependent variables.

Table 9. Regression Analysis

Variables	**β**	**Std. Error**	***t-ratio***
(Constant)	767074.463	1627619.3	.471
Buying Price	-0.259	54.901	-2.071
Price Sold	0.159	55.277	1.195
On loading	-0.033	30581.472	-0.212
Off loading	.058	24007.248	382
Storage	-0.027	586.875	-0.216
Telephone	0.178*	550.140	1.609
Transport	0.172	1510.650	1.574
Commission	-0.030*	17006.958	-0.168
Packaging	-0.049*	26450.266	-0.274
Packaging materials	-0.071*	3948.106	-0.623
Marketing experience R^2 = 0.115	0.005	10233.607	0.041

Source: Output from SPSS, 2018 ***Sig.at 1% level; **=5% level; * =10%

Constraints Associated with Marketing of Soybeans in Billiri

Constraints associated with soybeans marketing in the study area are presented in Table 10. The result showed that lack of adequate capital at the disposal of the marketers was perceived as the most serious problem 39% of the marketers. The result revealed that lack of access to capital constituted the most serious constraint facing their business. This was followed by scarcity and high price of soybeans at lean period 20.6% which also contribute to the problems in marketing of soybeans in the area. Transportation was also another constraint facing the marketers in the study area.

About 17.5% of the respondents expressed that transportation is one of the problems encountered in the study area. According to [9] and [11] road transportation is the main avenue through which different parts of the society are linked together. Only 9.3% of the respondent also lamented that risk of buying poor quality soybeans is among their constraints in the study area.

Poor packaging materials 8.3% also cause damages to the soybeans in the store of the marketers, as such causes waste and reduction in the quantity of soybeans. The respondents

(5.2%) also expressed that; there was high interest rate during the lean period of soybeans marketing in the area which affected some of the marketers.

Table 10. Constraints Associated With Marketing of Soybeans in Billiri

Constraints	Percentage	Rank
Lack of capital	39	1
Scarcity and high price of soybeans at lean	20.6	2
Transportation	17.5	3
Risk of buying low quality soybeans	9.3	4
Poor packaging material	8.2	5
Interest rate	5.2	6
Total	**100**	

Source: Field Survey, 2018

The constraints associated with marketing of soybeans in Billiri are graphically illustrated in Fig.1.

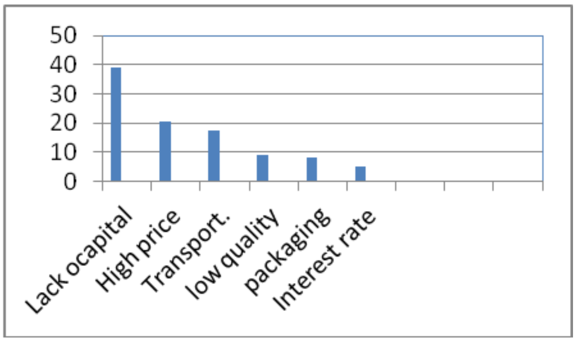

Fig.1. The order of the contraints associated with marketing of soybeans in Billiri

Regression equation = 767074.463 – $.259X_1 + .159X_2 - .033\,X_3 + .058X_4 - .027X_5 + .17X_6 + .172X_7 - .030X_8 - .049X_9 - .071X_{10} + .005X_{11}$

CONCLUSIONS

The result of the study revealed that socio-economic characteristics of the respondents engaged in soybeans marketing in the study area are mostly male, aged between 21-40 years, and was also married. Soybean marketing was a profitable venture since the gross margin was greater than the total variable cost. Marketing of soybeans was also found to be efficient in view of the high marketing efficiency obtained. The survey also showed that marketing of soybeans was constraints by problems such as seasonality in price fluctuation, high cost of transport, lack of access to credit and inadequate storage facilities to continuously promote soybeans marketers in the study area.

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RESEARCH ON THE SOIL BREATHING ACTIVITY UNDER THE IMPACT OF AGRICULTURAL TECHNOLOGICAL PROCESSES

Mariana BURCEA

University of Agricultural Sciences and Veterinary Medicine Bucharest, Faculty of Management, Economic Engineering in Agriculture and Rural Development, 59 Marasti Boulevard, District 1, 011464, Bucharest Romania, Phone: (+40) 213182564, Fax: (+40) 213182888, Email: burcea_mariana2003@yahoo.com

Corresponding author: burcea_mariana2003@yahoo.com

Abstract

The biological properties of the soil are important because they are closely related to soil physico-chemical properties and plants' health. Thus, the diversity of species, their number and their functions are indicators sensitive to changes in soil properties due to agricultural practices. From a biological point of view, improving the physical and chemical properties of the soil creates favourable conditions for the activity of the microorganisms and for the growth of the plant roots. Soil breathing is one of the soil's properties, determined by the plant roots' activity and microorganisms living in the soil, an activity that is appreciated by the carbon dioxide production (CO_2 emission) from the organisms that live in the soil. The research calls into question the soil breathing process under two crops, wheat and corn, following the impact of various soil technological processes on this respiration potential, on experimental variations such as conventional tillage, superficial tilling, disc harrowing and no tillage soil. From research in the field, soil breathing rates vary significantly between major plant biomasses, suggesting that the type of vegetation influences the rate of soil respiration.

Key words: *soil CO_2 emission, soil tillage systems, no-tillage, conventional tillage, wheat, corn*

INTRODUCTION

The carbon flow from the soil into the atmosphere occurs mainly in the form of CO_2 and is the result of the soil breathing process. Soil respiration represents the combined respiration of plant roots, microorganisms and macro organisms in the soil [10]. Microorganisms and roots contribution to total soil respiration is estimated at 42% using the relationship between biomass, root and CO_2 [5]. Root breathing covers a percentage between 51% and 62% of the evolution of CO_2 emissions [3].
Under insufficient aeration conditions, the decomposition of plant debris is incomplete and bacterial activity is intense and short-lived. It is estimated that an oxygen content below 10% is the lower limit below which soil processes are affected [2]. Oxygen is necessary in conducting soil oxidation processes and in the activity of aerobic nitrifying bacteria that oxidize ammonia and convert it in nitrates.
Soil biological activity (including the enzymatic enzyme) plays an important role as it is involved in the degradation of organic matter [4].
As a result of biological activity, mainly by the decomposition of organic matter by microorganisms, the majority of CO_2 is present in the atmosphere, more than 90% of CO_2. This CO_2 content is higher in cultivated soils than in non-cultivated soils [6]. These researches have been addressed but there have been no major predictable differences in soil respiration between cultivated and non-vegetated soils, possibly due to the diversity of crops and harvesting systems included [8].

MATERIALS AND METHODS

The research was carried out on a typical chernozem soil in the Roman Plain, considered to be the soil with the most favorable properties in terms of fertility [9].
The principle of the method for determining the soil respiration potential, consists in capturing the oxygen released by

the microorganisms during the breathing process in 0.2N NaOH and titrating the NaOH excess left uncombined with 0.1N HCl in the presence of the thymolphthalein indicator 1% until it turns blue to colorless [11].

The calculation and interpretation of the results is according to the formula [1]:

CO_2 mg/100g soil d.s. = (A - B) × f × 2.2 × 5 × KU

where:

A = ml of HCl with which titration was performed on control samples (mean of 3 repeats);

B = number of ml of HCl 0.1N with which titration of each soil sample was performed;

2.2 = CO_2 equivalent in mg for 1 ml of 0.1 N HCl;

f = correction factor;

5 = the ratio coefficient of the 20 grams of soil taken in the analysis to 100 grams of soil;

KU = correction coefficient for soil humidity.

The soil humidity is expressed by:

U% = water / dry soil × 100

To determine the correction factor (f), the following relationship is used:

f = 0.019011 × 10/0.019011 × ml of HCl

The experimental results were processed by using the variance analysis, by which the limit differences (D.L.) were calculated [7].

RESULTS AND DISCUSSIONS

The potential for soil respiration, is a global indicator for assessing the soil life activity level. Soil breathing is the main pathway where CO_2 fixed by terrestrial plants returns to the atmosphere. It is estimated to be about 75 × 1,015 g C/yr, this high natural flow is likely to increase due to Earth's activity [12].

For the wheat culture (Table 1), the soil respiration potential, as a result of the various technologies applied on the typical chernozem, recorded values of 27.18 mg CO_2/100g solution , as conventional tillage through plowing (A), indicating the richest biological soil activity, followed by the variant in which the soil was worked with the chisel (C), with a breathing potential of 26.75 mg CO_2/100 g dry substance solution.

Similar results have been found by Schlesinger [12], where conventional soil tillage and temperature increase have increased the CO_2 flow in the soil without increasing the amount of organic matter in the soil.

The version tillaged alternately with the disc and the chisel (D/C) showed a good breathing potential of 23.03 mg CO_2/100g dry substance solution.

Table 1. The potential for soil respiration under the influence of soil cultivation on wheat crop, mg CO2/100g dry substance solution

Soil processing method	The potential for soil respiration		Difference mg CO_2/100g dry substance solution	Meaning
	Mg CO_2/100g soluţion d/s	%		
Annual plowing (A)	27.18	100	Mt	
No-tillage (N)	18.96	69.75	- 8.22	0
Disc/Chisel (D/C)	23.03	84.73	- 4.15	-
Annual Disc (D)	12.61	46.39	- 14.57	000
Annual Chisel (C)	26.75	98.41	- 0.43	-
$Dl_{5\%}$ = 5.89; $Dl_{1\%}$ = 8.57; $Dl_{0.1\%}$ =12.87				

*DL - the limit difference (variance analysis method)

Source: own research.

Compared with the conventional version (A), considered as the control variant, the version with the yearly disc (D) recorded the lowest soil biological activity (12.61 mg CO_2/100g dry substance solution), the difference being statistically very significant negative, followed by the version in which it was directly sown in untreated land with statistically assured, significantly negative values of 18.96 mg CO_2/100g dry substance solution (Fig.1).

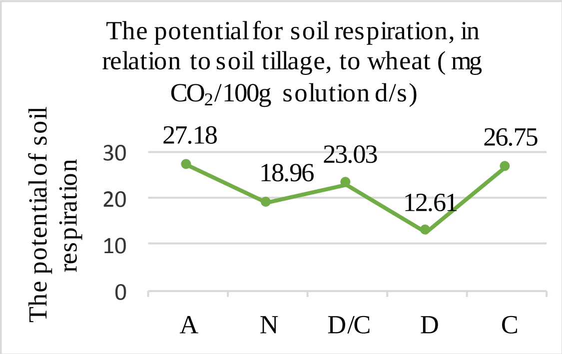

Fig. 1. The potential for soil respiration in wheat crop, mg CO_2/100g dry substance solution
Source: own research and design.

In this context, researches conducted by Raich in 2000 [8], and quoted by Guş [6], indicate the same increased values of the breathing potential in the classic system (81.3 g/m3) and the lowest values at direct sowing (5.9 g/m3).

In corn culture, a more intense biological activity is recorded in the soil compared to wheat culture (table).

In the version where the soil was alternatively processed with the disc/chisel (D/C), there is the richest biological activity in the soil, where it reaches 57.14 mg CO2/100g dry substance solution, followed by the version where the soil was processed by plowing with furrow turning (50.42 mg CO_2/100g dry substance solution) and yearly chisel version (C), where the values reach 47.37 mg CO_2/100g solution.

Table 2. Breathing potential under the influence of soil cultivation on corn crop, mg CO_2/100g dry substance solution

Soil processing method	The potential for soil respiration		Difference mg CO_2/100g dry substance solution
	mg CO_2/100g soluţion d/s	%	
Annual plowing (A)	50.42	100	Mt
No-tillage (N)	30.09	59.67	- 20.33
Disc/Chisel (D/C)	57.14	113.32	6.72
Annual Disc (D)	46.36	91.94	- 4.06
Annual Chisel (C)	47.37	93.95	- 3.05
Dl $_{5\%}$ = 15.88; Dl $_{1\%}$ = 23.09; Dl $_{0.1\%}$ =34.64			

*DL - the limit difference (variance analysis method)
Source: own research.

In the case of the yearly disc (D), the soil breathing potential has high values, close to the other reduced soil tillage versions, which is 46.36 mg CO_2/100g active substance solution (Fig 2).

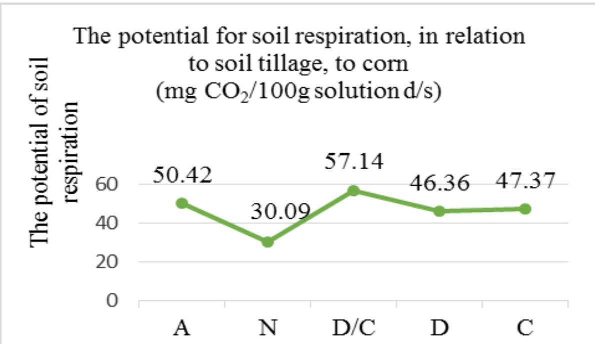

Fig. 2. The potential for soil respiration in corn culture, mg CO_2/100g dry substance solution
Source: own research and design.

As with wheat crops, the lowest biological activity in the soil was recorded as seeded in no tillage soil (N) where they have the value of 30.09 mg CO_2/100g dry substance solution, but here this value is higher than the conventional tillage version of the wheat crop, the difference being significantly negative, changes observed by the Rustad, due to the different use of soil technological works [10].

CONCLUSIONS

The soil's breathing potential was higher in the case of plowing (A) and lower in the no tillage soil, with no soil intervention (N) or only by superficial tilling (D), or disk tillage soil, for the wheat culture.

In wheat culture, the weakest biological activity, with regard to the potential for soil respiration, is recorded in the year round superficial tilling (12.61 mg CO_2/100g dry substance solution), which drops by 50%

versus the conventional version (27.18 mg CO_2/100g dry substance solution).

In corn culture, the potential for soil respiration values were higher than wheat crops. For corn, the smallest value of soil breathing potential was recorded in direct seed sowing, with the highest value being recorded in the plowed version.

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OBSERVATIONS REGARDING THE MANAGEMENT OF SOWS WITH HIGH PROLIFICACY FROM COMMERCIAL FARMS IN ROMANIA

Mirela CĂRĂTUȘ STANCIU, Simona POPP NAN

”Lucian Blaga” University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environmental Protection, 5-7 Ion Ratiu Street, 550003, Sibiu, Romania, Phone: +40269211338, Fax:+40213182888, Mobile:+40744472790, Email: mirela_stanciu2008@yahoo.com

Corresponding author: mirela_stanciu2008@yahoo.com

Abstract

*The paper presents the performances of sows with high prolificacy from a commercial farm in Romania. We analyzed breeding system and reproductive parameters. The correlation between the number of piglets from breeding and the average weight of piglets was analyzed. The exploitation of sows with high prolificity requires the application of appropriate management***.**

Key words**:** *sows, maternity sector, integrated management, high prolificacy*

INTRODUCTION

Worldwide in 2017 there were 1.266.077 thousand pigs. The top positions were China (435,040 thousand), E.U. (147,188 thousand), Brazil (39,215 thousand), Russia (21,888 thousand) and Canada (13,935 thousand). [6, 8]

In the U.E. the total number of pigs, in 2016, was 147.2 million. The top 10 emerging countries were: Spain (29.23 millions), Germany (27.3 millions), France 12.79 (millions), Denmark (12.28 millions), The Netherlands (11.88 millions), Poland (millions), Italy (8.48 millions), Belgium (6.18 millions), Romania (4.71 millions) and the United Kingdom (4.54 millions). [4]

A study on the evolution of pigs in Romania shows that the stock in this species reached 5,041 thousand in 2015. This study concluded that in Romania, pork production has declined due to the continuous decrease in pig livestock. [9]

The need to increase global meat production has made the world's leading swine-breeders to experiment and produce high-quality genetic material. They have developed selection and hybridization programs, providing healthy and performing breeding animals.

By applying research, these companies have been able to provide more and more performing breeds to meet the needs of the breeders. The final goal is the quality of the finished product that meets consumer’s requirements.

The programs of the major genetic producers have been developed using different breeds: Landrace, Great White, Yorkshire, Duroc, Hampshire, Pietrain, etc., as a pure breed or in the form of certified, tested and verified lines. Thus, cross-breeding schemes have been applied to obtain individuals with high breeding performance. [1, 3]

The management of sows with high prolificacy was and will remain a research and reflection object, as well as a critical and controversial subject. There is a need for extensive analysis of the problems encountered by large pig breeders.

In order to analyse management strategies in highly productive pig farms it is necessary to analyse the term "management". In this case, this term is used to indicate the specific way of managing the animals. Since the factors that act and interact on a farm are numerous, the term management has a very wide meaning.

Some authors in 2017, show the number of pigs weaned per sow per year (PWSY) can be used to compare the productivity of breeding herds, either between herds in a country or between countries. [5]

One study shows that there are also concerns in the US for the rising number of piglets. It is known that if the number of piglets increases, the weight of the piglets decreases. This will result in more pigs with a small weight. These lighter pigs will have lighter weaning weights, higher rates of pre-weaning mortality and take more days to market. [10]

MATERIALS AND METHODS

In order to understand the management of sows with high prolificacy from an industrial farm, observations were made during the period 01.01.2016-26.05.2016. The data collected included: reproduction indicators, diet of pregnant sows and lactation.

Observations have also been made on the average number of piglets and the average weight of the piglets.

The data was statistically processed and interpreted.

RESULTS AND DISCUSSIONS

Breeding indicators

For well-managed farms that want high productivity, it is essential to use genetically engineered high-yielding genetic material.

Table 1. Reproductive performances in a commercial herds in Romania

The hybrid	No of sows	PB	PBA	PBD	MP
F1 DANBRED (local origin)	604	17.71	15.29	1.7	0.71
F1 DANBRED (origin Spain)	45	18.4	15.02	2.6	0.78
TRI (origin Germany)	561	13.34	11.64	1.34	0.36
GRASE	60	11.97	10.33	1.37	0.27
PIC	1899	14.53	12.74	1.37	0.42
SP (origin Spain)	153	13.64	11.23	1.94	0.47
Large White (origin Danmark)	119	17.72	14.96	2.28	0.49
LPIC	70	13.71	11.87	1.49	0.36
Landrace (origin Danmark)	35	16.03	13.34	2.09	0.6
F1 DANBRED X Large White	160	16.05	13.83	1.53	0.64

Source: own calculation and observations, based on the data from a commercial farm.

In Table 1, we used the following abbreviations:

PB - The total number of pigs born
PBA – The number of pigs born alive
PBD- The number of pigs born dead
MP – The number of mummified pigs

These sows must have a minimum of 15-16 live piglets, to obtain a number of weaned piglets / sows to cover production costs.

The largest number of piglets at birth (18.4) was recorded in the F1 DANBRED sows imported from Spain. The largest number of live-born piglets (15.29) was recorded in the F1 DANBRED sows produced in the analyzed farm.

Management of feeding of sows with high prolificacy

The diet of sows with high prolificacy should be adapted as well as other factors to the new advances in genetics.

Since today's hybrid sows are characterized by lower body reserves, higher feeding needs and less environmental resistance, the nutrition strategy goals are:

-careful control of weight gain during gestation and

-maintaining a good physical condition during lactation.

It is mandatory to measure the thickness of the dorsal fat layer – TDFL (at point P2 - at the last rib, 5-6 cm from the median line).

In the case of young sows, the feed must have a high content of enzymes and fibber. Administration of this feed is necessary because the dorsal fat layer before being fertilized should reach 16-18 mm.

Administration of rationalized feed in the first 72 hours after fertilization is necessary to avoid embryonic death.

Because weight loss occurs during lactation, it takes a lot of food to recover the lost weight. This is not the case of young sows.

For hybrid sows with high prolificacy, maintaining a good state of the body depends on the use of fodder during gestation.

During gestation, the volume of the stomach increases, which then allows the ingestion of a large amount of feed during lactation.

For lactating sows, it is advisable to have a tasty fodder to get a high intake and high milk production. That is why we use appetizing feed formulations with a significant percentage of barley (50%) and a moderate energy level (3,150 kcal). 3 meals / day are provided in liquid form (with minimum 5 hours between them).

Measuring the dorsal fat layer (TDFL) at point P2 before fertilization, during gestation and lactation is very important. This is a benchmark indicating the need to correct possible food strategies.

Is recommended:

-in young gilts - TDFL - must be larger than 15mm. There will be no fetters with TDFL less than 15 mm. If needed, these gilts will be fed ad libitum until the corresponding fat layer is formed.

-in weaned sows - the TDFL must be greater than 14mm. If it is less, it is the same as in the case of gilts.

-Sows at birth must have a TDFL equal to at least 16mm. It would be best for the TDFL to be between 16-22 mm. TDFL greater than 22mm is not recommended. Lactation problems and slow births are avoided.

During lactation, a maximum TDFL loss of 2mm is normal. If the loss is greater, a review of the lactation feeding program is mandatory.

A paper published in 2017 shows that the TDFL determined on pig's carcasses classified in Romania fell from 14.2 mm in 2010 to 13.2 mm in 2015. The decrease in the TDFL shows the obtaining of carcasses of better quality. [2]

Comments on the average number of piglets in calving. The correlation between the number of piglets in calves and the average weight / piglet weight

A main feature to be considered in high prolificacy sows is the breastfeeding capacity, as the number of piglets exceeded the number of nipples.

In addition to the positive aspects, we have to consider the variability of piglet's weight at maturity and the management of cross-breeding.

Due to the number of piglets born in excess comparative with the number of nipples, breeders have been forced to find solutions for the survival of piglets in addition.

Generally, the higher the number of piglets at birth, the lower the birth weight / piglet. This has repercussions on pig weights at weaning and implicitly at slaughter.

It has been observed that weaned piglets at the age of 28 days, weighing 4-5 kg / animal, reach the cutting weight 28 days later than those weighed at 8-10 kg.

To see the correlation between the number of piglets at birth and their weight, 21 PIC sows were observed in calving.

At those the average of the total number of pigs born (PB) was 14.33; the number of pigs born alive (PBA) - 13.57; the number of pigs born dead (PBD) – 0.57; the number of mummified pigs (MP) – 0.19. The weight of the largest piglet in the breeding nest was 1.92 kg, the weight of the smallest piglet in the breeding nest was 0.98 kg. The average weight of a piglet was 1.53 kg.

For those the number of pigs weaned per sow per year (PWSY) will be 31.48, with a 2.32 litters/sow/year.

Genetics and sow management can increase PWSY up to that number of pigs in the future.

The management of sows with high prolificity exploited in commercial farms must be the object of future researches and reflections. [7]

CONCLUSIONS

From an economic point of view, the influence of genetic material on the cost of a piglet varies between 4% and 7%, justifying the use of "advanced" genetic materials.

These animals have guaranteed productivity. Purchasing this genetic material requires thorough training.

Not all farms are ready to use highly productive genetic material.

If shelters, quality of management and nutrition are not in balance with this type of genetic material, the proposed objectives will not be achieved.

The most suitable genetic material for a farm will be the one that will harmonize with all the other management factors. In order to optimize production, it is necessary to adapt the management factors to the type of genetic material.

Each genetic material corresponds to a particular management. It is essential that there is one type of genetic material on a farm. It is not possible to manage different types of genetic materials correctly in a single farm.

The genetic value of a swine used for breeding has a major impact on the quality of production as well as on the efficiency. That's why researchers in this field have developed selection and hybridization programs, delivering performing and healthy breeding animals.

In high yield pigs, it is necessary to use the term "management" to know the specific way of managing animals.

To achieve the desired results, it is essential to consider a cumulative strategy. These refer to: management of genetic material, nutrition, sanitation, shelter, animal management, animal age structure control, human resources.

The advantage offered by high prolificacy sows is that they offer a large number of piglets. Due to the fact that the number of nipples is insufficient for nursing piglets, and the lack of proper management to manage this situation, the piglets will be lost.

That's why different methods have been implemented to get these piglets to live.

In maternity the surplus of piglets can be redirected to other sows. Milk substitutes based on milk powder can also be used.

The value of the results is highlighted by the professionalism of the staff working in such farms.

A disadvantage of these sows is that genetic transformations in order to improve productive capacity have reduced their resistance. Their needs regarding diet, care and maintenance are high.

Regarding the evolution of breeds in time, it can be noticed that the number of products obtained at birth was tripled from 6-7 piglets of the Mangalita sows, to 17 piglets in the case of Danish sows.

Permanent breeders have to align to new developments in the field. Novelties can target hybrids with high prolificacy or their growth technologies.

Increasing the quality and quantity of production depends on how breeders can adapt to the new technologies. Science, through sustained research, aids those who put the new discoveries into practice.

Considering that not every race or hybrid fits anywhere, it would be ideal for domestic breeds to be improved with the imported hybrids. It is desirable to obtain robust, resistant and at the same time hyper-prolificacy and quality animals.

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ANALYSIS OF THE BEHAVIOR AND MOTIVATION OF CONSUMERS TOWARDS SHORT FOOD SUPPLY CHAINS

Mirela CĂRĂTUȘ STANCIU

”Lucian Blaga” University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environmental Protection, 5-7 Ion Ratiu Street, 550003, Sibiu, Romania, Phone: +40269211338, Fax:+40213182888, Mobile:+40744472790, Email: mirela_stanciu2008@yahoo.com,

Corresponding author: mirela_stanciu2008@yahoo.com

Abstract

The paper studies the main Short Food Supply Chains (SFSC) in Sibiu County. Data was obtained from local authorities regarding the number of producers selling their products in the markets. In the "Transylvania Market", their number increased in 5 years from 58 to 180. The SWOT analysis of the Short Food Supply Chains was carried out. In order to evaluate the consumers' attitude regarding SFSC in Sibiu County, an investigation was carried out among 120 consumers. The main advantages and disadvantages of buying local products through SFSC have been identified. The main beliefs of buyers about the products offered by SFSC are: quality, freshness, authenticity, traceability, producer confidence. The main disadvantages identified are unknown quality, low food safety, low supply capacity, long distance, lack of time.

Key words: *short food supply chain, attitude, behavior, motivation*

INTRODUCTION

On EU level the interest for the short food chain is growing, considering its role in achieving environmental goals. Short Food Supply Chain (SFSC) is described like an instrument of sustainable agriculture. [1]
On international level there is an increasing concern for sustainable food distribution. [5,]
The Slow Food movement defines SFSC as an alternative strategy that allows producers to regain their active role in the food chain. SFSC focuses on local, decentralized production, which minimizes the number of actors and the distance. [6]
Authors like Peters (2012) say that Short Food Supply Chains reduce the number of intermediates that are needed to deliver the product to the final consumer. [15]
After the distance from the place of production to the point of sale, several SFSC types have been identified on EU level: proximity sales (community-based farming, farm sales, out-of-farm sales to the private or public sector) and distance sales (direct sales to the consumer, on-line sales, sales to specialized retailers).[7, 10, 11, 12, 13, 16]
SFSC can be a traditional and/or alternative way of producing, distributing, retailing, and buying food. SFSC can be served as niches for producers and consumers, who look for alternatives. [9]
The Local Food Initiatives Foundation presents the impact of the local food sector on local sustainable development. Thus, the impact is reflected on human, social, economic, physical and natural capital. [8]
Other studies regarding the behavior of the consumers from Sibiu County showed that SFSC encourages the producers and helps develop a relationship based on trust between producer and buyer. [4, 17]

MATERIALS AND METHODS

Bibliographic documentation on SFSC and on the theory of planned behavior was carried out. The main types of SFSC in the county were identified. Data was obtained from local public authorities about local producers who sell in markets. The SWOT analysis of SFSC was carried out.
A questionnaire consisting of 9 items was developed and distributed on-line between 01-30 September 2018.
The questionnaire contained 9 items and was completed by 120 respondents. We have centralized, statistically processed and

interpreted the results. The items of the questionnaire refer to: the sex and age of the respondents; residence; the last graduated school; the average family income; number of family members; the person who makes family purchases. The most important reasons or disadvantages related to SFSC have been identified.

RESULTS AND DISCUSSIONS

In order to understand the role of SFSC, their SWOT analysis was carried out [2, 14]

STRONG POINTS

Consumers in the urban area are increasingly moving towards locally produced products.

SFSC offers different traditional foods, obtained locally.

Autonomy is highly related to conventional food chains.

There is collaboration between local producers and buyers in the markets.

Local gourmet supporters have access to personalized services.

Supporting resources and the local economy is the philosophy that unites local producers and end-users.

Transfer of expertise is made easier in local businesses. At the bottom lies the whole family experience over generations.

WEAKNESSES

Seasonality of products obtained locally by traditional methods.

Unsatisfactory product demand for large-scale customers.

Marketing and public relations are limited compared to major global brands.

Less and less labor force in rural areas. Exhaustion of those involved in the business appears.

Production from such businesses is less quantitative.

There is a risk that low-income people can distinguish SFSC as a niche for people with over-average income.

OPPORTUNITIES

Markets or trade fairs are viewed as a marketplace, a special destination where information interacts and is exchanged.

Rural tourism pensions are opportunities to present agri-food products

Caring for the health of animals, but also for protecting the environment and its sustainability is an opportunity. Locally produced products are considered to be sustainable products.

Numerous national and regional strategies are opportunities and support for SFSC development.

School farms can be considered places where young people can see the process of obtaining traditional products. They can be educational means.

Fuel prices have an upward trend globally. They do not significantly affect the prices of products locally produced and marketed through SFSC.

The FEADR program includes a series of funding measures through Local Action Groups (LAGs).

Promoting products and initiatives across various social media sites free of charge.

THREATS

Hypermarket stores develop their own short supply circuits. Local products of clear origin are made available to final consumers.

The purchasing power of end-users may decrease in the event of an economic crisis. Local products are targeted for middle-income and above-average people.

Small and local entrepreneurs are not able to provide tourists with a good quantity and constant quality of products.

The level of information on the various sources of funding and advice is low among the actors involved in SFSC.

Young generation's lack of interest in promoting local products and SFSCs.

Globalization facilitates trade between states.

Climate change (drought, late winter).

Difficult access to land purchase or leasing.

Producers in remote villages in urban areas do not have high-quality telephony and internet access.

Local fake products.

Unfair competition from traders selling "labeled" or "traditional" labeled products. They can be bought from hypermarkets and re-tagged.

Analysis of behavior and consumer's motivation on SFSC

Of the total of 120 responses, 71.29% are female and 28.71% are male. The first observation is that ladies are interested in local products.

The largest number of respondents was between 36 and 55 years old (65.8%), followed by those aged between 26 and 35 (30.6%). People aged 18-25 represent 1.8% and over 55 years old have the same share of 1.8%.

A share of 99.16% of all respondents comes from the urban area, and 0.84% comes from rural areas.

The level of training of the respondents shows that 35% have graduated university (42 persons), 36.67% high school (44 persons), 24.17% (29 persons) are master graduates, 3.33% (4 persons) 10 classes and only 0.83% (1 person) have doctoral studies.

Approx. 38.33% (46 persons) have a net income below 2,000 lei, 36.67% (44 persons) have an income between 2,100 and 3,500 lei, 22.5% (27 persons) between 3,600 and 5,000 lei, and 2.5% (3 persons) over 5,000 lei.

The number of family members varies, one person 35% of respondents (42 persons), 29.17% (35 persons) have 4 family members, 27.5% (33 persons) have 3 members, 6.67% (8 people) have 2 members, and 1.66% (2 persons) have 5 members.

A percentage of 97.5% (117 people) of the surveyed people are engaged in shopping in the family, while only 2.5% (3 people) do not.

The main motivations to buy food through a SFC are: 116 people (96.67%) are convinced that they contribute to local development; 112 people (93.33%) buy for product quality; 111 people (92.5%) buy for the authenticity of the products; 110 people (91.67%) buy for trust in the producer; 95 people (79.17%) buy because the products are traditional; 83 people (69.17%) buy because they are niche products; 76 people (63.33%) buy because they know the products; 66 people (55%) are friends with producers; 61 people (50.83%) buy because the price is convenient; 43 (35.83%) buy for freshness; 40 people (33.33%) buy for traceability of products.

The main reasons why they would not buy through a SFSC are: lack of time for 110 people (91.67%); low supply capacity for 85 people (70.83%); unknown quality for 45 people (37.5%); long distance for 43 people (35.83%); low food safety for 39 people (32.5%) and economically unconventional for 33 people (27.5%).

CONCLUSIONS

Several types of SFSC have been identified in Sibiu County. Consumers in the urban area are increasingly moving towards locally produced products. There is a partnership between producers and consumers. It was created because of trust and transparency.

On Sibiu County level, there are also initiatives to create and support SFSC through consumer associations. Thus, the project of the Association for Supporting Rural Agriculture created partnerships between consumer groups and farmers in the neighboring villages. These initiatives do not benefit from a high rate of success among consumers. Most citizens in Sibiu County have family ties or knowledge in nearby villages that can deliver food from farmhouses.

There is an increased interest in the direct delivery of the products obtained. They are delivered either at the customers' home or at a predetermined destination. There are few initiatives to open a store due to high rents and space planning. Only 3 producers' stores have been identified.

In Sibiu county there are also a number of gastronomic events. [3] During the winter, these are mainly held in the city of Sibiu, and in summer, in villages in the county, home to one of the local producers. Usually they take place once a month, and producers have to turn to other distribution channels.

Our research on the online environment has identified a limited number of facebook pages or websites of local producers. A number of 3 vegetable producers promote their products on the internet, 2 quail producers and 1 traditional bread or pastry producer.

On Hârtibaciu Valley there is an initiative designed to create a brand of the area. The products offered are promoted under the trademark "Din Hârtibaciu, cu drag".[2]

Producers' access to the city's markets is limited due to the high rental prices of the stalls, but also because of the intermediary placement of the stalls.

Transylvania Market is the point of attraction of the producers in the county, but also from the neighboring ones. The number of producers selling on Transylvania Market has increased in the past 5 years since its establishment, from 58 to 180. About 58% of them sell vegetables and fruits, respectively dairy products. The success of this market is due to the free of charge of the stand and its proximity to a neighborhood of flats.

Consumers are encouraged to buy products directly from the producers at a relatively short distance from their home.

Consumers education is an essential point of Transylvania Market organizers. A space was set up to inform about the products in the market. Information is also provided on the values promoted by SFSC, the seasonality of products, the economic and social benefits on local level.

Special attention is placed on gastronomic culture as a local patrimony. Transylvania Market is also a point of attraction for orders placed during the week. The market is also a space for creating long-term relationships between producers and consumers. Producers have been loyal to their clientele, a great deal of which has been bought from the same stand for every week.

Supermarkets also have special stands for local producers. Local producers do not want to participate in the program. They can not deliver large quantities of products throughout the year. A relevant example of a local product sold in a supermarket is raspberry from a farmer in the area.

The main beliefs of buyers about the products offered by SFSC are: quality, freshness, authenticity, traceability, producer confidence.

The main disadvantages identified are unknown quality, low food safety, low supply capacity, long distance, lack of time.

It has been observed that the feminine sex is responsible for the purchase of food in the household.

Revenue from people who are interested in local products is around the average economy. Products marketed through SFSC are products accessible to middle class people.

At the base of the intention to buy local products is the quality of the products.

On Sibiu County level, a great deal of attention is paid to environmental protection and the development of the local economy.

Buyers consider purchasing local products to contribute to environmental protection and local development.

It turns out that SFSC creates links between producers and consumers. There were significant responses that respondents say they are friends with farmers.

Society has become one of the speed in which population is pressed by time, by deadlines. People can not afford to waste a lot of time looking for products. Lack of time is the main disadvantage identified in the intention to buy local products.

Small producers have all the strengths to develop and maintain short food supply chains. They must have the ability to associate.

On country level (Romania), the creation of these short food chains is supported financially by the National Rural Development Program 2014-2020. Local Action Groups have a special role to play in this.

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ANALYTICAL EVALUATION OF ORGANIC AGRICULTURAL DEVELOPMENT IN UKRAINE

Yuriy DANKO[1], Nataliia MARCHENKO[1], Volodymyr OREL[2], Lyudmila ANTONOVA[3], Irina KOSAREVA[4]

[1]Sumy National Agrarian University, 160, H. Kondratiiev St., Sumy, Ukraine, Phone: +38(0542)721042, +38(0542)222448, E-mails: yuriy.i.danko@gmail.com, tashka7571@ukr.net
[2]Kharkiv Petro Vasylenko National Technical University of Agriculture, 44, Artema St., Kharkiv, Ukraine, E-mail: vova7003@gmail.com
[3]Petro Mohyla Black Sea National University, 10, 68-Desantnykiv St., Mykolayiv, Ukraine, Email: Antonovalv77@gmail.com
[4]Kharkiv Institute of Finance of Kyiv National University of Trade and Economics, 5, Pletnyovsky Lane St., Kharkiv, Ukraine. E-mail: kosareva@mail.ru

Corresponding author: yuriy.i.danko@gmail.com

Abstract

This article explores preconditions for the development of agrarian enterprises producing organic products in Ukraine. The study is focused on analysis of the factors that determine the competitiveness of agrarian producers of organic food, as well as trends in organic production development. The paper is an analytical assessment of Ukrainian organic farming development based on the scientific works existing in the literature and the reports of the enterprises. The investigation has proved the efficiency of the organic farming system implementation at Ukrainian enterprises.

Key words: *organic farming, organic products, competitiveness, agrarian enterprises*

INTRODUCTION

In the last decade, the development of organic food production and agrarian enterprises and other entities that provide it, is becoming increasingly important. Their work is focused on the preservation and reproduction of the natural environment and its biodiversity, the increase in the volume of high-quality food, better health and social conditions of the population.
In Ukraine, the urgency of the problem of organic production enterprises development is of the highest priority among other important problems of the functioning of the agrosphere. Domestic consumers seek to improve the quality of consumption and healthy lifestyle. Organic products provide real benefits to consumers who prefer the use of organic production methods, and therefore the organic produce market is constantly growing.
To intensify the processes of increasing the turnover in this market, the issue of analytical evaluation of the development of agrarian enterprises-producers of organic food and factors that determine the competitiveness of agrarian enterprises-producers of organic food in the conditions of European integration of Ukraine, requires further research.

MATERIALS AND METHODS

According to the International Federation of Organic Agricultural Movements (IFOAM), the size of the world organic market is 62.9 billion dollars. The US is projected to reach $ 200-250 billion in 2020.
In recent years, Ukraine has ranked 21st in the ranking of organic producers. The share of certified organic areas in the total agricultural land in Ukraine is about 1.1%. In addition, Ukraine ranks first in the Eastern European region regarding the certified area of organic arable land and specializes in the production of cereals, legumes and oilseeds [12].
In Ukraine, the concept of the State Program for the Development of Organic Production has been developed. The purposes of the Program are: to ensure sustainable development of the agrarian complex of

Ukraine by developing and supporting organic production as one of the priority directions of the implementation of the state agricultural policy aimed at preserving and improving the soil fertility; to ensure the competitiveness of Ukrainian agricultural products in conditions of Ukraine's integration into the world economic space; to promote nation's health protection by providing the population with high-quality and safe certified organic foodstuff as well as other goods; to promote environmental protection and biodiversity conservation; to create proper conditions for the development of rural areas.

This study aims at conducting an analytical assessment of Ukrainian organic farming development. It is based on the scientific works of the authors who have made a significant contribution to the development of the theory and methodology of the organization of organic production of agrarian enterprises, in particular Antonecz and Pysarenko [2], Artysh [3], Kapshtyk and Demydenko [6], Marmul and Novak [7], Pysarenko [9], Pylypenko [8] and others.

RESULTS AND DISCUSSIONS

An important impetus for the development of organic production in Ukraine was the implementation of the Swiss-Ukrainian project - "Certification of organic agriculture and the development of the organic market in Ukraine", implemented by the Research Institute of Organic Agriculture (FiBL, Switzerland). As part of this project, in 2007 the Organic Standard, Ltd. was created - the first Ukrainian certification body providing services in the field of organic production [4]. Today, such organizations as the Federation of Organic Movement of Ukraine, the consulting authority QueS, Retail Academy, Organic Business, etc. contribute to the development of organic agricultural production in Ukraine.

With great potential for organic agricultural production, its exports, consumption in the domestic market, Ukraine has achieved significant results in the development of organic production. In response to increasing global and domestic demand for ecologically safe products, production and processing of organic agricultural raw materials are intensified Marmul and Novak [7]. This is evidenced by the increase in certified organic areas and capacity of the national consumer market for organic products (Figure 1). Thus, the area of certified agricultural land in Ukraine involved in the cultivation of various organic products is already more than four hundred thousand hectares, and our state holds the honorable twentieth place among the countries-world leaders of the organic movement [5, 1].

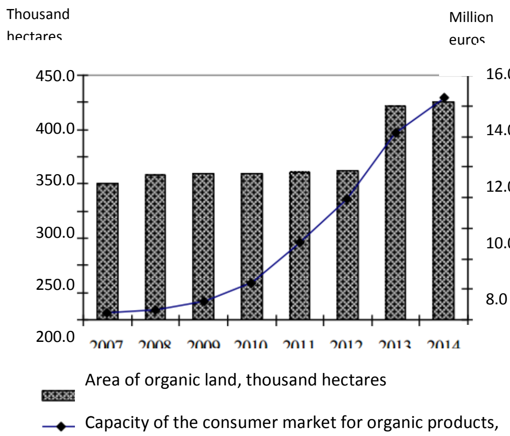

Fig.1. Trends in the development of organic production in Ukraine
Source: [5]

Therefore, only for 2010-2014 the capacity of the organic market has increased six-fold. At the same time, the area used for organic cultivation of crops has increased by only 48.3%. This indicates an increase in the market share of livestock products and the products of their processing. However, certified organic enterprises in Ukraine specialize mainly in the production of plant products.

In recent years, the tendency of active filling of the domestic market with its own organic products due to the establishment of own processing of organic raw materials has been observed. In particular, these are cereals, flour, dairy and meat products, juices, syrups, jam, honey, oil, tea, medicinal herbs. Official statistical reviews IFOAM confirm (Figure 2), that if at the beginning of 2003 there were 31 registered organic farms in Ukraine, then in 2014 there were already 182 certified organic farms, while the total area of certified organic agricultural lands amounted to 400.76 thousand hectares [5].

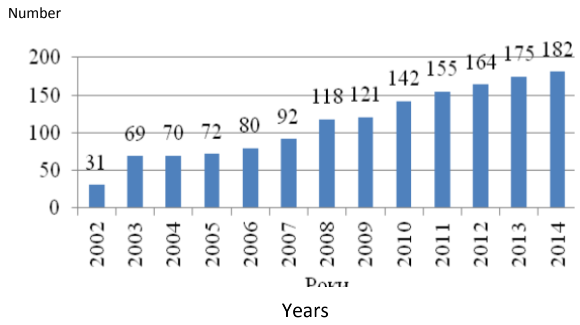

Fig.2. Total number of organic farms in Ukraine
Source: [5]

Of all the companies that represent the organic agricultural production, the majority are limited liability companies (54.9%), in addition, 12.1% are farms, 11.0% - private enterprises and 9.8% - sole proprietors. The number of private households is only 4%, that is, 7 units. Among all 95 limited liability companies 57 (60%) are engaged in more than one activity, and 39 of them are not certified producers of organic products, plant protection products, fertilizers. As a rule, these business entities deal with storage and processing of organic products, provide advisory services. 86% of farms are engaged in one type of activity, 72% of farms are engaged exclusively in crop production, and 19% - in the production of both crop and livestock products. All individual farms are engaged in one type of activity, which is directly related to the production of organic products, mainly plant growing.

By the beginning of 2013, there were about 164 certified organic farms operating in Ukraine, which cultivated over 272.9 thousand hectares of agricultural land (table 1). In the 2000s, mainly large and medium-sized integrated agroindustrial enterprises with an average area of 5.3 thousand hectares were engaged in organic agricultural production. The analysis of Organic-world data and their forecast show that the number of organic farms has increased. They were joined by small private farms and enterprises, which led to a decrease in the average size of organic farms in 2013 to 1.5 thousand hectares [11, 5].

Table 1. The value and dynamics of indicators characterizing the development of agricultural enterprises producing organic products in Ukraine

Indicators	Year							
	2002	2005	2009	2010	2011	2012	2013	2014
Area of agricultural land, mln. Ha	41.8	41.7	41.6	41.6	41.6	41.6	41.5	41.5
The total area of organic agricultural land, thous. Ha	164.4	241.9	269.9	270.2	270.2	270.3	272.9	400.8
The share of the organic agricultural land , % of total area of agricultural land	0.39	0.58	0.65	0.65	0.65	0.65	0.66	0.82
The growth rate of the total area of organic agricultural land	-	1.01	1.08	1.00	0.99	1.00	1.01	1.3
Number of farms, units	31	72	118	121	142	155	164	182
The growth rate of the farms	-	1.03	1.28	1.03	1.17	1.09	1.06	1.12

Source: [5]

The study has determined that most organic enterprises producing agricultural raw materials and food products are concentrated in Kyiv (25%), Vinnytsya (11.1%), Lviv (8.3%) and Volyn (8.3%) regions. A much smaller number of them operate in Zhytomyr, Poltava, Ternopil, Dnipropetrovsk, Zaporizhia, Mykolaiv, Donetsk and Lugansk regions (Figure 3).

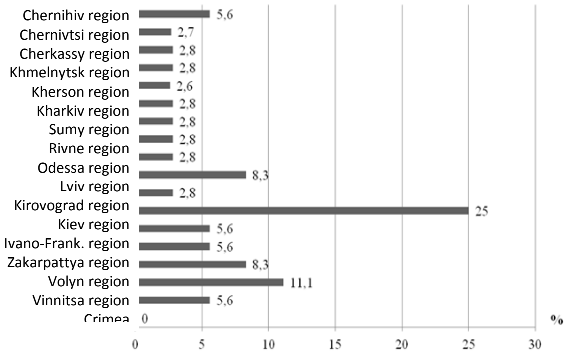

Fig.3. Placement of agrarian enterprises producing organic agro-food products in Ukraine's regions, %
Source: [5]

The largest producers of organic products in Ukraine are PE "Argoecology" of Shyshatskyj district, Poltava region, PE "Galkes-Agro" of

Novograd-Volynskyj district, Zhytomyr region and joint-stock company "Nibulon".

At PE "Agroecology" agricultural lands occupy 8,516 ha. In 2011, the company was certified for the production of organic agricultural products (buckwheat, sunflower, rye, barley, winter wheat, oats, alfalfa, sainfoin) and their processing (semolina, buckwheat, wheat, pearl barley and other groats).

PE "Agroecology" specializes in growing wheat, rye, barley, buckwheat, sugar beet, and has a large number of dairy cows. A significant step forward since the introduction of organic farming system has been done in crop production. The yield of grain crops has increased by 97%, and the early grain - by 110-116%. The yield of sugar beets has increased by 64% and sunflower seeds – by 74%, as shown in the table 2.

Table 2. The effectiveness of the implementation of organic farming systems in increasing crop yields in PE "Agroecology" (c/ha)

Years	A total of grains	Winter wheat	Spring barley	Oat	Sunflower	Sugar beet
Yields for 1971-1975 (before implementation)	26.1	29.2	25.2	27.1	16.1	255.0
Average yields for 1986-1995	48.9	63.2	53.3	37.0	28.6	292.0
1991-1995	46.1	57.3	51.2	33.3	21.3	393.2
1996-2000	41.7	43.3	38.2	36.5	24.4	399.6
2001-2005	38.8	48.3	33.8	36.6	16.8	295.0
2006-2010	48.9	56.8	42.5	47.0	23.0	487.7
2011-2014	52.7	61.3	49.4	53.1	27.5	498.6

Source: Enterprise annual reports

Crop rotation, soil tillage systems, fertilization of crops, weeds, pests and diseases protection of crops (physical and prophylactic), systems of machines, systems of care for crops have been worked out in the plant growing. The most productive varieties of crops have been selected from the recommended ones. Cultures are sown no lower than the second reproduction. In the system of soil tillage, the enterprise turned to a minimum ground-protection soil cultivation in 1990. This allowed to reduce fuel consumption and costs of soil cultivation threefold and to conduct technological operations for growing crops within scheduled time.

The introduction of biological farming system of soil protection has a significant impact on the development of the livestock sector. The data in table 3 can prove it. Livestock productivity since the introduction of the organic farming system has doubled. And this is not only a quantitative aspect, the qualitative one is equally important. Ecologically safe feeds give environmentally safe livestock products.

Table 3. Efficiency of organic farming system introduction to increase livestock productivity in PE "Agroecology"

Years	Milk yield per cow, kg	The average increase for fattening, g	Meat produced per 100 hectares of agricultural land, c	Milk produced per 100 hectares of agricultural land, c	Milk obtained, t	Meat obtained, t
1997-1975	2,572	450	66	383	-	-
1986-1990	3,770	471	124	740	-	-
1991-1995	4,431	758	145	1,059	-	-
1996-2000	4,286	696.8	133.8	957.6	2,717.4	362.1
2001-2005	5,090.4	588.8	77.0	780.7	5,548.8	558.0
2006-2010	5,285	763.8	98.6	11,590	8,720.5	7,41.9
2011-2014	5,684	849.2	102.4	1,354.1	9,487.0	9,76.5

Source: Enterprise annual reports

The introduction of a soil organic farming system to a significant strengthening of the financial and economic state of the enterprise (table 4).

Table 4. Key financial and economic indicators of PE "Agroecology"

Years	Gross output, ths. UAH	Gross production per 1 ha, UAH.	Gross output per worker, UAH.
2005	16,980	2,225	34,303
2006	17,333	2,267	36,338
2007	25,120	3,297	49,800
2008	25,385	3,352	54,126
2009	26,674	3,545	58,753
2010	26,987	3,687	61,458
2011	27,168	3,849	64,354
2013	28,264	3,915	67,498
2013	29,030	4,021	69,135
2014	30,247	4,298	72,480

Source: Enterprise annual reports

Thus, PP "Agroecology" can be characterized as an enterprise with a special system of agricultural production, where the introduction of organic farming system contributed to the solution of agronomic, livestock, economic, social and other problems that ensured the sustainable development of the enterprise.

PE "Galex-Agro" grows products certified in accordance with organic standards, on an area of 5,480 ha. All products of the company are certified by the Institute of Environmental Marketing (IMO, Switzerland), and approved as organic and meets the requirements of the standard Bio Suisse. The activity of the enterprise is controlled by “Organic Standard” and certified in accordance with the requirements set out in Council Regulation (EC) No.834/2007 and No. 889/2008.

The main activity of this enterprise is the production of organic certified crop and livestock products. The main cultivated crops are wheat, spelt wheat, rye, barley, oats, field peas, beans, vetch, buckwheat, millet, soybeans, corn. As for livestock, it is raising of meat-dairy cattle of Simmental breed.

In its activity, PE "Galex-Agro" is guided by the fact that for optimal results in growing grain crops, a correct balance of humus in the soil and the nutrient content is needed. According to the rules, organic farms are not able to use nitrogen fertilizers, and plants are fed only from the soil. Practice shows that many organic farms suffer from a low level of yield and quality of products (for example, low content of protein in wheat), which is a consequence of the negative balance of humus in the soil.

There is a way out of this situation, and the experts from FIBL helped to find it. They provide advisory support to the company within the framework of the project on the development of the organic market in Ukraine. The most effective solution in this case was the introduction of legumes for green fodder (clover and alfalfa) into crop rotation. Swiss experience shows that a minimum of 20-25% of legumes for green fodder significantly improves the situation with nutrients: yields per hectare and product quality increase. Due to this, the structure of the soil improves, microorganisms, worms begin to actively develop in it; the humus balance is restored; the effect of inhibiting the growth of weeds due to the growth of fast-growing legumes and their constant mowing and subsequent use for feeding animals is achieved.

Thus, the organic growing cannot do without proper rotation. But, if crop production is combined with livestock production, even better effect is achieved, since manure is introduced into fields that require nitrogen. In 2010 in the village of Gulsk, Novograd-Volynskyi district, PE “Galex-Agro" created an innovative milk production complex of European standard with a capacity of 500 heads of cattle for the purpose of developing organic livestock breeding and reproduction of the Simmental meat-dairy breed in Polissya. The average yield per cow is currently 22 liters per day, or 6,700 liters per 305 days of lactation.

Currently, the enterprise is a member of the Swiss-Ukrainian project "Development of organic market in Ukraine 2012-2016", which aims to promote the development of the organic sector in Ukraine and integration of Ukrainian SMEs in international trade in certified organic products. The enterprise activity in the framework of this project, supported by the Research Institute of Organic Agriculture (FiBL, Switzerland), aims to expand the area under organic arable crops and to improve quality and increase the volume of trade in dairy products in Ukraine.

Unlike PE "Agroecology", PE "Galex-Agro" exports grown products. Export-oriented organic farming is a common trend. According to the Ministry of Agrarian Policy of Ukraine, about 70% of Ukrainian producers supply organic products abroad. The products grown in Ukraine are mainly exported to the EU (Italy, Germany, the Netherlands, Switzerland, France), to North America (USA and Canada), Russia, Israel and Japan. About 80-90% of all organic products produced in Ukraine, mainly legumes, grain and oil crops, are exported. The rest of the products grown by organic standards are sold in the domestic market, but the lack of appropriate processing and market infrastructure allows to sell such products as organic ones only partially, and the rest is sold as high-quality conventional products. But the overall trend in the domestic market for producers of organic products is positive, the market for organic products is growing steadily.

It is also worth considering the example of the activity of joint-stock company "Nibulon", which is one of the leaders of the modern Ukrainian market. This is a joint Ukrainian-Hungarian-English agricultural enterprise, co-founded by the Hungarian company Kombiseed kft and the English company Meridian Commodities ltd. This company is one of the largest domestic producers and exporters of agricultural products (wheat, barley, corn, rye, sunflower, etc.). The company has 40 subdivisions located in eleven regions of Ukraine, but is gradually expanding the geography and scale of production activity.

Joint-stock company "Nibulon" is one of the largest domestic producers and exporters of agricultural products (wheat, barley, corn, rye, sunflower, etc.). With its development company gradually expands the geographic scope and the scale of its production activity. The company has 22 production units located in nine regions of Ukraine. Using advanced agricultural technology and equipment, joint-stock company "Nibulon" constantly ensures the implementation of complex technology of cultivation of agricultural products on its own and leased lands, and provides services to other farms with cultivation and harvesting. Diversification of production activities in climatic zones reduces the natural risks associated with harvest losses due to fluctuations in weather conditions in different regions of Ukraine, and provides annual high yields of grains and oilseeds. In addition, by comparing the state of production crops, the reliability of predicting the level of yield in the marketing period increases, and that is important for making commercial decisions.

In recent years the enterprise has increased the amount of land under cultivation by 1.4 times or by 15,923 ha. Most of the land was concentrated in zones of sufficient moisture. With the preservation and some increase in the production of crops in areas of risky agriculture, gradually the proportion of land located in zones of sufficient moisture was increased to 52% of the total amount of cultivated land. Thus, the industrial risks of under-harvesting from adverse weather conditions (drought) have been significantly reduced, with some increase in the risk of adverse wintering. With the changes in land zoning of the enterprise, there were changes in the structure, reflecting the most appropriate proportion of crops in the regions.

The main factors that today can accelerate the development of organic production in Ukraine include the following [10, 5]:

(1) the presence of large areas of agricultural land suitable for organic production;

(2) successful experience (about 40 years) of organic farming in some domestic agricultural enterprises;

(3) unsatisfied demand for organic products in countries with developed economy, which predetermines their interest in the development of organic production in Ukraine;

(4) potentially significant capacity of the domestic market.

Among the main external factors hindering the development of organic agricultural production in Ukraine, the following should be distinguished: demand factors, competition, limited product sales, possible changes in the market situation of organic products, instability of domestic markets for agricultural products; exchange rate changes, prices of agricultural machinery, fertilizers and plant protection products, inflation, changes in income levels; not consistent state tax and customs policy; low level of political stability in the country, high level of corruption, etc.

CONCLUSIONS

During the last 10 years, Ukraine has also demonstrated steady growth of agricultural land, certified organic production and occupies the 20th place in the list of countries with the largest area of organic farmland. The vast majority of domestic organic farms are certified in Vinnitsa, Zhytomyr, Zakarpattya, Lviv, Odessa, Poltava, Ternopil and Kherson regions.

Organic agrarian enterprises are the most widespread in the Kyiv region, where 25.0% of their total number are concentrated, as well as in Vinnytsia (11.1%), Volyn and Lviv (8.3%), Zakarpattya, Ivano-Frankivsk and Chernihiv (5.6%) regions. The basis of their specialization is the production of grain, legumes and oilseed organic crops. However, in recent years, organic berry and fruit production, with a predominantly export orientation can be characterized as being rapidly developed. Given that the European market for organic fruit products exceeds 1.0 billion euros, domestic organic producers, having resource-competitive advantages, have unlimited opportunities for development in this particular direction.

In order to intensify the processes of increasing the turnover of organic products market in Ukraine, the relevant legislative and regulatory framework for organic agricultural production needs to be improved. Organic agricultural production does not have a functioning state control system that would be accredited at the national and international levels and would encompass control of both organic operators and products. Land reform is unfinished and there is no transparent and civilized market of agricultural land.

In addition, in order to develop the production and market of organic products in Ukraine in the context of social responsibility of agrarian enterprises, it is necessary to: develop and maintain agricultural co-operation; create specialized shops, catering establishments, places for these products in the wholesale markets; promote the export of organic products; organize specialized fairs and exhibitions.

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ASSESSMENT OF THE ECOLOGICAL SUSTAINABILITY OF AGRICULTURAL LAND USE IN THE TERRITORIAL STRUCTURE OF REGION

Halyna DUDYCH, Lesia DUDYCH

Lviv National Agrarian University, Ukraine, 1 V. Velykoho str., Lviv Region, 80381, Ukraine, Phone: +38 032 22 42 961; E-mails: dudych_g@ukr.net, dyduchl@ukr.net

Corresponding author: dudych_g@ukr.net

Abstract

The article is devoted improves method of the assessment of the ecological sustainability of agricultural land use in the territorial structure of region. Approbation of this method was carried out on the example of the districts of the Lviv region, located in the western part of Ukraine. The analysis of ecological parameters and modern structure of lands of the territory of Lviv region is presented. Based on the analysis of the coefficients of ecological sustainability of agricultural land use, three groups of districts have been identified, depending on the level of this indicator: stable, average sustainability, low sustainability. Using correlation-regression analysis, we established the relationship between ecological parameters of the organization of the territory and humus content, as well as the normative-monetary valuation of land, using the example of Lviv region districts. The proposed method for assessing the ecological sustainability use can be an integral part of the ecological passport of the territory, which makes it possible to consider the environmental factors that have resulted in the result of the assessment in combination and interdependence. The application of the proposed methodology makes it possible to choose the best variant of the organization of land use in agrosphere, which will increase the efficiency of production, as well as optimization of natural ecosystems.

Key words: *method, assessment, ecological sustainability, agricultural, land use*

INTRODUCTION

An important direction of land policy of any country is to provide ecological balanced using of land in agrosphere. However, today the peculiarity of domestic market relations is that in the activity of a significant part of agrarian enterprises in the process of land use, the main attention is paid to the socio-economic orientation, while environmental problems are of secondary importance. This causes a violation of the ecological balance and the balance between the economic activity of society and the natural environment. Therefore, the importance of the environmental component in the system sustainable use of land in agrosphere every year becomes more and more important. At the same time, the territorial structure and the ecological imbalance of the land fund, significantly impair the effectiveness of the use and protection of soil, as well as its natural ability to heal itself, leads to depletion of species diversity of flora and fauna in landscapes.

Optimization of agricultural land use involves the normalization of its size, legal status, the achievement of appropriate economic parameters, regulation of landscape and environmental aspects. In turn, environmental aspects are represented by specific qualitative and quantitative indexs, in particular the level of ecological stability of the territory. Therefore, today it is important to research the state of land resources, the peculiarities of their transformation in the territorial structure of the region, as well as the assessment of the ecological sustainability of territory in agricultural.

Ecological features of land in agrosphere occurred in the works of many experts, including D. Dobriak, Y. Dorosh, G. Gutsulyak, O. Kanash, A. Martin, M. Stupen, O. Shkuratov, A. Tretyak, S.Volkov and others. In particular, the representative of the School of Agro-Ecological Economics O. Shkuratov [11] suggests the ecological prerequisites for land use optimization with using the index of environmental nonconformity of existing use.

O. Kanash [5; 6] considering an approach that, in his opinion, "will help to establish the real environmental situation, making the design on the organization of land and crop rotation should perform appropriate calculations, using an algorithm". Despite the comprehensive study of the mentioned scientific directions, the exacerbation of environmental problems associated with the imbalance of land use led to the need to find ways to study the theoretical and methodological foundations for assessing the ecological state of territorial structures.

Thus, the specific imperatives of the formation of ecological sustainable land use can effectively control the use and protection of land and increase their productivity.

MATERIALS AND METHODS

An assessment of the ecological sustainability of agricultural land use was made on the example of the districts of the Lviv region located in the western part of Ukraine. The territory occupied by the Lviv region is interesting in terms of relief and climatic conditions, since it is located in various natural-economic zones (forest-steppe, polissya, mountain, foothill). The agricultural development of the territory of the Lviv region during the last years remains in the range of 60%, while the cultivation of the territory of individual districts ranges from 25% in the Skolivskyi district to 79% – in Sambirskyi.

To determine «the ecological norms of the level of sustainability of land use in the territorial structure, S. Volkov's methodology was applied to the ecological stability of the territories» [14] taking into account the specifics of the landscape structure of the territory of the Lviv region on the basis of certain specifications of the coefficients of ecological stability for various types of agricultural and other lands specified by the author (Table 1).

In particular, we propose to specify the coefficients of ecological sustainability of land use for three types of territory. In particular, in our opinion, open land without vegetation is less stable compared to arable land, therefore we propose to reduce this index to 0.05. At the same time, perennial plants have many features characteristic of natural forests, so this indicator S.Volkov providing total value 0,43 diminish the value of this type of land. Given our previous calculations, factor ecological sustainability perennial plants should be at 0.72. The same calculations were made for the type of land - pasture, as a result, the coefficient of their ecological sustainability is equal to 0.85.

Table 1. Assessment of ecological properties of lands

Indexes	The coefficients of ecological sustainability of land under the method of S. Volkov	Author's coefficients of ecolodgical sustainability of land
Built-up area	0.00	0.00
Open lands without plant cover	0.14	0.05
Arable	0.14	0.14
Perennial plantings	0.43	0.72
Hayfields	0.62	0.62
Pastures	0.68	0.85
Earth Water Fund	0.79	0.79
Forests	1.00	1.00

Source: formed by the author on the basis of data [14].

In this case, the overall coefficient of ecological sustainability of land using in agricultural, which characterizes the level of intensity of use of the territory of the region (I_{es}) can be calculated by the formula:

$$I_{es} \frac{\sum I_{з} \times LA_{з}}{\sum LA_{з}}, \quad (1)$$

where I_i – the coefficient of ecological stability of the land of the *i*-th species;

LA_i – the area of the land of the *i*-th species.

Based on the results of the calculation, the level of ecological sustainability is represented by the corresponding gradation (Table 2).

The proposed methodology for assessing the ecological sustainability use can be an integral part of the ecological passport of the territory, which makes it possible to consider in combination and interdependence the ecological factors that have caused the result of the assessment.

Table 2. Grading scale of the coefficient of ecological sustainability of land use in agricultural

The level of ecological sustainability	The magnitude of the coefficient of ecological sustainability
Unsteady	< 0.33
Low sustainability	0.33–0.50
Average sustainability	0.51–0.66
Stable	> 0.66

Source: author's development taking into account the S. Volkov method [14].

RESULTS AND DISCUSSIONS

At present, the organization of land using of agrarian enterprises should be based on fundamentally new scientific, methodological and methodological provisions. Thus, the system of measures for the territorial organization and arrangement represents the method of forming agrolandscapes, and the agrolandscape itself should be considered as the material basis for the existence of an ecosystem, with the creation of conditions for ensuring optimal environmental regimes [1; 3].

Solving the problems of organizing agricultural land use and preserving the ecological framework of natural complexes are considered as the main measures to increase the efficiency of agro-industrial systems. One of the main problems of the organization of land in agrosphere is not fully the adequacy of the existing farming system to natural conditions, the imbalance of reproduction processes. These factors have led to the need to clarify the existing farming systems, taking into consideration the agrolandscape structure and modern economic circumstances.

With ecological optimization, on the basis of the criteria of the land parcels, it is imperative to foresee an exception from the intensive use those lands which, due to their modal properties, can not ensure the stability of land use [2; 4; 7]. Under ecological optimization of the structure of land is to be understood as a set of measures to find the optimal variant of the organization of use and protection of soil at the level of the rural (village) council for the purpose of their use in an ecologically safe mode [12, 15].

In territorial terms, the definition of the appropriate natural equilibrium is a dynamic balance of various ecological subsystems that provides elemental diversity and component optimum that preserve the ecological system in the state of potential self-healing to the zonal natural or natural-human type, to which an adapted district economy has been adapted.

The maintenance of natural equilibrium is achieved in two main ways: functional and territorial. The functional direction is achieved by a set of measures for rationalization of land use at the expense of stable agricultural lands, and the territorial is based on the system-balance method of full and partial conservation of a part of territorial complexes. The conservation of natural areas, the optimal proportional ratio of arable land, forests and forage lands, from studies by a number of scientists [13], contribute to increasing the stability and productivity of agrolandscapes and the stability of natural systems in general.

An analysis of the current structure of land and boundary ecological parameters makes it possible to conclude that a high degree of plowing in the territory of most studied regions of Lviv region (Table 3). Distribution of land resources for economic use of them today has no comprehensive environmental and economic justification. Along with the forms of management has changed the composition and structure of agricultural land. About 60% of the total land area is involved in economic use, which far exceeds the permissible limits. In recent years, there has been a tendency to decrease this share, although the indicator of economic use of the territories is still much higher than the similar indicator of the developed countries of the world. For example, in Europe, the share of arable land is on average 30-35%, while in the Lviv region this figure has reached 59%. Negative is the fact that a large area of arable land became possible due to deforestation and the transfer of pastures to their composition.

Based on the above data, we can talk about a significant differentiation of the territory as about the presence of various land use structures, as well as about the presence of various arable land areas, and, as a result, an objective need arises to develop special strategic programs that take into account the specifics of the area and necessarily take into account these conditions production [8-10].

Table 3. The structures of land using and ecological parameters of Lviv region, 2016

District	Land area, ha									Normative monetary valuation of agricultural lands, ths. UAH	Average weighted humus content, %
	Territory in general	Arable	Hayfields	Pastures	Perennial plantings	Forest	Constructed land	Open lands without plant cover	Earth Water Fund		
Brodivskyi	113,601	42,340	11,295	12,204	1,070	40,005	4,286	928	1,473	17,621	2.8
Buskyi	83,291	36,006	10,365	9,768	606	20,594	3,781	155	2,016	17,966	2.6
Horodotskyi	71,214	36,856	6,062	10,652	1,645	9,441	3,193	639	2,726	11,180	2.6
Drohobytskyi	118,887	37,189	10,980	14,061	1,293	47,643	4,646	1,151	1,924	6,038	2.7
Zhydachivskyi	96,980	44,197	10,206	12,343	918	19,337	6,116	887	2,976	14,278	2.6
Zhovkivskyi	126,415	56,472	11,087	15,305	1,720	32,566	5,467	909	2,889	13,065	2.6
Zolochivskyi	107,202	46,151	15,088	10,927	1,372	26,183	4,147	2,017	1,317	19,362	3.5
Kam`ianka-Buzkyi	85,007	40,136	8,065	10,263	1,035	17,841	4,909	189	2,569	14,662	2.5
Mykolaivskyi	66,315	22,510	7,031	9,573	642	18,705	4,591	765	2,498	9,290	2.4
Mostyskyi	83,127	45,005	4,466	10,555	1,212	16,797	3,898	157	1,037	12,969	2.2
Peremyshlianskyi	90,413	37,854	6,569	12,044	1,145	28,722	2,796	418	865	10,225	2.2
Pustomytivskyi	92,415	47,661	7,888	10,054	1,891	16,467	6,277	389	1,788	16,825	2.6
Radekhivskyi	111,619	49,792	9,559	13,808	474	30,559	5,510	362	1,555	16,120	3.6
Sambirskyi	91,618	44,715	12,826	13,343	1,114	12,003	4,118	1,080	2,419	11,669	2.8
Skolivskyi	146,521	12,903	13,299	10,014	177	104,864	3,080	1,064	1,120	3,736	3.0
Sokalskyi	153,136	63,669	21,614	18,327	1,371	36,000	7,029	728	4,398	18,153	2.0
Starosambirskyi	122,561	38,331	3,979	13,941	1,496	57,373	4,017	1,732	1,692	5,496	1.9
Stryiskyi	79,631	31,742	5,664	7,952	656	24,815	3,298	3,477	2,027	8,504	2.2
Turkivskyi	118,764	21,768	5,563	17,049	211	68,002	3,899	1,035	1,237	3,281	3.0
Yavorivskyi	151,836	35,769	5,830	23,437	1,410	61,645	9,246	10,905	3,594	6,355	1.6

Source: author's calculations

Research existing in the Lviv region of stability of ecosystems, which shows not in favor of that land is adapted to the environment.

Table 4. Characteristics of the ecological state of land use in the Lviv region by district

District	I_{es}	The level of ecological sustainability
Brodivskyi	0.57	Average sustainability
Buskyi	0.51	Average sustainability
Horodotskyi	0.43	Low sustainability
Drohobytskyi	0.62	Average sustainability
Zhydachivskyi	0.47	Low sustainability
Zhovkivskyi	0.51	Average sustainability
Zolochivskyi	0.50	Low sustainability
Kam`ianka-Buzkyi	0.47	Low sustainability
Mykolaivskyi	0.56	Average sustainability
Mostyskyi	0.44	Low sustainability
Peremyshlianskyi	0.55	Average sustainability
Pustomytivskyi	0.43	Low sustainability
Radekhivskyi	0.51	Average sustainability
Sambirskyi	0.44	Low sustainability
Skolivskyi	0.85	Stable
Sokalskyi	0.51	Average sustainability
Starosambirskyi	0.65	Average sustainability
Stryiskyi	0.52	Average sustainability
Turkivskyi	0.76	Stable
Yavorivsky	0.62	Average sustainability

Source: author's calculations.

Based on the information provided, we were able to adequately characterize the degree of ecological sustainability of agricultural land using in agrosphere the example of Lviv region districts (Table 4).

On the basis of the analysis of coefficient data, the following groups of areas are allocated, depending on the level of ecological sustainability of agricultural land use:

1.Stable: Turkivskyi, Skolivskyi.

2.Average sustainability: Brodivskyi, Buskyi, Drohobytskyi, Zhovkivskyi, Mykolayivskyi, Peremyshlyanskyi, Radekhivskyi, Sokalskyi, Starosabirskyi, Stryyskyi, Yavorivskyi.

3.Low sustainability: Horodotskyi, Zhydachivskyi, Zolochivskyi, Kamyanka-Buzkyi, Mostyskyi, Pustomytivskyi, Sambirskyi.

The average and low level of constancy of the territory of Ukraine and its regions is a result of human impact on nature, which is the reason for the transformation of ecologically stabilizing lands into open lands with low levels of stability. Two regions of Lviv region belong to a group of ecologically stable agricultural land use, due to the fact that they are mountainous regions and in which agriculture is at a low level of development.

Using correlation-regression analysis, we established the relationship between ecological parameters of the organization of the territory and humus content, as well as the normative-monetary valuation of land, using the example of Lviv region districts (data of 2016), which is described by linear equations. The assessment of the correlation coefficients confirms that the ecological constancy of land using in agrosphere in no way affects the content of humus (Table 5).

Table 5. The significance of the coefficients of regression of the impact of ecological sustainability of land using in agrosphere on humus content and land valuation

Indexes	Correlation coefficient (R)
Humus content	0,05
Normative-monetary assessment of agricultural land	-0,72

Source: author's calculations.

At the same time, there is a strong link between the ecological constancy of the territory and the same inversion, which indicates that the higher the level of ecological sustainability, the lower will be the normative-monetary valuation of land. This is due to the fact that the normative-monetary valuation of agricultural land depends on the productivity of crops and the efficiency of production.

CONCLUSIONS

An assessment of the ecological sustainability of land using in the territorial structure of the region has once again highlighted the dilemma of the alternative choice of the economic development of the agrarian sector or preservation of the natural environment. According to the results of the analysis, it is determined that the normative-monetary valuation of agricultural lands depends on the level of agricultural production through the increase of sown areas. Using these indicators allows to control and, if necessary, adjust the land use structure.

The method of calculating the ecological stability of natural zones, makes it possible, in the presence of only data on the area of land to get remote, but remotely correct data on the constancy of territories. Certainly, this analysis does not allow to draw conclusions about the productivity of specific plots, but gives an idea of the territorial differentiation of agricultural land uses of the Lviv region and is the basis for further research in this direction.

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STUDIES ON THE FARM MACHINERY MANAGEMENT

Mariana DUMITRU

Lucian Blaga University of Sibiu, 10 Victoriei Boulevard, 550024, Sibiu, Romania, Phone/Fax: +40-(269) 21.60.62, E-mail: mariana.dumitru@ulbsibiu.ro

Corresponding author: mariana.dumitru@ulbsibiu.ro

Abstract

The paper presents studies and researches made on machines performance, which is one of the most important component of the economic performance of a farm. We made measurements for determination of work quality and energetic index for tractors, considering that tractors are the main energetic power used in modern agriculture anywhere, that is why the improving of the quality and energetic index of tractors and machines is very important. The aim of the research is to improve power performances and to increase the efficiency of tractors and agricultural machines. The productivity is one of the most significant characteristics of tractors and agricultural machines, especially of harvesting machines, which are the most important machines for harvesting cereals. We wanted to emphasize that designing and making these complex agricultural machines has much evolved in the last years, from the productivity point of view and from the design and interior comfort as well.

Key words: *productivity, fuel consumption per hour, effective work speed, tractor efficiency, machine performance, machinery management*

INTRODUCTION

In present days, farm machinery management is a section of farm management that deals with the optimization of the equipment phases of agricultural production. The importance of this part of farm management is increasing more and more, because a modern agriculture is based on performing machinery.

As a result, the quality management of agricultural products represents the activity of planning, organization and control undertaken by one or more persons in order to combine the factors that lead to the increasing quality of the obtained products, in the conditions of internationalization of human activity. Quality management of agro-food products is required to start from two premises: is an area of management, and as a result, the basics of management, including the theoretical foundations, are found in quality management of agro-food products; has a high specificity in relation to the classic management that comes from the nature and content of the quality of the agro-food products. [1]

The 3 components of economic performance are: machine performance, power performance and operator performance [4]. From these 3 components, in this paper we shall refer especially to machines performance. When we refer to machines in an agricultural farm, we refer first to tractors, which are indispensable to any farm and then to agricultural machines.

From all agricultural machines that operate all over the world, the cereal harvesting machines are the most complex machines, which make all the technological operations in the technological process of harvesting the main product of cereals: the grains. They were at first designed only for harvesting grain cereals, but later these were endowed with work equipment for harvesting other weeds, such as: corn, sun flower, peas, beans etc.

The cereal harvesting machines can be classified after many criteria, being such complex machines as they are. In this paper we shall present only particular aspects of classifying these machines and the main adjustments that can be made to them in order to improve one of their most important characteristic, which is productivity.

In what concerns the way in which we can increase machine productivity, it is very important to introduce innovation in the domain of agriculture, because it is considered that in the following decades the agricultural production must increase with approx. 70 %, in order to satisfy the world's food necessities. [2]

MATERIALS AND METHODS

In order to determinate the work index of tractor, a few trials were made in the experimental field. Different work was made on sandy soils after corn harvesting. There were established quality work index such as: work depth and widening with respective deviation, the establishing in vertical and horizontal plane of the aggregates, the mincing degree of the plowed soil, the covering degree of vegetal waste, the plowing profile, etc.
In what concerns the harvesting machines, we tried more adjustments to be made on these machines for increasing productivity. Generally, any adjustments are made in order to improve a certain characteristic of the machine. In our case, we wanted to made adjustments in order to improve, if possible, the productivity of these machines. The technological adjustments are made depending on weeds, density, humidity, the state of the field etc. Their role is to achieve an optimal harvesting process, without loss of harvest and thus, to increase productivity.

RESULTS AND DISCUSSIONS

The determination of quality work index
A first index determined in our researches was the medium depth of work. This parameter was determined with a precision under 1 cm, from 5 to 5 m, on the whole length of the lot, from 10 trials.
$a_m = \sum a / n$ [cm], [5]
where
a_m = medium depth of work [cm]
a= the depth measured in furrow [cm]
n = the number of measurements.
The medium deviation of work depth was calculated as an arithmetic medium of the deviations of measurements, considered in absolute value towards the medium depth.
The covering degree with vegetal waste was determined through dividing the quantity of vegetal waste remainedon the surface of the lot to the total existing quantity established before the beginning of plowing. Each sample consisted of determining the vegetal waste berried in furrow on a surface of 10 cm^2 of plowing. The covering degree with vegetal waste must be over 90 %. Between the work quality index determined, it was the medium widening of the plow. This parameter was determined through dividing different plow widening to the number of measurements. The widening of the plow was lots were chosen, thus the ground should not have significant slopes.
The trials on the lots were made on determined through the difference between 2 measurements made in the spots, in which the depth of the work was determined too. The measurements were made from the furrow wall to the determined points from the un-plowed field, marked through sticks with a distance of 15 cm between them.
The determination of energetic index was made measuring the specific resistance to plowing.
The specific resistance to plowing, K
$K = R / S$ [kgf/cm^2] [5],
where:
R = the resistance to traction force of the plow [kgf]
S= the furrow section [cm^2].

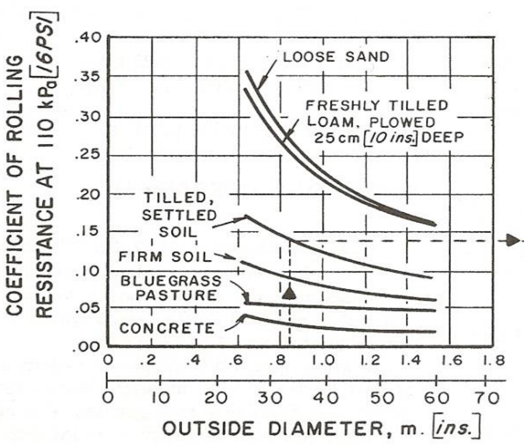

Fig. 1. Specific resistance of tractor rolling depending on the type of soil
Source: own determination based on [7].

The results obtained at samples for 2 aggregates were read and, based on the medium obtained through reporting to furrow section, we obtained the specific resistance of plows at plowing (Fig.1).

Other parameters which were determined were: the fuel consumption per hour, the effective work speed, the technical efficiency per hour, the fuel consumption per ha and tractor efficiency. The results concerning the fuel consumption, depending on the type of the engine of tractor are presented in Table 1.

Table 1. Fuel efficiency

Loading % max.	Gasoline	Diesel		
		Natural aspirated	Turbo	Turbo and cooled
100	2.17	2.90	3.07	3.09
80	1.96	2.84	2.82	2.86
60	1.63	2.60	2.55	2.59
40	1.28	2.13	2.10	2.15
20	0.83	1.38	1.36	1.42

Source: own determination.

Particular aspects of harvesting machines

Considering the supplying output of the threshing machine the combines can be divided in 2 categories: with small output of supplying (< 3 kg/s), with medium output (3-8 kg/s) and with high output (> 8 kg/s).

Considering the technological flows point of view, the cereal combines can be divided in: combines with tangential threshing machine and combines with axial threshing machine. In the first case, the threshing machine is positioned transversely, the material flow entering perpendicular on it. The material is taken from the central transporter and put in the threshing machine, where it is stricken by the beater bars approximately tangential.

The combines with axial threshing machine has the threshing apparatus put axial on the longitudinal axe of the combine, the flow of material moving after a helicoidally trajectory and is separated due to centrifugal forces and friction and not due to stricken. They have small supplying output and a working widening of 1.5-2.2 m.[7]

Considering the technological flow geometry, the cereal harvesting machines can be divided in 2 categories: with direct flow (the moving direction of material is not modified) and with indirect flow (material from technological flow modifies its moving direction). From the form of the technological flow direction point of view, combines with indirect flow can be divided in : combines with flow in L shape and with flow in T shape (self –propelled with supplying output over 15 kg/s and with working widening of 2.1-7.3 m. The most frequent are combines with indirect flow in T shape, because they can enter the field without needing access ways, need small turning zones and have a good stability [3].

The grain cereals combines can be equipped with a device for pressing and balloting straws. The bales have a volume mass of 50-100 kg/m3, a length of 900-1,200 mm, wide of 250-800 mm and height of 250-300 mm.

The engines used for combines are with internal combustion, usually with ignition through compression.

Their nominal power can be situated between 30 and 170 kW at a nominal speed of 1,500-3,000 rot./min. The new harvesting machines cabins are completely automatized and computerized and the design of the cabin is impressive (for example, Massey Ferguson combines and Claas combines).

From the most used adjustments made, we can remind: the cutting height adjustment, the cutting apparatus adjustment, the creeper transporter adjustment, the adjustment of turation of the beater, the adjustment of the distance between beater and counter-beater, the adjustment of the recovery circulation, etc.

At the present time, the biggest combine of the world is John Deere STS, having a power of 465 HP, with cylinder capacity of 12.5 L and a very small specific consumption.

This combine has a tank of 11,000 L capacity, cu cabin Ultra-deluxe, with a special comfort, including a system of monitoring and charting through satellite, using GPS position satellites.

In Fig. 2 is presented the cereal combine JOHN DEERE 2266 E. Its working process is presented in Fig. 3.

Fig. 2. Cereal combine JOHN DEERE 2266 E
Source: [5]

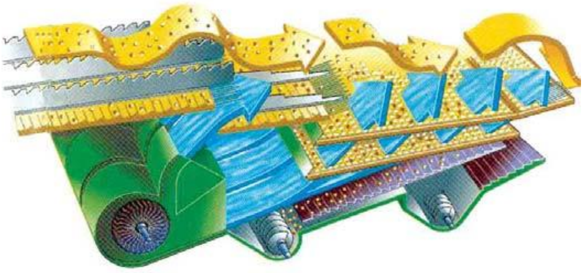

Fig. 3. The working process of cereal combine JOHN DEERE 2266 E
Source: [5]

In Fig. 4 is presented the most recent product of the American firm New Holland, the combine CX 880 de 375 CP, launched in 2002, provided with control system through satellite, with central commands to a single hand lever.
In the latest years, the designing of the component parts of the cabin is realised on computer, with the aid of special designing programs (fig.5). The threshing process simulation can also be made on computer. As a result, these harvesting machines are very performing.

Fig. 4. The cereal combine NEW HOLLAND Seria CX
Source: [5]

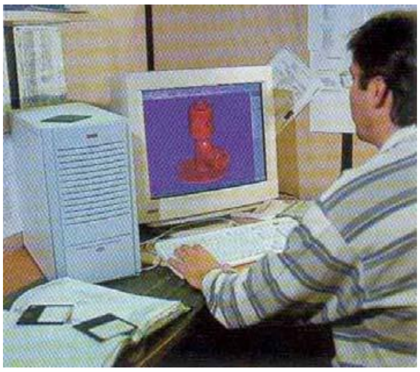

Fig. 5. Designing of the component parts of combine with computer
Source: [5]

CONCLUSIONS

In any farm, the machinery management is a very important part of this business. Among the machines used in farm, in this paper we referred to tractors and harvesting machines, because we considered them the most representative for machinery park of a farm.
The harvesting machines, especially the combines, are some of the most complex machines used in modern agriculture, that is why the increasing of their productivity is very important in farm machinery management. The paper presents some new aspects concerning these machines, taking in consideration the latest development at world level. These machines are designed by computer and the manufacture technology has been changed very much, using robots in some parts of the manufacture technological process.
It is very clear that agriculture is of great importance , not only to the people, but in the country as a whole. Steps and measures should be taken to improve agriculture ways, thus making it a powerful sector to trade for. Special attention should be given to this sector so that farmers use the latest technology for agriculture that results in higher yield. Better the agriculture, higher will be the growth of the nation. [6]
Farms are characterised by a dual structure. In our country, there are about three million small scale and semi-subsistence oriented farms on the one side and just about 13,000 farms cultivating 100 ha and more on the other. These large farms cultivate about one half of the total utilised agricultural area. Medium-sized farms cultivating 5 – 50 ha are almost missing. This fragmentation of agricultural producers prevents efficient operation of small-scale farms. In general, these farms operate in isolation and lack adequate access to financial services, marketing channels, input supply and extension services [8]. These differences between farms are given, mostly, by the size of machine park which the firm has. A large farm can be considered so, only if it has a proper machine park, which is also well managed. So, in order to have in our country a

performing agriculture, we must give a bigger attention of the farm machinery and of the way it is used and managed.
The extent to which mechanization is possible depends not so much on engineering technology, as on the economics of applying the machinery. Each year, however, the cost of labour rises and its availability decreases, thus bringing ever closer the time when all crops will be mechanized.

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ON THE METHOD OF OBTAINING BORATELIC SUPERPHOSPHATE

Zhanyl DZHANMULDAYEVA, Galina SEITMAGZIMOVA, Aigul JANMULDAYEVA, Amid MURATOV

M. Auezov South Kazakhstan State University, 5, Tauke Khan Avenue, 160012 Kazakhstan, Shymkent, Mobil phone: + 77756135158, E-mails: a.jan_75@mail.ru, zhanyld@mail.ru

Corresponding author: zhanyld@mail.ru

Abstract

Under laboratory conditions, the effect of the amount of borate salt additive, norm and temperature of EPA on the yield and quality of the product was studied. The effect of the ratio of phosphorite: borate salt on the degree of decomposition of phosphorite, the effect of the norm and temperature of extraction phosphoric acid on the degree of decomposition of the mixture of phosphorite: borate salt was also studied. On the basis of the obtained research results, the optimal parameters of the technological process for the production of borate-double superphosphate using borate salts of the Inderskoe field are determined.

Key words: *mineral fertilizers, mycorrhoeic elements, borate double superphosphate, borate ores, phosphorites Karatau, extraction phosphoric acid*

INTRODUCTION

Currently, the use of microfertilizers is an integral part of modern crop production technology and the key to obtaining a high yield of good quality, due to their influence on biochemical processes. Along with this, some plants show an increased need for certain microelements, and microfertilizers provide a balanced set of trace elements for the needs of different cultures [1-3].

Microelements are part of compounds that have important vital functions, in particular - enzymes, vitamins, hormones, pigments and other compounds. Microelements significantly affect biochemical transformations and thus have an effect on many physiological functions in plant and animal organisms. They affect carbohydrate metabolism, enhance the use of light in the process of photosynthesis and accelerate the synthesis of proteins. Under the influence of individual microelements, the useful properties of plants are enhanced, such as drought resistance, frost resistance, acceleration of development and maturation of seeds, resistance to diseases, etc. The lack of trace elements leads to a disruption of metabolism, which in turn leads to diseases of plants and animals. But, it is necessary to take into account that the excess of trace elements can lead to harmful consequences. Boric fertilizers are the most common and are among the first micro fertilizers produced on an industrial scale. Boric fertilizers are the most common among micro fertilizers. The most concentrated boric fertilizers include boric acid H_3BO_3 and borax $Na_2B_4O_7 \cdot 10H_2O$. Industrial wastes containing small amounts of boron and some natural borates can be used as fertilizers. Natural solutions, such as brines of some salt lakes and oil drilling waters, as well as waste from boron ore enrichment, can also be used to produce borate fertilizers. In addition, boron is contained in local fertilizers (ash, peat, manure), for example 1 kg of wood ash contains 200-700 mg of boron, 1 kg of dry matter of manure and peat - about 20 mg [1-3].

Borate superphosphate is obtained by mixing superphosphate with boron-todalite fertilizer or other water-soluble boron compounds. The borate superphosphate contains 17-18% assimilated P_2O_5 and 1-2% boron in terms of H_3BO_3. One of the promising boron-containing fertilizers is borate double superphosphate. This is the most universal concentrated water-soluble fertilizer used effectively on sod-gley and limed sodpodzolic soils. Borate double superphosphate is usually obtained by treatment with phosphoric acid of datolite ore or a mixture of datolite concentrate with phosphate flour, it contains 36-40% of assimilable P_2O_5 and 6-8% of H_3BO_3. According to the requirements of TU 6-08-315-80 Superphosphate double granulated with trace elements should contain B (water) 0.4 ± 0.05% and assimilable P_2O_5 ≥42% [4].

At present, borate double superphosphate is used mainly for seed crops of leguminous grasses (clover, alfalfa), for root roots, sugar beet, flax, fruit and berry and vegetable crops. Usually, borate double superphosphate is applied to the soil before sowing of crops, and is also used for extra-fertilizing the plants (spraying and pollination).

MATERIALS AND METHODS

Laboratory studies were carried out in the following way: in the extractive phosphoric acid with a P_2O_5 content of 21,6% heated to 50-90^{0}C, a mixture of Karatau phosphoresces and borate salt, preliminarily mixed, depending on the component ratio was added. The decomposition of a mixture of phosphoresces and borate ore with extraction phosphoric acid was carried out under conditions of an unabated pulp. Under these conditions, the borate ore is uniformly distributed throughout the volume of the reaction mixture and decomposes in the phosphoric acid pulp. Then, the resulting pulp was dried at a temperature of 105-110°C for 60 minutes. The obtained product was analyzed for the content of total, digestible and free forms of P_2O_5 by standard methods in accordance with GOST 20851.2-75 and on the content of water-soluble boron (B).

Following raw materials were applied for the laboratory research: Karatau phosphorites of composition (mass %): P_2O_{5total} - 25.0; CaO – 37.04; MgO – 2.4; Fe_2O_3 – 1.18; Al_2O_3 – 0.8; insoluble residue – 21.62; F – 2.38; moisture – 0.32 and wet-process phosphoric acid produced from these raw materials; its composition (mass %): P_2O_5 $_{total}$ – 21.6; CaO – 0.57; MgO – 1.49; Fe_2O_3 – 0.99; Al_2O_3 – 0.86; F – 1.74; SO_4 - 2.22. Wet-process phosphoric acid used for the experiments was produced at the Plant of mineral fertilizers of "Kazphosphate" LLP. A complete analysis of Karatau phosphorites and WPA was conducted in the central laboratory of "Kazphosphate".

RESULTS AND DISCUSSIONS

In the laboratory, the effect of the amount of borate salt additive, the rate and temperature of the EFC on the yield and quality of the product was studied. In laboratory studies the ratio of the mass part of phosphorite was used: the mass part of the borate salt (m.ch.ph: m.ch.b). To determine the effect of the amount of the borate salt additive on the decomposition process of the "phosphorite: borate salt" mixture, the EFK rate was 120% from stoichiometry at a temperature of 800°C, a reaction time of 1 hour and a drying temperature of 105-110°C. The results of laboratory studies are presented in Table 1.

Table 1. Effect of the amount of borate salt additive on the phosphorite decomposition factor

№	The amount of borate salt addition, «M.ch.ph: m.ch.b.»	Decomposition temperature, ° C	P_2O_5 com %	P_2O_5 assimilable %	B_2O_3, %	Degree of decomposition, %
1	100:30	80	38.2	32.89	1.80	86.1
2	100:40	80	36.1	31.21	2.36	86.4
3	100:50	80	34.5	27.65	2.90	80.1
4	100:60	80	31.7	25.11	3.11	79.2

Source: Our own experimental data, which were not previously published.

As can be seen from Table 1, with an increase in the amount of the borate salt addition, the B_2O_3 content of the product increases. However, at a ratio of "m.h.ph: m.ch.b." = 100: 60, the content of P_2O_5sv. in the product decreases, i.e. the degree of decomposition of phosphorite decreases. Perhaps in these conditions, the EFC norm is not sufficient, which is the object of further research. Under these conditions, the optimal ratio of "m.ch.ph: m.ch.b." is 100: 40.

The mixture of phosphorite and borate salt was decomposed by extraction phosphoric acid. In the thermal polycondensation of phosphates in the presence of boron compounds, copolymers of phosphorus and boron of complex composition with P-O-B bonds are formed. As a result, the degree of polymerization of the phosphate part is lower than in the absence of boron compounds. This leads to an increase in the solubility of the product. In addition, boron compounds accelerate the dehydration of phosphates, which leads to an increase in the content of total and assimilated P_2O_5. The absence of sulfate ions in the process of obtaining calcium polyphosphate, which is a ballast in the fertilizer, which also leads to an increase in the total and assimilated P_2O_5 in the product. As a source of boron, we used borate ores of the Inder deposit containing 11% of B_2O_3. The use of borate ores with this percentage is optimal. Since the use of borate ores with a B_2O_3 content of less than 5% leads to a decrease in the P_2O_5 content of the product due to an increase in the insoluble precipitate. The higher the concentration of ore in B_2O_3, the higher the concentration of the product by P_2O_5. A decrease in the process temperature leads to a deterioration in the dehydration process, and an increase in the reduction in the water soluble form of P_2O_5 in products.

The process of dehydration of phosphates in the presence of boron compounds intensifies, which makes it possible to increase the nutritional properties of fertilizers by introducing beneficial properties of the components: boron and magnesium, while simultaneously increasing the content of P_2O_5. Due to the fact that the amount of phosphoric acid is taken slightly higher than the stoichiometric norm for the formation of dihydrogen phosphates, the added boron compounds lead to complete neutralization of free acidity, the products somewhat swell and become lighter.

Borates in phosphoric acid solutions easily transform into a soluble form. With further dehydration of the resulting suspension, the process of polycondensation of phosphates and borates occurs with the formation of polymeric compounds of phosphorus and boron, the role of boron is reduced to that under these conditions boron participates in reactions of joint polycondensation with phosphates, forming heteropolymer compounds containing P-O-B bonds. Bohr exerts an accelerating effect on the process of polycondensation, as a result of which the dehydration process intensifies, which allows to increase the content of P_2O_5 in the product, to lower the temperature of the process. The resulting heteropolymers with P-O-B bonds are hydrolytically unstable, which leads to an increase in the content of the water-soluble form of P_2O_5. As a useful microelement, boron improves the quality of the product obtained. In addition, natural borates contain magnesium, which is also a useful component in fertilizers, whose presence increases the nutritional properties of the fertilizer.

Using the optimal ratio of extraction acid and borate salt to decomposition of phosphate raw materials allows to increase the degree of decomposition of raw materials, intensify the process of dehydration of phosphates in the presence of boron compound, eliminate the stages of warehouse ripening and obtain a conditioned product for a short time. The product contains useful components: phosphorus, boron. The product is characterized by good physical properties, non-hygroscopic, no free acidity, boron in the product is in a water-soluble form and evenly distributed.

The amount of boron added is limited by the requirements of agrochemistry. Since excess boron content has a harmful effect on plants. Calculation of the borate salt consumption was carried out taking into account the ratio B: P_2O_5 in granular borate double superphosphate 1: 100.

A study of the influence of the EFC norm on the degree of decomposition of phosphorite was carried out at the temperature of EFC 80^0C, the ratio "m.h.ph: m.ch.b." is 100: 40, the duration of the interaction is 60 minutes and the drying temperature is 105-110^0C. The rate of EFC consumption was varied within 110-130% of the stoichiometry. The results of laboratory studies are presented in Table 2.

From the data given in Table 2 it can be seen that with the increase in the rate of consumption of the ESP, the degree of decomposition of the "phosphorite: borate salt" mixture increases, however, the content of P_2O_5 spore. the same increases. At an acid rate above 120% of stoichiometry, the degree of decomposition of phosphorite does not increase significantly, but the content of free unreacted P_2O_5 increases. The optimal norm of EFC in this case is 120% of stoichiometry. Under these conditions, a relatively high degree of decomposition of the "phosphorite: borate salt" mixture is achieved. The product obtained under these conditions has good physical properties.

Table 2. Influence of the EFC rate of application on the decomposition factor of the Karatau phosphorite mixture and the borate salt

№	EFC consumption rate,% of stoichiometry	Decomposition temperature, ° C	Drying temperature, ° C	P_2O_5 com., %	P_2O_5 free., %	Degree of decomposition,%
1	110	80	105-110	34.5	1.2	80.2
2	120	80	105-110	36.1	3.2	86.4
3	130	80	105-110	39.1	4.3	86.1
4	140	80	105-110	41.5	5.6	89.5

Source: Our own experimental data, which were not previously published.

A study of the effect of temperature on the degree of decomposition of the "phosphorite: borate salt" mixture was carried out within the temperature range of ESP 70-90^{0}C at a ratio of "m.h.ph: m.ch.b." of 100:40 and an EFC rate of consumption of 120% of stoichiometry. From the literature data it is known that the degree of decomposition of phosphorite decreases with increasing temperature of the ESP, this is explained by the nature of the change in solubility in the system of CaO-P_2O_5-H_2O [5-7].

At a temperature of 70°C, the degree of decomposition of the "phosphorite: borate salt" mixture is somewhat higher, but the temperature of the superphosphate mass is reduced due to the relatively low ratio of the amount of heat released from the decomposition reaction. In the drying process, evaporation of moisture occurs and the content of phosphoric acid in the liquid phase increases, i.e. the activity of hydrogen ions of the liquid phase increases, which leads to an additional decomposition of the "phosphorite: borate salt" mixture. As a result of drying the pulp obtained at different temperatures to the same moisture content, the degree of decomposition of the "phosphorite: borate salt" mixture is practically the same. The results of the studies showed that when the temperature is raised above 90^{0}C, a more viscous and dense pulp is obtained. At an acid temperature of 90^{0}C, a more mobile pulp is obtained, which is easily transported to further stages of the manufacturing process. From the literature data it follows that an increase in temperature is undesirable, since the content of the assimilated form of P_2O_5 decreases. Reducing the temperature leads to a deterioration of the process.

Based on the results of the studies, it was determined that the optimum temperature of extraction phosphoric acid is 90^{0}C. Under these conditions, the product of the composition was obtained,% (by mass): P_2O_5 com. 36.1; P_2O_5 assim. 33.2; B_2O_3 2.36 (in terms of B – 0.37), which fully meets the requirements for the quality of borate double superphosphate.

CONCLUSIONS

Thus, under laboratory conditions, the influence of the ratio of phosphorite: borate salt on the degree of decomposition of phosphorite, the effect of the rate and temperature of extraction phosphoric acid on the degree of decomposition of the phosphorite: borate salt mixture was studied.

On the basis of the obtained research results, optimal parameters of the technological process for obtaining borate double-superphosphate using borate salts of the Inder deposit are determined:

-the ratio "mass part of phosphorite: mass part of borate salt" ("m.ch.ph: m.ch.b.") is equal to 100: 40;

-EFK consumption rate - 120% of stoichiometry;

-temperature of EFC - 90^{0}C.

The product obtained under these conditions contains,% (by mass): P_2O_5 total. 36.1; P_2O_5 assim. 33.2; B_2O_3 2.36 (in terms of B – 0.37), which fully meets the requirements for the quality of borate double superphosphate.

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DIVERSITY AND MARKETING POTENTIAL OF NON-WOOD FOREST PRODUCTS IN BERTEA LOCALITY (PRAHOVA COUNTY)

Cristian Mihai ENESCU, Mihail Cătălin BELCIUG

University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Agriculture, Forestry Specialization, 59 Mărăști Boulevard, 1st District, Bucharest, Romania, Email: mihaienescu@agro-bucuresti.ro

Corresponding author: mihaienescu@agro-bucuresti.ro

Abstract

In Europe, in the last two-three decades, the sector of non-wood forest products (NWFPs) received a special attention, thanks to their multiple uses. The most famous and used NWFPs in Romania which are harvested from the spontaneous flora are represented by the edible mushrooms and truffles, aromatic and medicinal plants, and forest fruits. Across the country, there are districts with high potential in harvesting these forest products, Prahova County being one of them. According to current legislation, the county is divided into two municipalities, twelve towns and ninety communes, including Bertea. The purpose of this research was to assess the potential of harvesting and marketing of the NWFPs in Bertea. A questionnaire with eleven questions was applied in the timeframe between 20th of April and 20th of May 2018 and one hundred households were the subject of the survey. The main way of procuring NWFPs is through harvesting by a family member, only a few people buying these products from local markets. The marketing of the NWFPs in Bertea is almost none, most of the people using the NWFPs for familial purposes and in small quantities. The majority of the interviewed people don't think that the marketing of the NWFPs should be promoted or collaboration between local stakeholders should be established.

Key words*: *Bertea, forest fruits, marketing, NWFPs, Prahova

INTRODUCTION

In Europe, in the last two-three decades, the marketing and trade of non-wood forest products (NWFPs), also known as non-timber forest products (NTFPs) [3] or green products [8], gain more interest [13].

In Romania, the most famous and used NWFPs which are harvested from the spontaneous flora are represented by the edible mushrooms and truffles, aromatic and medicinal plants, and forest fruits [5]. According to a recent study, the most appreciated forest fruits by the Romanian students are the raspberries, followed by walnuts, common hazels, wild strawberries and blueberries [9]. Forest fruits are valuable especially for their several antioxidants and active properties that are beneficial to human health [1], [4], [10].

Romania has also high interest in picking edible mushrooms, honey fungus [*Armillaria mellea* (Vahl) P. Kumm.], penny bun (*Boletus edulis* Bull.), and chanterelle (*Cantharellus cibarius* Fr.), being the most common species [16].

Regarding the game species, even if Romania has a great potential in harvesting and marketing of the game products, the yearly income obtained by the forest districts from these products is almost insignificant, being less than 1% [6].

Thanks to its great diversity regarding the forest composition and the land forms, Prahova County has a great potential for businesses targeting NWFPs [7]. According to the National Forest Administration - Romsilva annual report, in 2017, Prahova Forestry Directorate delivered 122.7 tons of forest fruits and 30.7 tons of medicinal plants [14].

From an administrative perspective, the county is divided into two municipalities, twelve towns and ninety communes, the names of thirty of them being related with the common names of certain forest tree species [15].

Bertea is one of the ninety communes from Prahova County. Its neighbors are Valea Doftanei (North-West), Ștefești (East), Aluniș

(South) and Brebu (South-West) localities, respectively (Figure 1). It is a scattered commune, which recorded in the last three decades a significant population decrease, from 3,777 inhabitants (in 1985) down to 3,490, in 2002, and 3,239, in 2011, respectively [11], [12]. In the last twenty years, a similar trend was also recorded in the case of the arable lands [2].

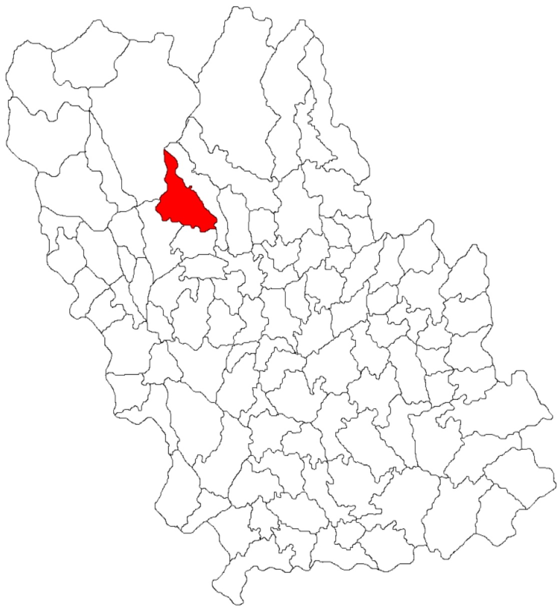

Fig. 1. Location of Bertea Commune
Source: https://commons.wikimedia.org/wiki/File:Bertea_jud_Prahova.png

The forest fund within the administrative borders of Bertea accounts for 1,876 hectares, out of which 1,232 hectares are state-owned, being managed by Slănic Forest District, a territorial unit of Prahova Forestry Directorate [12]. Common beech (*Fagus sylvatica* L.) and silver birch (*Betula pendula* Roth.) are the most common hardwood species, accounting for 67% and 7% of the total forest area managed by Slănic Forest District, respectively. The coniferous species are represented by Norway spruce [*Picea abies* (L.) H. Karst.; 17%] and silver fir (*Abies alba* Mill.; 4%). The remaining 5% consist in other hardwood species [12].
The purpose of this research was to highlight the importance of harvesting/picking and marketing of the specific NWFPs in Bertea locality.

MATERIALS AND METHODS

The main instrument used for assessing the importance of harvesting/picking and trade of the NWFPs in Bertea consisted in a questionnaire with 11 questions, as follows:
Q1. What are the main ways of procuring NWFPs by your family?
(a) A family member collects them from the forest;
(b) I buy them locally;
(c) Other method (please specify which).
Q2. Which are the main types of NWFPs that you harvest and/or buy?
Specify, please, also the main species for each category, as follow:
(a) Medicinal plants;
(b) Forest fruits;
(c) Edible mushrooms;
(d) Other categories (please specify which).
Q3. What quantities of non-timber forest products do you (or your family) purchase and/or harvest every year?
Specify, please, the quantities for every species/type of NWFPs/product.
Q4. What is the price you pay per one kilogram/piece?
Specify, please, prices and quantities for every species/type of NWFPs/product.
Q5. For what purpose do you harvest/purchase non-timber forest products?
(a) Family consumption;
(b) Income generation through sale;
(c) Other purpose (please specify which).
Q6. If you have chosen option (b) to question no. 5, in what form do you sell the non-timber forest products?
Please specify the forms, under which you sell, for every species/product, where applicable:
(a) Fresh, immediately after harvest;
(b) Processed/prepared (please specify in what form; e.g. frozen, processed as juices, jams, etc.).
Q7. If you personally harvest NWFPs, which areas do you often visit?
Q8. According to your experience, these products should be strongly promoted in Bertea? If so, could you motivate your answer by presenting an effective way of promotion?

Q9. Do you frequently use these forest products in your diet? If so, what do you prefer (examples)?
(a) Mushrooms;
(b) Forest fruits;
(c) Medicinal and aromatic herbs.
Q10. Do you think there should be a shop with products specific to this segment in Bertea (Yes or No)?
Q11. Do you think it would be more appropriate to have collaboration between the main commercial entities already established in Bertea and the local people who are harvesting certain NWFPs (Yes or No)?

The questionnaire was applied in the timeframe 20th of April 2018 and 20th of May 2018. The distribution of the chosen households took into account the main streets within the locality (Figure 2).

Fig. 2. Distribution of the main streets in Bertea
Source: Google Maps, https://www.google.com/maps

RESULTS AND DISCUSSIONS

One hundred people (one per household) participated in the survey and their answers are centralized in the followings.

As regards the way of procuring the NWFPs (Q1), 85% of the respondents specified that the harvest was made by a family member, 10% of the people said that they were buying them from local people and 5% bought them from the market.

The main categories of NWFPs that are harvested/bought (Q2) consisted in mushrooms (especially honey fungus, penny bun and Blancaccio), forest fruits (blackberries, raspberries, and berries of sea-buckthorn, rosehip and Cornelian cherry) and medicinal plants (flowers of elder, peppermint, plantain and common Saint John's wort).

The harvested quantities ranged between 2 and 20 (on average 5.2) kilograms of edible mushrooms, between 1 and 25 (on average 6.7) kilograms of forest fruits and around 1 kilogram of medicinal plants per household (Q3).

The average price per one kilogram (Q4) of edible mushrooms was 5 RON (*i.e.* 1.1 Euro), while the price for one kilogram of the forest fruits was a little bit bigger, *i.e.* 7 RON (1.5 Euro).

All respondents, with the exception of one, declared that they are collecting the NWFPs for familial uses (Q5). The only person who is not doing this is selling the products fresh, immediately after their harvesting at very low prices and in small quantities (Q6).

The most preferred places for harvesting / collecting of NWFPs (Q7) across Bertea are marked in yellow in Figure 3.

61% of interviewees said that they don’t think that the NWFPs should be intensively promoted in Bertea. According to the ones who share the opposite opinion (*i.e.* they think that the NWFPs should be promoted), collecting and storing places, and a shop are needed. Also, according to their opinion, these products should be promoted during the local festivals, especially some of the by-products, such as jams and juices (Q8).

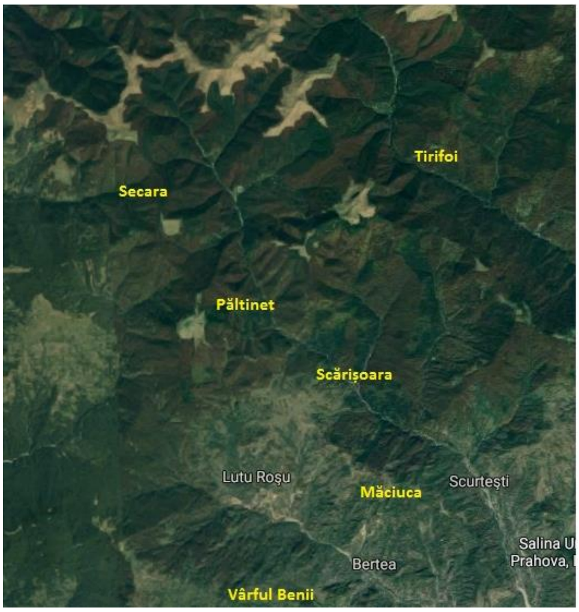

Fig. 3. Preferred harvesting/collecting places
Source: Google Maps, https://www.google.com/maps

Most of the people said that they are consuming very often the NWFPs (Q9). For example, the mushrooms are consumed immediately after harvesting, forest fruits are consumed throughout the year (mainly as jams and juices), while medicinal plants are used (mainly as teas) to treat various medical problems.

40% of the interviewees wish to have a market in Bertea, where they might find these kinds of products (Q10).

Seven out of ten respondents don't think that collaboration between the ones who are harvesting/collecting certain NWFPs and the ones already involved in marketing activities would be benefic for them (Q11).

CONCLUSIONS

In Bertea, the main way to procure NWFPs is to harvest them by family members, with very few people buying these products from local markets, the most common products being the edible mushrooms, the forest fruits and the medicinal plants.

The marketing of the NWFPs in Bertea is almost none, almost all inhabitants using the NWFPs for familial purposes and in small quantities, without selling them.

Most of the people don't think that the marketing of the NWFPs should be promoted or collaboration between local stakeholders should be established.

Although the diversity of the non-timber forest products in Bertea locality is high and the prices of these products are low, only a small part of the respondents truly think that a business targeting their marketing would be a success.

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CHEMICAL CHARACTERISTICS OF THE FOREST SOILS FROM PRAHOVA COUNTY

Cristian Mihai ENESCU[1], Lucian DINCĂ[2], Iulian Alexandru BRATU[3]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, Department of Soil Sciences, 59 Mărăști Boulevard, 1st District, Bucharest-011464, Romania
[2]"Marin Drăcea" National Institute for Research and Development in Forestry (INCDS), 13 Cloșca Street, Brașov-500040, Romania, Email: dinka.lucina@gmail.com
[3] "Lucian Blaga" University of Sibiu, 7 Doctor Ion Rațiu Street, Sibiu-550012

Corresponding author: mihaienescu@agro-bucuresti.ro

Abstract

Chemical, physical and biological characteristics of forest soils are very important for foresters especially for assessing the capacity of forest sites for timber production. More and more foresters started to take into consideration the relation between the forest soils, the tree layer composition and the silvicultural measures in order to find the best combination from a sustainable development point of view. The aim of this study was to realize a description of the forest soils from Prahova County. The data for the timeframe 1988-2012 from the forest management plans of the eight state-owned forest districts within Prahova Forestry Directorate were taken into account. The most common forest soils across Prahova County were the eutric cambisol, the dystric cambisol and the luvisol. By taking into account the values of the pH and soil base saturation, two of the most relevant chemical characteristics of forest soils, we can say that the forest sites with eutric cambisols and luvisols provide the optimum conditions for the development of beech and Norway spruce. In order to conserve or to increase the chemical characteristics of the forest soils to an optimum level, future silvicultural measures should be focused on promoting the mixed stands, even if by doing this, the forests managers will have to face several challenges.

Key words*: *dystric cambisol, eutric cambisol, forest soils, luvisol, Prahova

INTRODUCTION

Knowing that the biological, physical and chemical properties of forest soils represents for foresters one of the main way to assess the capacity of certain forest sites especially in terms of timber production [19].
Nowadays, more and more foresters, both from research and production fields, are taking into consideration the impact of certain silvicultural measures on the forest soils [10], including their capacity for carbon sequestration [14], [15].
It is well known that the tree harvesting, especially the ones with high intensity (*e.g.* clear cuttings) is mainly affecting the activity of several soil microorganisms by changes that are occurring in plant cover, compaction of the top layer of the soil or reduction of organic matter [16].
Moreover, by maintaining or changing different tree layer compositions, the foresters have a direct impact on the biological, physical and chemical properties of the soils. For example, in the case of pure Norway spruce forest stands [*Picea abies* (L.) H. Karst.], it was reported that the physical properties of the soils were negative affected, especially regarding the content of Magnesium and Calcium [2].
The impact of forest stands planted on former agricultural soils is also notable. For example, according to a research done in Lithuania, Sweden and Denmark, where plantations with small-leaved lime (*Tilia cordata* Mill.) and Norway spruce were established on arable lands, almost four decades later, the soils where linden was planted recorded higher values for base saturation and pH in comparison with the stands planted with Norway spruce [9]. *P. abies* was expanded beyond its natural distribution across Europe in the last century [20] and perhaps this is one of the main reasons for soil acidification in most of the stands, several proofs being recorded [12]. Soil characteristics are linked

to soil fertility [2], determining also the quality of the water in the soil [17].

The aim of this paper was to realize a description of the forest soils from Prahova County.

MATERIALS AND METHODS

Data and information regarding the soil types and their chemical characteristics were collected from the forest management plans (FMPs) of the eight forest districts within Prahova Forestry Directorate, namely Azuga, Câmpina, Măneciu, Ploiești, Sinaia, Slănic, Văleni and Verbila [1].

Special attention was given to the soil pH, soil base saturation, humus content, the total cation exchange capacity and nitrogen content. The main chemical characteristics were recorded separately on pedogenetic horizons. Some examples of horizons are given in Fig. 1.

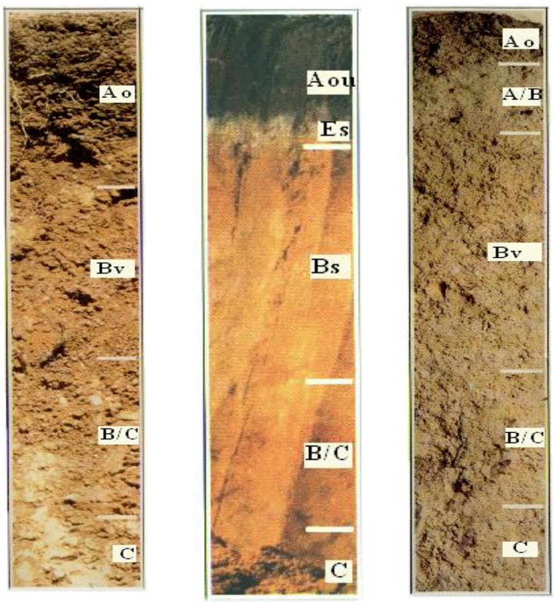

Fig. 1. Examples of soil profiles
Source: Soils of Romania [22]

Prahova County covers an area of almost 2% of the total area of the country [4], having all three main landform types and a high degree of torrentiality in the mountainous regions, especially on Prahova Valley [5].

The total forest area from Prahova County accounts for about 146.600 hectares, being composed, in majority (76%), of hardwood species, mainly beech (*Fagus sylvatica* L.). Almost two thirds of the forests are managed by Prahova Forestry Directorate, the rest being managed by private-owned forest districts, Ever Green and Ingleby having the highest shares across the county [7].

The county has a good tourism potential especially thanks to the socio-economic perspective [8] and the landscape across Prahova Valley [11], [13]. The forest vegetation from Prahova Valley is mainly composed by beech, silver fir (*Abies alba* Mill.) and Norway spruce [18], some of them being natural forests [3], that were recently included in the National Catalogue of Virgin and Cvasi-Virgin Forests of Romania.

RESULTS AND DISCUSSIONS

The soil samples taken into account for this study were collected in the timeframe 1988-2012, a total of 550 soil profiles and 1.584 pedogenetic horizons being analyzed.

Thirteen forest soils types were identified across the forest lands managed by Prahova Forestry Directorate.

Eutric cambisols and dystric cambisols were the most common ones (50% and 17%, respectively), followed by luvisols (14%), rendzic leptosols (6%), phaeozems (3%), preluvisols (3%) and others (Fig. 2).

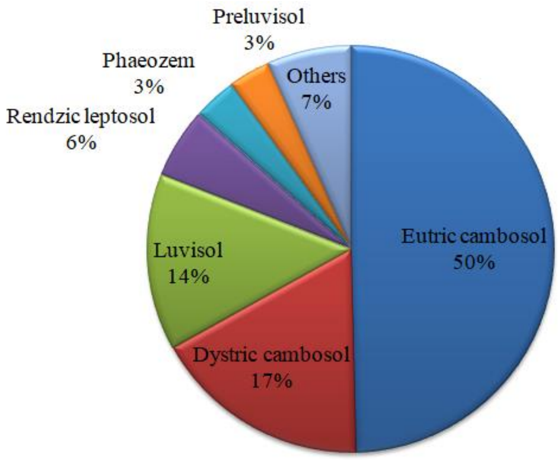

Fig. 2. The main forest soils types from Prahova County
Source: centralized data from the FMPs [1]

Very low represented were the phaeozem, preluvisol, entic podzol, chernozem, luvisol, gleysol, solonchak, solonetz and vertisol types (in total, 7% of the forest soils).

As regards the top three, the results are similar with the situation reported at national level [6], according to which dystric cambisol is placed on the first place in terms of occupied area (35%), luvisol on the second position (22%) and eutric cambisol on the third (13%).
The values of the soil pH, which was differentially calculated on pedogenetic horizons for the three most common soil types, are presented in the followings.
In the case of the most common forest soil, the average pH value in Ao horizon was 5.36 and 5.90 in Bv horizon, respectively.
Similar values were recorded also for the luvisols. The average pH value in Ao horizon was 5.32, while in Bt horizon the value was 5.42, and slightly smaller in El horizon (*i.e.* 5.06), respectively.
Dystric cambisols had an average pH value of 4.58 in Ao horizon and of 4.68 in Bv horizon, being a strongly acid soil.
By taking into account the average values of the pH recorded for the main three forest soils types and corroborating them with the data from specialized manuals as regards the optimum range of the site characteristics for certain forests species [21], we can say that the beech and Norway spruce pure or mixed stands have optimal condition in forest sites with eutric cambisol and luvisols and suboptimal condition is sites with dystric cambisols.
The average values of the soil base saturation (V%) for the main three forest soil types from Prahova County are given in Table 1.

Table 1. Average values of soil base saturation (V%)

Soil type	Horizon (V%)			
	Ao	Bv	Bt	El
Eutric cambisols	66.66	74.75	-	-
Dystric cambisols	45.12	43.49	-	-
Luvisols	61.97	-	64.39	46.28

Source: centralized data from the FMPs [1]

Based on these values, eutric cambisols are classified as mesobasic soils, while the dystric cambisols are oligomesobasic soils.
In the case of the luvisols, the differences between the values recorded for the main horizons were bigger, being oligomesobasic (El horizon) – mesobasic (Ao and Bt horizons) soils.
All these values recorded for all of the three forest soil types are optimal for the beech and Norway spruce, pure or mixed stands [21].
The average humus content (H; %) and the total cationic exchange capacity (T; me/100 g soil) for the main three soil types from Prahova County are given in Table 2.

Table 2. Average humus content and total cationic exchange capacity for the main forest soils from Prahova County

Soil type	H/T	Horizon			
		Ao	Bv	Bt	El
Eutric cambisols	H	6.44	2.84	-	-
	T	27.79	22.32	-	-
Dystric cambisols	H	6.07	2.52	-	-
	T	27.58	22.01	-	-
Luvisols	H	6.94	-	2.58	2.16
	T	29.5	-	22.03	20.92

Source: centralized data from the FMPs [1]

Based on the values recorded for humus content in the first horizon (*i.e.* Ao), all three soil types are classified as being intensely humiferous soils.
The nitrogen content, which was calculated only for the first pedogenetic horizon, is given in Table 3.

Table 3. Average nitrogen content of the main forest soils from Prahova County

Soil type	N content Ao
Eutric cambisols	0.309
Dystric cambisols	0.336
Luvisols	0.262

Source: centralized data from the FMPs [1]

The highest quantity of nitrogen was found for the dystric cambisols, followed by eutric cambisols and luvisols.

CONCLUSIONS

The most common forest soils across Prahova County were the eutric cambisols, dystric cambisols and luvisols.
As regards the values recorded for soil pH for the main three forest soils types, the dystric

cambisols are classified as acid soils, while the eutric cambisols and luvisols are moderately acid soils. By corroborating the pH values with the ones of the soil base saturation, we conclude that the forests sites with eutric cambisols and luvisols present the optimal condition for the development of the two most common tree species across Prahova County, namely the common beech and Norway spruce.

Based on the above-mentioned aspects, in our opinion, in order to conserve or to increase the chemical characteristics of the forest soils to an optimum level, future silvicultural measures should be focused on promoting the mixed stands to the detriment of the Norway spruce pure stands, even if by doing this, the forests managers will have to face several challenges.

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DEVELOPMENT OPPORTUNITIES FOR BIOGAS PRODUCTION FROM ANIMAL MANURE IN LITHUANIA

Albertas GAPŠYS, Ovidija EIČAITĖ, Vida DABKIENĖ, Deiva MIKELIONYTĖ

Lithuanian Institute of Agrarian Economics, LAEI, V. Kudirkos st. 18–2, 03105, Vilnius, Lithuania, Phone: +37052622429, Emails: albertas.gapsys@laei.lt, ovidija.eicaite@laei.lt, vida.dabkiene@laei.lt, deiva.mikelionyte@laei.lt

Corresponding author: ovidija.eicaite@laei.lt

Abstract

Biogas production from animal manure offers many environmental, agricultural, energy security, and social-economic benefits. The growth of biogas from animal manure in Lithuania is limited. Currently, there are only 10 biogas plants in operation that have been installed on large-scale pig farms. This study aimed to evaluate development opportunities for biogas production from animal manure in Lithuania. In order to achieve this aim, the total amount of animal manure generated in the country over the last year was estimated and the views and opinions on biogas production from animal manure of Lithuanian large-scale livestock farmers and representatives of agricultural holdings were investigated by conducting a survey. The total amount of animal manure in Lithuania was estimated to be 11.4 million tonnes in 2017. The results of the survey revealed that the level of awareness of biogas technology and economy, and support schemes for biogas among the potential biogas plant operators was low. The possibility to produce the own energy and complaints by local residents about animal manure management were identified as the main motives for installing biogas system on farms. The belief that investment is needed to solve some other problems on farms was found as the major obstacle for installing biogas system on farms.

Key words*: *animal manure, biogas production, large-scale livestock farms, biogas plant, Lithuania

INTRODUCTION

The expansion of biogas production from animal manure is affected by environmental goals, renewable energy, and bioeconomy issues expressed in the European Union's (EU) strategic documents [5; 6; 7; 8]. Apart from the fact, that, in the EU, primary energy production from biogas has increased significantly in the last decade (from 4,461 ktoe in 2006 to 16,600 ktoe in 2016) [9], animal manure provides only a small share of biogas production (7% in 2014) [14]. It is generally acknowledged that the largest potential for biogas growth is in making more use of animal manure [14]. In the EU, the potential of biogas production from animal manure is considerable [4; 12; 13; 19].

Biogas production from animal manure is recognized as being a concept of multifunctional character that is able to offer a wide range of benefits for the agricultural and energy sectors, environment, and society [2]. These benefits include the following [10; 12; 16; 17]:

-production of renewable energy;
-reduction of greenhouse gas emissions by substituting fossil fuel energy use and by capturing methane gas from animal manure;
-improvement of animal manure management and nutritional uptake efficiency;
-considerable reduction of odours;
-inactivation of pathogens;
-lesser air and water pollution;
-additional income for farmers;
-money savings for farmers;
-new job opportunities in rural areas when building and operating biogas plants;
-improvement of rural economies.

Different stakeholders (e.g. agricultural companies, farmers, energy generators/providers, policy makers, scientific researchers, environmental activists, regulators, local residents) have different attitude on agricultural, environmental, economic, and social benefits of biogas, which in turn influence their decision-making processes [18]. Despite the broad consensus among stakeholders on the need to develop biogas production from animal manure on farms, the implementation of biogas projects falls mostly on farmers and agricultural companies. In recent years, several studies have been conducted in different countries aimed to identify motivational factors and barriers which underlie farmers' reasons for and for not adopting biogas technology on farms [3; 11; 18; 21; 22].

The outcomes of the survey conducted in Austria revealed that the main motives leading farmers to invest in biogas plants on their farms were: improvement of manure; possibility to produce the own energy; and diversification of farm income [22]. The results of the survey which was carried out in Austria, Bulgaria, Germany, Denmark, Spain and Poland indicated that the major hindrances for organic farmers to introduce sustainable organic biogas production included financial constraints and little knowledge about best practice examples [3]. The findings of the survey performed in England showed that the benefits from installing biogas technology on farms in terms of importance were seen by all interviewed farmers as improving farm profit and reduce pollution/contamination risk, whereas the most important potential obstacles put forward by farmers were establishment costs seem too high and the returns seem too low [21]. The results of the survey conducted in Czech Republic uncovered that the main motivational factors for adopting some renewable energy (including biogas) enterprises as reported by farmers were: diversification of agricultural activities and stabilization of farm income; landscape management; legislative and financial support. Constant changes in the legislation, unclear and complex legislation, and unprofitable production of renewable energy had been reported as the main barriers for adopting some renewable energy enterprises [11].

The livestock sector historically and traditionally has been, and remains, one of the most important agricultural activities in Lithuania. Livestock production generates animal manure which is considered as an organic fertilizer but often treated as an inevitable waste. Therefore, biogas production from animal manure provides a possibility to manage waste problems, while offering many other benefits.

The biogas production from animal manure in Lithuania has started only recently, and thus, the development of this production is in its initial stage. According to the data from the Lithuanian website for renewable energy sources, currently, of the 40 biogas plants operating in Lithuania, only 10 have been installed on livestock farms (more specifically on large-scale pig farms) and use animal manure (pig manure) as a feedstock for biogas production. The total installed capacity of these plants amounts to 9.4 MW_{el} [15]. Since there has been limited adoption of biogas technology on farms, therefore it is of particular interest to evaluate development opportunities for biogas production from animal manure in Lithuania.

MATERIALS AND METHODS

This study consists of two parts. The first part of the study aimed to estimate the total amount of animal manure (liquid and solid) generated in Lithuania over the last year and to define the counties with the highest concentration of animal manure production, whereas the second part aimed to investigate the views and opinions on biogas production from animal manure of Lithuanian large-scale livestock farmers and representatives of agricultural holdings.

The equation in estimating the total amount of animal manure (liquid and solid) generated in the country for a given year was used as follows:

$$M = \sum_T \left((MC_{T(S)} \times N_T + MC_{T(L)} \times N_T) \times 12 \times 0.7 \right);$$

in this equation:

M – total amount of animal manure (liquid and solid) generated in the country for a given year, tonnes;

$MC_{T(S)}$ – extraction coefficient of solid manure for animal type T, m^3 $head^{-1}$ $month^{-1}$;

$MC_{T(L)}$ – extraction coefficient of liquid manure for animal type T, m^3 $head^{-1}$ $month^{-1}$;

N_T – animal population of animal type T (number of heads);

T – animal type;
12 – months year^{-1};
0.7 – conversion coefficient of m^3 to tonnes.

The total amount of animal manure was calculated as the sum of liquid and solid manure generated by all animal types. The extraction coefficients of solid and liquid manure for different animal types were taken from the 'Advanced farming rules and recommendations' and the animal population (number of heads) was obtained from Statistics Lithuania [1; 20].

In order to investigate the views and opinions on biogas production from animal manure of Lithuanian large-scale livestock farmers and representatives of agricultural holdings, the survey method was employed. The survey was addressed to the large-scale livestock farmers and representatives of agricultural holdings having a herd size of about 500 or more head of cattle and of 1,000 or more head of pigs. The information was obtained by means of a standardised questionnaire which was sent to 95 respondents identified as the potential biogas plant operators. The survey took place in February 2018. A total of 25 large-scale livestock farmers and representatives of agricultural holdings filled the questionnaire: 19 of respondents had a herd size of more than 500 head of cattle, 3 of which reared cattle and other animals (1 respondent reared cattle and more than 1,000 head of pigs, 1 respondent reared cattle and less than 1,000 head of pigs, and 1 respondent reared cattle and poultry), 2 respondents had a herd size of less than 500 head of cattle and 4 respondents had a herd size of more than 1,000 head of pigs.

The questionnaire included questions on: connection with activities related to biogas production from animal manure; level of awareness of biogas technology and economy, and support schemes for biogas; intention to produce biogas from animal manure on farms in the future; motives and obstacles for installing biogas system on farms; awareness of the interest of local rural communities in the construction of biogas plants. Data were also collected on general farm characteristics – herd size and structure of the herd.

Descriptive statistics of frequency, mean and standard deviation were applied to examine the data from the survey.

RESULTS AND DISCUSSIONS

Animal manure production for Lithuania

In 2017, the total amount of animal manure in Lithuania was estimated to be 16,223 thousand m^3 or 11,356 thousand tonnes. Cattle manure accounted for the highest share of the total amount of animal manure generated in the country (76%). The remaining manure was from poultry (12%), pigs (8%), and sheep, goats and horses, taken together (4%). In terms of geographical distribution, the county that generated the most animal manure was Šiauliai (2,101 thousand m^3 or 1,471 thousand tonnes), followed by Kaunas (2,069 thousand m^3 or 1,448 thousand tonnes), and Tauragė (1,972 thousand m^3 or 1380 thousand tonnes) (Table 1).

Table 1. Total amount of animal manure generated in Lithuania in 2017 by county and animal type, thousand m^3

County	Total amount of animal manure generated in Lithuania, thousand m^3				
	Cattle	Pigs	Poultry	Sheep, goats and horses	**Total**
Alytus	632	19	44	76	**771**
Kaunas	1,542	175	267	85	**2,069**
Klaipėda	1,444	99	96	41	**1,679**
Marijampolė	1,324	105	47	38	**1,514**
Panevėžys	1,442	221	175	46	**1,884**
Šiauliai	1,648	268	117	67	**2,101**
Tauragė	1,795	115	29	33	**1,972**
Telšiai	1,216	50	300	43	**1,608**
Utena	756	87	89	122	**1,054**
Vilnius	561	86	813	113	**1,573**
Total, thousand m^3	**12,360**	**1224**	**1977**	**663**	**16,223**
Share, % of total in Lithuania	**76**	**8**	**12**	**4**	**100**

Note: 1 m^3 = 0.7 tonne.
Source: Own calculations.

The largest amounts of animal manure were generated in the counties where large-scale livestock farms prevailed. In 2017, there were 93 cattle farms with 500 or more head of cattle and 53 pig farms with 1,000 or more head of pigs (Table 2).

Table 2. Large-scale cattle and pig farms, and biogas plants in Lithuania in 2017 by county

County	Cattle farms with 500 or more head of cattle			Pig farms with 1000 or more head of pigs			Number of agricultural biogas plants
	Number of farms	Number of cattle (heads)	Average number of cattle (heads)	Number of farms	Number of pigs (heads)	Average number of pigs (heads)	
Alytus	1	585	585	1	1,014	1,014	–
Kaunas	15	19,622	1,308	11	84,585	7,690	–
Klaipėda	4	2,776	694	4	38,076	9,519	–
Marijampolė	17	22,011	1,295	4	35,486	8,872	1
Panevėžys	20	23,767	1,188	6	100,812	16,802	2
Šiauliai	26	30,663	1,179	12	131,649	10,971	4
Tauragė	5	3,457	691	3	37,527	12,509	–
Telšiai	1	901	901	3	21,132	7,044	–
Utena	2	1,672	836	6	44,337	7,390	2
Vilnius	2	1,869	935	3	34,232	11,411	1
Lithuania	**93**	**107,323**	**1,154**	**53**	**528,850**	**9,978**	**10**

Source: Own calculations.

In 2017, the average number of cattle on large-scale cattle farms was 1,154 and the average number of pigs on large-scale pig farms was 9,978. Large-scale cattle farms in Kaunas, Marijampolė, Panevėžys and Šiauliai counties were bigger than the average large-scale cattle farm for the country. The biggest large-scale pig farms were in Panevėžys, Tauragė, Vilnius and Šiauliai counties. The counties with the highest numbers of large-scale livestock farms (mainly the northern and central parts of Lithuania) were identified as the potential areas where biogas plants could be built. In 2017, approximately 1,913 thousand m^3 or 1,339 thousand tonnes of cattle manure was generated from large-scale cattle farms, which accounted for 15% of the total amount of cattle manure generated in Lithuania, and approximately 972 thousand m^3 or 680 thousand tonnes of pig manure was generated from large-scale pig farms, which accounted for 79% of the total amount of pig manure generated in Lithuania (the total amount of animal manure generated from large-scale livestock farms was estimated using an average amount of manure generated per animal per year and the total number of animals on large-scale livestock farms) (Table 3).

Of all large-scale livestock farms, only 10 pig farms have adopted biogas technology (Table 2). These biogas plants utilize only a very small share of the total amount of animal manure generated in Lithuania. No any biogas project has been developed on large-scale cattle farms. Given the facts that large-scale livestock farms produce significant amounts of animal manure and face the most serious problems related to animal manure management, it is appropriate to construct biogas plants on these farms in particular. At present, there are 136 large-scale livestock farms in Lithuania, where biogas systems are feasible.

Table 3. Total amount of animal manure generated from large-scale cattle and pig farms in Lithuania in 2017 by county, thousand m^3

County	Average amount of manure generated per animal per year, m^3		Total amount of animal manure generated from large-scale livestock farms in Lithuania, thousand m^3	
	Cattle	Pig	Cattle farms with 500 or more head of cattle	Pig farms with 1000 or more head of pigs
Alytus	18.01	2.09	11	2
Kaunas	17.59	1.81	345	153
Klaipėda	17.40	1.83	48	70
Marijampolė	18.12	1.95	399	69
Panevėžys	18.20	1.86	433	187
Šiauliai	17.49	1.82	536	240
Tauragė	18.20	1.87	63	70
Telšiai	17.60	1.77	16	37
Utena	17.65	1.87	30	83
Vilnius	17.49	1.76	33	60
Total, thousand m^3	–	–	**1,913**	**972**

Source: Own calculations.

The results of the research conducted by the European Commission’s Joint research centre revealed that the total amount of animal manure in Lithuania was estimated to be about 10.7 million tonnes fresh matter per year (data on animal population represented the average values for the period 2009–2013). Of the total amount of animal manure, only 5.3 million tonnes could be collected.

Between 157 and 212 biogas plants, with a total installed capacity between 29.1 MW_{el} and 35.2 MW_{el}, and an average capacity between 137 kWe and 224 kWe, could be built in Lithuania in the two scenarios analysed: variable collection area and a constant (10 km) collection radius, respectively [19].

Survey results

Lithuanian large-scale livestock farmers and representatives of agricultural holdings identified as the potential biogas plant operators were interviewed. First of all, respondents were asked about their connection with activities related to biogas production from animal manure. Some types of this connection were distinguished. The majority of interviewees (44%) stated that they are considering whether it is worthwhile to invest in installing biogas system on their farms. Almost one fifth of survey participants (19%) pointed out that they are already planning to construct biogas plants on their farms. However, slightly more than one quarter of respondents (26%) claimed that they are not, in principle, interested in installing biogas system on their farms (Table 4).

Table 4. Respondents' connection with activities related to biogas production from animal manure

Statements	Answers	
	Number	%
Respondent is considering whether it is worthwhile to invest in installing biogas system	12	44%
Respondent is not, in principle, interested in installing biogas system on farm	7	26%
Respondent is planning to construct a biogas plant	5	19%
Biogas plant is already operating on the farm	1	4%
Respondent supplies animal manure to a biogas plant	0	0%
Other	2	7%

Source: Own calculation from Field survey.

In this question, an *'Other'* category was included and this allowed interviewees to indicate issues that had not been included in the list. One survey participant reported that the economic evaluation carried out 5 years ago confirmed that the construction of a biogas plant on the farm would be not cost effective. Another respondent noted that she/he is hesitant about installing biogas system on the farm.

Respondents were asked if they are being aware of biogas production from animal manure, using a 5-point rating scale (1 – 'Not at all aware', 5 – 'Extremely aware'). It was found that the level of awareness of biogas technology and economy, and support schemes for biogas was low. 60% of interviewees (those who chose '1' or '2' on the scale) indicated non-awareness of support schemes for biogas, with mean score 2.2 (SD = 1.0). An equal percentage of survey participants, 48% each, stated being not at all aware or slightly aware of biogas technology and economy (Table 5).

Table 5. Respondents' awareness of biogas production from animal manure

Area of awareness	Results, %			Mean	SD
	Awareness[1]	Somewhat awareness[2]	Non-awareness[3]		
Technology	12%	40%	48%	2.5	1.0
Economy	16%	36%	48%	2.6	1.2
Support schemes	8%	32%	60%	2.2	1.0

In this table:
[1]Awareness – categories 'Extremely aware' and 'Moderately aware' were merged;
[2]Somewhat awareness – category 'Somewhat aware';
[3]Non-awareness – categories 'Not at all aware' and 'Slightly aware' were merged;
SD – Standard Deviation.
Source: Own calculation from Field survey.

Respondents were asked if they are going to construct biogas plants on their farms over the next 10 years, using a 5-point rating scale (1 – *'Definitely not going to construct'*, 5 – *'Definitely going to construct'*). 29% of survey participants noted that they are definitely or most probably going to construct biogas plants, and 46% of interviewees reported that they are definitely or most probably not going to construct biogas plants. The mean score of this item was 2.7 (SD = 1.3) (Table 6).

Respondents were asked if they are aware of the interest of local rural communities in the construction of biogas plants. The majority of interviewees (68%) reported that they have no information regarding this interest, and one fifth of survey participants (20%) stated that local rural communities are interested in the construction of biogas plants (Table 7).

Table 6. Respondents' intention to construct biogas plants on their farms over the next 10 years

Results, %			Mean	SD
Intention[1]	Neutral[2]	No intention[3]		
29%	25%	46%	2.7	1.3

In this table:
[1]Intention – categories 'Definitely going to construct' and 'Most probably going to construct' were merged;
[2]Neutral – category 'Neutral';
[3]No intention – categories 'Definitely going to construct' and 'Most probably going construct' were merged.
Source: Own calculation from Field survey.

Table 7. Respondents' awareness of the interest of local rural communities in the construction of biogas plants

Statements	Respondents	
	Number	%
No information	17	68%
Yes, local rural community is interested	5	20%
No, local rural community is not interested	3	12%

Source: Own calculation from Field survey.

Respondents were provided with the list of motives and obstacles for installing biogas system on farms and then asked to assess the level of agreement towards each statement, using a 5-point rating scale (1 – *'Totally disagree'*, 5 – *'Totally agree'*).

Of the statements relating to obstacles for installing biogas system on farms, interviewees expressed the strongest agreement with the item suggesting that investment is needed to solve some other problems on their farms. The mean score of this items was 4.1 (SD = 0.9), with 76% of survey participants (those who chose '4' or '5' on the scale) indicating agreement. Other obstacles such as 'Low purchase for electricity', 'Concerns of drawing attention away from primary farm activity', 'Lack of financial capacity', 'Unfamiliar technology and lack of specialists' and 'Insufficient level of support and unattractive support conditions' also received strong endorsement, with mean scores ranging from 3.6 to 3.9, and agreement percentages ranging from 52% to 68% (Table 8).

Of the statements relating to motives for installing biogas system on farms, the items generating the strongest agreement were 'Possibility to produce the own energy (electricity and heat)' and 'Complaints by local residents about animal manure management (odour reduction)'. The mean scores of these items were 3.8 (SD = 0.9) and 4.0 (SD = 0.9), respectively, with an equal percentage of survey participants, 72% each (those who chose '4' or '5' on the scale), indicating agreement.

Table 8. Obstacles for installing biogas system on farms

Obstacles	Results, %			Mean	SD
	Agreement[1]	Neutral[2]	Disagreement[3]		
Competing investment priorities	76	20	4	4.1	0.9
Low purchase price for electricity	72	24	4	4.0	0.9
Concerns of drawing attention away from primary farm activity	68	16	16	3.8	1.1
Lack of financial capacity	68	20	12	3.9	1.0
Unfamiliar technology and lack of specialists	64	24	12	3.7	0.9
Insufficient level of support and unattractive support conditions	52	40	8	3.6	1.0
Low familiarity with the opportunity to construct a biogas plant	44	48	8	3.1	1.2
Uncertainty about maintaining the same number of animals	36	32	32	3.0	1.3
High price of animal manure	24	40	36	3.0	1.0
Hostility of local residents to biogas plants	24	48	28	3.0	1.0
Insufficient amount of animal manure and other agricultural residues	20	24	36	2.6	1.0
Limited possibilities to obtain a loan	16	40	44	2.7	1.1
Non-compliance to eligibility criteria for support	12	52	36	2.6	1.1
Lack of consultations	4	40	56	2.6	0.8
Problems related to the construction site selection	4	24	72	2.2	0.9

In this and following table:
[1] Agreement – categories 'Totally agree' and 'Agree' were merged;
[2]Neutral – category 'Neither agree nor disagree';
[3]Disagreement – categories 'Totally disagree' and 'Disagree' were merged.
Source: Own calculation from Field survey.

Table 9. Motives for installing biogas system on farms

Motives	Results, %			Mean	SD
	Agreement[1]	Neutral[2]	Disagreement[3]		
Possibility to produce the own energy (electricity and heat)	72	24	4	3.8	0.9
Complaints by local residents about animal manure management (odour reduction)	72	20	8	4.0	0.9
Higher tariffs for produced energy	68	24	8	3.9	1.0
Increased support for investment	64	20	16	3.6	1.1
Possibility to get electricity quota	53	35	12	3.5	1.2
Detailed information regarding the construction of a biogas plant and the possibilities of consulting farmers who have already adopted biogas technology	52	44	4	3.8	0.9

Source: Own calculation from Field survey.

Other motives such as, 'Higher tariffs for produced energy' and 'Increased support for investment' also received strong endorsement, with mean scores ranging from 3.6 to 4.0, and agreement percentages ranging from 64% to 72% (Table 9).

These results supported some previous studies conducted in other countries suggesting that, as regards installing biogas system on farms, the major obstacles were associated with financial issues [3; 21], whereas the main motive was related to the production of own energy [22].

In order to promote the development of biogas production from animal manure in Lithuania, significant efforts should be made to strengthen the incentives and weaken the barriers. Particular attention must be given to raising awareness of the benefits of biogas production from animal manure among potential biogas plant operators and setting out long-term and stable support policies for biogas.

CONCLUSIONS

In order to evaluate development opportunities for biogas production from animal manure in Lithuania, in this study, the total amount of animal manure generated in the country over the past year was estimated and the views and opinions on biogas production from animal manure of Lithuanian large-scale farmers and representatives of agricultural holdings were investigated by conducting a survey.

The total amount of animal manure in Lithuania was estimated to be 11.4 million tonnes in 2017. The counties that generated the most animal manure were Šiauliai, Kaunas and Tauragė. The highest numbers of large-scale livestock farms were mainly located in the northern and central parts of Lithuania (Šiauliai, Panevėžys, and Kaunas counties) and these parts were identified as the potential areas where biogas plants could be built.

Of all large-scale livestock farms, only 10 pig farms had adopted biogas technology. Although cattle manure accounted for the majority of the total amount of animal manure in Lithuania, no any biogas project had been developed on large-scale cattle farms. In that regard, particular efforts should be made in order to encourage large-scale livestock farms to invest in biogas plants.

The results of the survey revealed that the level of awareness of biogas technology and economy, and support schemes for biogas among the potential biogas plant operators was low. The possibility to produce the own energy (electricity and heat) and complaints by local residents about animal manure management (odour reduction) were identified as the main motives for installing biogas system on farms. The belief that investment is needed to solve some other problems on farms was found as the major obstacle for installing biogas system on farms.

The results of this study are important for Lithuanian farmers and agricultural holdings in raising awareness of the benefits of biogas production from animal manure and stimulating interest in adopting biogas technology on farms.

Also, the results of this study provide useful information for policy makers in establishing the policy framework and introducing support schemes that would promote the development of biogas production from animal manure in Lithuania.

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GROSS AND NET PROFIT OF DAIRY CATTLE FARMS - A CASE STUDY IN EASTERN ANATOLIA REGION OF TURKEY

Faik GENÇDAL[1], İbrahim YILDIRIM[2]

[1] Directorate Food, Agriculture and Livestock, Diyarbakır, Turkey
[2] University of Van Yuzuncu Yil, Faculty of Agriculture, Department of Agricultural Economics, 65080, Van Turkey, Phone;+90432 225 1701 Email: veyselibrahimab@gmail.com

Corresponding author: veyselibrahimab@gmail.com

Abstract

The major aim of this study was to compare the gross and net profit of culture, cross and native-breed dairy cattle farms in Gevaş district of Van Province, Turkey. The required data belonged to 2009 production period and was collected from 44 farms by means of questionnaires interviewing the managers directly. Stratified random sampling method was used in determining the sample size. The number of cows per farm, daily milk yield per cow and lactation period were 3.15 head, 11.54 kg and 210 days for culture-breed farms; 4.0 head, 6.43 kg, and 210 days for cross-breed farms and 3.06 head, 4.21 kg and 215 days for native-breed farms, respectively. Daily feed intake per cow was 13.47 (9.88 kg roughage and 3.59 kg concentrated feeds) for culture-breed farms, 11.00 kg (9.66 kg roughage and 1.134 concentrated feeds) for cross-breed farms and 11.19 kg (9.29 kg roughage and 1.9 concentrated feeds), for native-breed farms, respectively. Feed costs consisted of 90.34, 89.11 and 84.59 % of total variable costs for culture, cross and native-breed farms, respectively. The cost of one kg milk was $0.49, $0.76 and $ 1.11 for culture, cross and native-breed farms, respectively. Gross profit per farm and per cow were $2,665 and $846 for culture-breed farms, $1,220 and $305 for cross-breed farms; $55 and $17.8 for native-breed farms, respectively. Economical profitability rate of culture-breed farms in terms of gross profit were nearly two times higher with 19.27% compared to that of 10.01 % for cross-breed farms. The economical profitability rate for native-breed farms was only at 0.53% levels. Production elasticity of inputs (Σbi) was 1.66, which means increasing return to scale. In case of duplicating the inputs used, milk quantity is expected to increase by 1.66 times.

***Key words**: dairy cattle farms, Gross Profit, Turkey*

INTRODUCTION

Dairy cattle farms need sufficient and continuous profit to sustain their activities. In order to meet the milk need of people in Turkey where a rapid population increase is experienced, the annual milk supply should be in accordance with yearly demand [37; 36].
Many research findings revealed that gross profit of dairy cattle farms is effected by a lot of factors, namely, cow breed, lactation period and length of cow productive life [30; 14], feed costs and the efficiency of inputs used [8; 32; 13; 19], milk output per cow [17; 14]; the sale prices of milk and the prices of inputs used [30; 21; 2; 35; 3], farm size [11; 20], support given by public institutions [29; 18; 22; 13], management [30], and organization of cooperation [31; 23; 1; 15].
Taking into consideration 1996-2017 periods, milk production obtained from dairy cattle rose from 9.4 million to 18.8 million tons in Turkey [33]. This means that yearly average annual increase was 496.6 thousand tons. On the other hand, milk output per cow during a lactation period at the same period rose from 1,586 kg to 3,143 kg. This indicates 98% yearly increase representing 89.2 kg yearly addition to milk production [33].
The main hypothesis of this study was that the culture-breed farms would have higher profitability rates given higher gross profit per cow stemming from relatively higher milk yield per cow and calf incomes, which means higher gross production value.

MATERIALS AND METHODS

The research material of this study constituted 254 dairy cattle producers located at Gemini, Yemişlik, Dilmetaş and Kayalar villages in Gevaş town of Van Province, Turkey. The data, which belong to 2009 production period, was collected through a questionnaire interviewing the managers directly. Optimum sample size was determined as 44 farms using the following stratified random sampling method with 10% error amount permitted from the average and 90% reliability range [6].

$$n = \frac{N.\Sigma N_h.S_h^2}{N^2.D^2 + \Sigma N_h.S_h^2}$$

where:
n= Sampling size
N= Total dairy cattle farms
N_h= Farms available in h th strata
S2h=the variance at h th strata
$D^2=d^2/Z^2$ value
d= Error amount permitted from the population average
Z= Z value in standard normal distribution according to error amount

Taking into consideration the relative distribution of cattle numbers, the farms were classified into three groups. Accordingly, 13, 14 and 17 farms constituted the culture, cross and native-breed farms, respectively.

The data were controlled for extreme values using outlier tests before the analysis were made. In comparison of means of some physical variables of culture, cross and native breed farms, variance analysis was used. The functional relationship of milk quantity per farm and the major inputs used was determined by means of Cobb-Douglas Production Function, which shows the production elasticities of inputs directly.

RESULTS AND DISCUSSIONS

General Demographic Information on Farms: The average population per farm was 8.59 person. The managers' age, experience and education years were 45.32, 18.8, and 4.11 years, respectively. The average family labour potential was 1,449 man-days, however, nearly two-third of this potential (69.58%) was not used.

Cow Number, Lactation Period and Milk Yields: The average cow numbers for culture, cross and native-breed farms were 3.15, 4.0 and 3.06 head, respectively. Daily milk yield per cow was 11.54, 6.43 and 4.21 kg, for culture, cross and native-breed farms, respectively (Table 1). It seems that daily milk yield per cow of culture-breed farms is 1.79 and 2.74 times more than that of cross-breed and native-breed farms, respectively. The period of lactation for culture-breed and cross-breed farms were 210 days, while this period was slightly longer with 215 days for native-breed farms (Table 1). The average milk yield per cow per lactation were 2,423 kg, 1,350 kg and 905 kg for culture, cross and native breed farms, respectively (Table 1). This amounts to 1.79 and 2.67 times higher milk production per cow during a lactation period for culture-breed farms in comparison to that of cross-breed and native-breed farms, respectively. The result stems from a higher milk yield per cow of culture-breed farms. Milk production per farm was 7,633 kg, 5,400 kg, and 2,769 kg for culture-breed, cross-breed and native-breed farms, respectively (Table 1). Milk production per farm was nearly 1.41 and 2.75 times higher for culture-breed farms when compared to that of culture-breed and native-breed farms, respectively.

The farm types (culture, cross and native-breed farms) didn't differ statistically in terms of cow numbers (p=0.245) and lactation period (p=0.535). However, they differed in terms of average means of daily milk per farm (p=0.000), daily milk per cow per lactation (p=0.000) and daily milk per cow (p=0.000).

Milk yield per cow in different parts of Turkey was reported as 7.63, 7.9, 15.1, 18.73 27.45 kg in Van Province [36], in Kırklareli Province [37], in Hatay Province [29], and in Konya Province [23], respectively. The reported milk production per cow per lactation period in Thrace region of Turkey was 5.8 tonnes [16].

[14;17;26;25], revealed that milk yield per lactation and economic efficiency per cow were two main profitability factors for dairy cattle farms in South-Hungary, Czech Republic, Romania and Romania, respectively.

[18] reported that there existed positive relationship between herd size and milk yield per cow and total efficiency in Czech Republic. On the other hand, inverse

relationship were reported between milk yield and herd sizes in Haryana State region of India [19].

Labor Demand. The daily labour demand per cow ranged between 1.35 for culture-breed cattle farms and 1.0 hours for cross-breed farms (Table 1). In terms of daily labour demand per cow, the farm types didn't differ statistically (p=0.252).

Feed Intake and its Compositions. The main roughages were straw, dry weed (clover) and silage while major concentrated feeds constituted milk meal, bran, wheat and barley break. Feed intake per cow ranged from 13.47 to 9.62 kg being the highest with 13.47 kg for culture-breed and the lowest with 9.62 kg for native-breed farms (Table 1). The share of roughage in the total feed intake for culture cross and native-breed farms were 73.34, 87.81 and 87.73%, respectively. Concentrated feed per cow was more than twice for culture-breed farms (3.59 kg) compared to that of cross-breed farms (1.34 kg) and native-breed farms (1.18 kg). In terms of average means of daily forage feed intake per cow (p=0.020) and daily concentrated feed intake per cow (p=0.000), the farm types differed statistically.

[4; 13; 30] cited feed quantity given daily per cow, efficiency of feeds and its management as the major factors effective on the profit.

The Composition of the Assets. Operating assets made up 62.77% of total assets ($ 11,971) while remaining was building assets (37.23%). The greater part of operating capital was animal capital ($5,597). This figure was the highest for culture-breed farms with $7,428 and the lowest with $3,109 for native-breed farms. Animal capital made up 79.49 and 46.76% of operating and total assets, respectively. The animal assets rate in the total assets was the lowest with 29.97% for native-breed and the highest with 56.78% for the cross-breed farms. Out of total assets 98.73% consisted of self-capital (equity) for culture-breed farms while all the capital belonged to farm managers in native-breed farms, which means they didn't perform with debt.

Table 1. Some Physical Aggregates Related to Output and Inputs

	Culture-Breed	Cross-Breed	Native-Breed	Total
Cow Number (Head)	3.15	4.00	3.06	3.39
Daily Milk Yield Per Cow (kg)**	11.54	6.43	4.21	7.08
Period of Lactation (Day)	210	210	215	212
Milk Production Per Cow Per Lactation (kg)**	2,423	1,350	905	1,501
Milk Yield per Farm (Kg) ***	7,633	5,400	2,769	5,088
Daily labour demand per cow (h)	1.35	1.00	1.02	1.10
Daily feed intake per cow (kg)*	13.47	11.00	9.62	11.19
Forage feed intake per Cow (kg)**	9.88	9.66	8.44	9.29
Concentrates feed intake per Cow (kg)	3.59	1.34	1.18	1.9

Source: Calculated by authors from preliminary data collected from producers
*** P<0, 01   * P<0, 05*

Gross Production Value. Gross production value was $5,815, $4,473 and $2,080 for culture, cross and native-breed farms, respectively. More than half of gross production value consisted of milk production values with 66.07, 60.78 and 67.11% followed by calf selling values with 31.07, 36.44 and 29.70% for culture, cross and native-breed farms, respectively

Production Costs Production costs per farm and per cow were $5,712 and $1,813 for culture-breed farms; $5,957 and $1.489 for cross-breed farms and $3,953 and $1,292 for native-breed farms, respectively (Table 2). Feed costs made up 49.83, 48, 64 and 43.32% of production costs for culture, cross and native-breed farms, respectively. Feed costs amounted to 90.36, 89.20 and 84.54% of variable costs for culture-breed, cross-breed and native-breed farms, respectively. The costs of one kg of milk was $0.49 for culture-breed farms, which shows it is nearly ¼ less than that of cross-breed ($0.76) and amounts to only 44.45% that of native-breed farms ($ 1.11) (Table 2).

The reported feed costs in total production costs for different parts of Turkey were 52.99 % in Van province [36]; 47.31 % in Ankara province [28]; and 42.17% in Kırklareli province [37]. The feed cost constituted 84.33 and 86% of the variable costs in Konya

Province [23] and Thrace regions of Turkey [16], respectively.

[5; 7; 12; 19] Reported the feed costs in total production costs as 55.4%, 53%, 73% and 68% in Tunisia, in the regions of Minnesota, Wisconsin, Iowa, and South Dakota of U.S, in Pennsylvania counties of U.S, and in the regions of Karnal, India, respectively [10; 24], drew attention to feed costs effects on the profit in Semarang regency, India and Tamil Nadu, India, respectively.

Gross Profit, Net Profit and Profitability Rates: Gross profit per farm and per cow were $2,665 and $846 for culture-breed farms, $1,220 and $305 for cross-breed farms; $55 and $17.8 for native-breed farms, respectively (Table 2). Economical profitability rate of culture-breed farms in terms of gross profit were nearly two times higher with 19.27% compared to that of 10.01% for cross-breed farms. The economical profitability rate for native-breed farms was only at 0.53% levels.

Net profit per farm and cow was negative for cross-breed with $-372 and $-612 and $-1873 and $-612 for native-breed farms, while these figures were positive with $103 and $33 for culture-breed farms, respectively.

The reported profitability rates in different parts of Turkey were 3. 27% in Van Province [36], 6.3% in Kırklareli Province [37] 2.04% in Konya Province, [23], and 7.62% in Hatay Province [29].

[17] Reported that milk yield per cow had positive effect on the profitability of dairy cattle farms in 12 regions in the Czech Republic. Milk yield per lactation and the length of cow productive life were also reported as the major factors which increase the profitability in Michigan, U.S dairy cattle farms [14]

[36] indicated that the farm size was a major factor for the profitability of dairy cattle farms in Van Province, Turkey being negative with -1.93 % for small-scale farms (farms with 1-5 dairy cattle) and positive with 5.92% for large-scale farms (farms with more than 10 dairy cattle). The reported differences between economical profitability of small-scale farms with < 10 tonnes milk production (-7.2 %) and large-scale farms with >40 tonnes milk production (24.7%) were dramatic in Kırklareli Province, Turkey [37]. More research conducted on dairy cattle farms demonstrated that the farm size was a major component contributing to profitability positively [11; 20; 18; 35; 9; 27]. However, [8] reported that the smaller dairy cattle farms achieved more net profit compared to larger ones in Haryana State and Hisar and Karnal, regions of India. [21]Suggested that effective cost management and improved livestock breeds would improve the dairy farms' profit in Sargodha, Pakistan. [26] Cited the major factors effective on the profit as cost of inputs, milk output and milk market prices in Southern Romania. Researches made on Michigan and Wisconsin dairy farmers indicated that volatility in milk and feed prices had potentials to affect dairy farm profitability [34, 35].

Table 2. Production Costs and Profits per Farm and per Cow

	Culture-Breed	Cross-Breed	Native-Breed	Total
Gross Production Value per Farm ($)	5,815	4,473	2,080	3,967
Production Costs per Farm ($)	5,712	5,957	3,953	5,143
Production Costs per Cow ($)	1,813	1,489	1,292	1,517
Variable Costs per Farm($)	3,150	3,253	2,025	2,749
Fixed Costs per Farm ($)	2,562	2,707	1,928	2,394
Feed Costs per Farm ($)	2,846	2,899	1,713	2,425
Feed Costs per Cow ($)	903	725	560	715
Costs of 1 Kg Milk ($)	0.49	0.76	1.11	0.72
Gross Profit per Farm ($)	2,665	1,220	55	1,218
Gross Profit per Cow ($)	846	305	17.8	360
Net Profit per Farm ($)	103	-1,484	-1,873	-1,176
Net Profit per Cow ($)	33	-371	-612	-347
Economical Profitability rate in terms of gross profit (%)	19.27	10.01	0.53	10.18

Source: Calculated by authors from preliminary data collected from producers

Cobb-Douglas Production Function. Cobb-Douglas production function was as follows.

$Y= -3.867\ X_1\ -0.153\ X_2\ 0.540\ X_3\ 0.355\ X_4\ 0.529\ X_5\ 0.398\ X_6\ -0.009$

Determination coefficient (R^2) was 0.606, which means 60.60% of variances in milk production quantity is explained by inputs used in the model. The production elasticities of X_1 (number of dairy cattle), X_2 (lactation period), X_3 (concentrated feed intake), were statistically significant at 10% probability level (P<0.01).

Production elasticity of inputs in total (Σbi) was 1.66, which means increasing return to scale. In case of duplicating the inputs used, milk production quantity is expected to increase by 1.66 times. On the other hand, milk production quantity is expected to increase by 54.0, 35.50, 23.70, 52.90 and 39.80 %, respectively in cases of doubling the inputs of X_2 (lactation period), X_3 (concentrated feed intake), X_4 (roughage feed intake), and X_5 (barn capacity) individually; while the other inputs remained unchanged.

CONCLUSIONS

Given nearly two times higher profitability rate of culture-breed farms (19.27%) compared to that of 10.01% for cross-breed farms and that of extreme low level of native-breed farms (0.53%), we suggest culture-breed dairy cattle for milk production. The higher profitability rates of culture-breed farms stems from daily milk yield per cow of culture-breed farms, which is 1.79 and 2.74 times more than that of cross-breed and native-breed farms, respectively. On the other hand, daily feed amount given per cow of culture-breed farms was only 0.22 and 0.40% higher than that of cross-breed and native-breed farms, respectively. These findings show that feed efficiency is higher for culture-breed farms in terms of transformation the feed costs to gross profit.

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SWOT ANALYSIS OF ROMANIA'S APICULTURE

Mircea Adrian GRIGORAS

University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Manastur Str., Cluj-Napoca 400372, Phone:0264 596 384, Email: mircea.grigoras@usamvcluj.ro

Corresponding author: mircea.grigoras@usamvcluj.ro

Abstract

The paper presents SWOT analysis of beekeeping in Romania using various results in scientific research and author's critical opinion on the past, present and future of this important sector of agriculture. The paper is based on the data from the National Institute of Statistics and on the study of many published articles closely connected with the topic. The results emphasized that Romania has a long tradition in apiculture, favourable conditions for Apis mellifera carpatica, for pickings in a large range of wild and cultivated flora, good pastoral areas, technological solutions for bee growing and breeding, a high number of bee families and apiarists, a high quality honey production and a potential for organic honey. Romania is facing with a small apiary size, a low honey yield, a weak beekeepers organization in associations, a various apiarists' training level, a non sufficient number of honey collecting centres and brands, and with fake honey. The existence of Apimondia, Apiculturits' Association in Romania, Research and Development Institute, the legislative framework, the EU and National programes for beekeeping development are a guarantee that apiculture will continue to develop in the future. The low internal consumption and the increased demand in the EU as well as the numerous rural population could encourage the business in the field of beekeeping for increasing export and trade balance, the income and living standard in the rural areas. But, the increased price of apiary inputs, the low acquisition price of honey, the severe competition in the EU market between producers and exporters, honey imports from China at dumping prices, climate change and bees diseases are threats which could affect beekeeping in Romania. For increasing productivity and competitiveness of beekeeping, apiarists should apply for financial aids offered by the EU and Romanian Government to grow the number of bee families over 150, to intensify pickings in pastoral, to increase honey production and its quality, to extend organic honey production, to diversify production and develop more local brands, to export a higher honey amount at a better price in the EU and assure a high efficiency along the honey chain.

Key words*: *apiculture, Romania, strengths, weaknesses, opportunities, threats, analysis

INTRODUCTION

Apiculture is "the science studying bees life, keeping and care in order to obtain and use the apicultural products and to pollinate agricultural crops" [11, 28].

Apiculture supplies honey which is a food of high nutritive and energetic value and also a medicine with an important role in human health. Other bee products (pollen, royal jelly, propolis, wax, venom etc) are successfully used in human disease prophylaxis and treatment. [62, 63].

Beekeeping brings a huge contribution in agriculture assuring pollination of the entomophilous plants increasing crop, fruit, vegetable and grains harvests.

In addition, it contributes to the diversification of activities in the rural space, valorizing the local natural and human resources and offering income alternatives for the local population [3, 12, 17, 24, 30, 50, 72]

Bee colonies have an important role in the maintenance of flora biodiversty and environment protection.

Apiculture has a long tradition in Romania dating more than 2,000 years ago, as proved by historical testimonials [48].

At present, Romania occupies an important place among the honey producers and exporters of the EU, as the number of bee colonies and honey production have continuously increased. [37, 44, 45, 47].

Honey is the most important bee product. This is due to its special composition which consists of carbohydrates (80-85%), water (16-10%), proteins, amino-acids, minerals (Na, Ca, Mg, Cl etc), vitamins (B1, B2, B3, B5, B6, pantothenic acid and C vitamin), organic acids, pigments, enzymes, aromatic substances, antioxidants. For this reason honey is important to provide energy and stimulate biological processes and metabolism in human body. That is why is could be consumed by everyone: child, adolescent, adult or old people. It stimulates the nervous activity and appetite, gives energy, develops the intestinal flora, combats the stress and the lack of minerals, prevents atherosclerosis, treats the respiratory and gastric diseases, and strengthens the immunity system and it has a high digestibility [21].

Honey provides "310 calories per 100 g, and 1 kg of honey is equivalent with 3 liters milk, 30 bananas, 50 eggs or 12 kg of meat. It is a natural product without additives and preservers and its flavor and taste qualities could be preserved for a long time" [28].

Grace to its economic, social and environment importance, beekeeping will countinue to be developed in many countries.

The countries located in the South part of Europe with favorable climate conditions for apiculture like: Romania, Spain, Hungary, Germany, Italy, Greece, France and Poland are the largest honey producers of the EU [9].

Romania will continue to be an important honey producer and exporter, taking into account its performance achieved so far, but it has to strengthen its efforts to face the new challenges and threats in honey international market and climate change.

For this reason, the paper had the purpose to make a SWOT analysis of apiculture in Romania in order to identify the strengths, weaknesses, opportunities and treats in its future development.

MATERIALS AND METHODS

The study was set up using a large number of information sources such as: books, textbooks and published articles and a critical analysis was made in order to identify the key aspects which could offer a comprehensive image of the strengths, weaknesses, opportunities and treats for Romania's beekeeping.

At the beginning it is presented the evolution of the number of bee colonies and honey production in Romania in order to identify the main trends.

Also, the production function Y= bX +c was used to characterize the relationship between honey production (Y), the dependent variable and the number of bee families, X, the independent variable.

In this purpose, the empirical data have been picked up from the National Institute of Statistics for the period 2007-2017 [36].

Then, the SWOT analysis was carried out in order to establish the key internal and external favourable and non favourable factors elements which could affect beekeeping development in Romania.

The results have been graphically exposed and then interpreted and the schema of SWOT analysis was included in the author's opinion box.

RESULTS AND DISCUSSIONS

The number of bee colonies in Romania had a positive evolution in the studied period. It increased from 998 to 1,602 thousands bee colonies, meaning by 60.5 %.(Fig.1.)

This ascending trend was determined by the stimulation of apiculture by the Romanian authorities and by the European Union in order to meet better the market requirements.

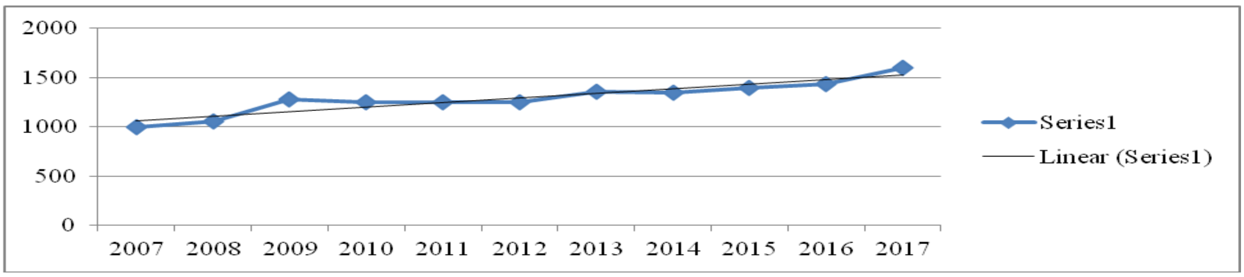

Fig.1.Dynamics of the numbre of bee colonies in Romania in the period 2007-2017 (Thousans)
Source: author's determination based on NIS, 2018 [36]

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Honey Production also achieved a positive dynamics in the year 2017 accounting for 30,177 tons by 79.7 % higher than in 2007. The year 2014 and 2016 have been difficult for beekeeping because of the weather disturbances which diminished honey production (Fig.2.).

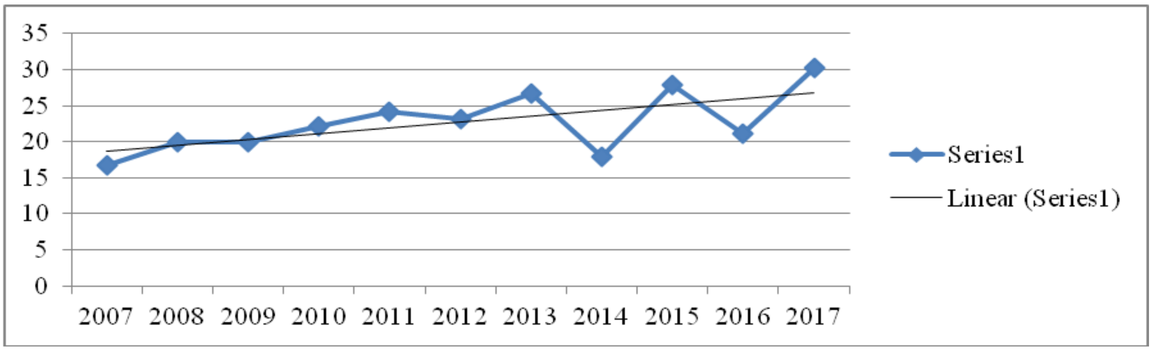

Fig.2. Dynamics of honey production in Romania in the period 2000-2017 (tonnes)
Source: author's determination based on NIS, 2018 [36]

The influence of the number of bee families on honey production. The achieved honey production was deeply influenced by the number of bee families as the correlation between these two indicators was r = 0.705 and the regression function was y = 0.0176x - 0.0687 with a determination coefficient R^2= 0.498, meaning that about 49.8 % of honey production was determined by the number of bee families. Therefore, there are other influence factors such as: climate change, pickings opportunities, the power of the bee family, the apiary management etc (Fig.3).

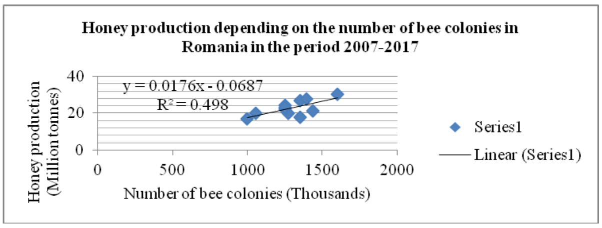

Fig.3. The dependence of honey production on the number of bee families in Romania in the period 2000-2017
Source: author's determination based on NIS, 2018 [36]

Similar results were obtained by [56].
This situation should be analyzed in more details and requires a SWOT Analysis.
SWOT analysis of apiculture. In this study have been identified the strengths, weaknesses, opportunities and threats in the field of beekeeping in Romania, which are presented in the author's opinion box.(Table 1).

(a)Strengths
The favourable geographical position of the country. Romania is situated in the North hemisphere, in South Eastern and Central Europe, in the Carpatho-Danubian-Pontic space, being bordered by the Danube river to the South and the Black Sea to the East. Its relief is like an amphitheater 35 % mountains, 35 % hilly areas and 30 % plains. [61].
The favourable climate for beekeeping. Romania has a temperate continental climate with transition nuances, moderate precipitations ranging between 400-600 mm in the plains and 1,000 mm per year in the mountain areas [61].
The varied entomophilous wild flora. On Romania's territory there are over 3,000 plant species, distributed in various floors by relief zone, in accordance with the features of altitude, climate and soil type. Most of these plants are entomophilous allowing the bee colonies to pick up the nectar and to fulfill their duties to pollinate this flora and contribute to the preservation of the biodiversity.
The large variety of agricultural crops favours beekeeping offering a rich resource of nectar and benefiting of pollination from the bee colonies side.
The areas favourable for nectar pickings in Romania are: "South Plain (acacia, sunflower, lime, meadow flora), Moldovan Plain (lime, sunflower, acacia, grasslands), Western Plain (agricultural crops and acacia), Transylvanian

Plateau (agricultural crops, orchards, meadows), Carpathian Mountains (agricultural crops, orchards, meadows), the Danube Delta (Herbaceous flora with late blooming)" as mentioned by [69].

Table 1. SWOT Analysis of Romania's apiculture

Strengths	Weaknesses
The geographical position and climate of Romania	The small average apiary size
The varied entomophilous wild flora and agricultural crops	The small honey production per bee colony
The long tradition in beekeeping	The small honey production per apiary
The existence of the Apis mellifera carpatica race	The non sufficient organization of the beekeepers in associative forms
The scientific results in the bee breeding and beekeeping technologies	The different training level of the beekeepers
The progress in apiary inputs	The non sufficient centres for honey collection
The existence of areas favourable for pastoral beekeeping	The lack of own Romanian honey brands
The continuous growth of the number of bee colonies and beekeepers	The blending of various honey qualities leading to honey fake
The high quality of honey	
The favourable conditions for producing organic honey	
The reasonable invested capital	
Pleasant work in the apiary for beekeeper	
Beekeeping - a healthy activity for humans	
Opportunities	**Threats**
The existence of Apimondia	The increase of the price for apiary inputs (apicultural pavilion, electricity, diesel etc)
The existence of ACA- Association of Romanian Beekeepers	The low acquisition honey price
The existence of the Research and Development Institute for Apiculture	The fake honey
The Law 383/24 Dec. 2013 for the development of apiculture	The imports of low quality honey
The existence of EU Programme for the development of beekeeping	The lower price of the imported honey compared to the average price in the domestic market
The existence of models of beekeepers associations and honey brands	The increased competition among the honey producers and exporters
Training courses for beekeepers	The climate change
A large variety of apiary inputs and input prices in the market	The bees diseases
The EU and Government financial support for beekeeping	The collapse disorder of the bee colonies
The high honey demand on the EU market and especially of organic honey	The plant protection measures which affect pickings and bee colonies health
The low honey consumption on the domestic market	
The existence of a numerous rural population	
Beekeeping is a healthy activity	
Beekeeping could be a good business	
The need of the sustainable development of the rural areas	

Source: the author's opinion box.

A long tradition in beekeeping. Beekeeping is an old activity on the territory of Romania. The first testimonial of beekeeping on the Romanian territory dates back in the 5th century BCh. and belongs to Herodot, the great Greek historian who mentioned that "the Thracians and Dacians, who were ancestors of the Romanian people, were engaged in raising bees from which they obtained honey, wax and other apicultural products" [71].

Also, other historical sources, archaeological discoveries, folk sources have a great importance in attesting the continuity of beekeeping in the Carpatho-Danubian-Pontic space [5].

The existence of the Apis mellifera carpatica race. Apis mellifera carpatica is a Romanian bee race, well adapted to the climate conditions and the large range of specific meliferous flora (meadows, pastures, acacia, lime, rape, sun flower etc) in Romania. Grace to its features: gentle and quiet behaviour, high production potential (over 50 kg.bee colony), taking good care of the bee brood and of the whole colony to survival over the seasons, the race was homologated in 2009 [20, 29, 65].

More than this, Apis mellifera carpatica assures a quiet replacement of the bee queen, it is slightly prone to fuss and has a moderate mood instinct. For its productivity and good behaviour, this race received medals at various Apimondia International Congresses [8].

The scientific results in the bee breeding and beekeeping technologies. Apis mellifera carpatica has been studied by researchers who established breeding programmes destined to "protect and preserve the local genetic and biological material, to improve production performance and behaviuor, to set up standard methods for evaluation and selection of bee colonies, to develop and implement modern techniques of morphometry and molecular, to optimize the methods and technologies for the growing of bee queens and instrumental insemination, to improve bee colonies feeding based on balanced nutritive supplements (biostimulators), to study the structure of entomophilous flora and its needs for pollination, to set up an integrated programme for pastoral beekeeping and indicate the best areas for pickings. Also, new technologies were established for the maintenance and exploitation of the bee colonies, for the conditioning of honey, for obtaining bee queens and bee families with a good resistance to diseases, for the sustainable management of the apiaries both in conventional and organic apiculture" [15, 16, 39, 40, 41, 60, 64].

The progress in apiary inputs has allowed a large range of equipments and specific tools to improve the beekeepers activity and bee colony productivity (mobile apicultural pavilions, honey extractors etc).

The existence of areas favourable for pastoral beekeeping as an alternative to stationary growing favours pickings and productivity of the bee colonies. Pastoral beekeeping has the advantage that the bee colonies are brought in the middle of nature where the plants are full of nectar. In this way, the bees do not lose their time and are successful in collecting the nectar and filling the honeycombs. Most of good areas for pastoral are known by beekeepers, but it depends on technical endowment to practice this [46].

The continuous growth of the number of bee colonies. The number of bee colonies has continuously increased in Romania due to the interest of beekeepers to have more hives and bee colonies and to increase their honey production, income and profit from this activity. In 2017, there were 1,602,453 and their number will continue to grow [36, 52, 56]

The increasing number of beekeepers. The interest for apiculture as a supplementary income source has attracted many people from the rural areas but also from the cities. In this way, the number of beekeepers increased and in 2017 it was over 46,000 in Romania [36].

The high quality of the Romanian honey is assured by the large opportunities for pickings, by the low quantity of chemicals used in agriculture, by the rigorous control of honey at acquisition and export. Honey quality depends of the flora and area where the pickings were made. According to the legislation in force, honey quality could be recognized by the specific signs: DOP with controlled origin or IGP with geographic protected indication. Honey traceability is checked the by inspection and certification private bodies, accredited by RENAR and recognized by MARD. The specificity of honey could be recognized by pollen analysis which allows the identification of the type of flora where nectar was picked up and the geographical area, also by sensorial analysis of honey and by using physical-chemical methods [59].

Romanian honey is highly appreciated by its quality in the EU market, a reason as more honey amounts to be required for export [49, 57].

The favourable conditions for producing organic honey. Organic honey could be successfully produced in Romania, where the amount of fertilizers and pesticides is the lowest in the EU. It is a niche for the Romanian beekeepers for obtaining a high quality honey for export in order to get a higher price than on the internal market. Of about 20,000 tones honey annual production, approximately 4,000 tons are exported, meaning about 20 %. This honey is certified.

In 2011, there were 912 beekeepers in conversion and ecologically certified, owning 97,997 bee colonies [4, 66].

In the North West Region of Romania, it was found that organic apiculture is not attractive yet compared to conventional beekeeping due to the high production cost, high risks and difficulties in production sale, and expensive inspections [38].

The reasonable invested capital in beekeeping is a reason to attract more and more investors.

A young beekeeper could start with Lei 600 to buy a complete wood hive (painted, frames, podium, feeder, etc.) for about Lei 200-250 and the bee colony for about Lei 400-500. But an apiary requires at least 50-100 bee families to be profitable. Therefore Lei 600 should be multiplied by the number of bee families needed to get some profit!

Not to forget that there are some additional expenses destined to buy: the beekeeper's protection suit (Lei 150), leather gloves (Lei 25), a smoker (Lei 60), a pollen collector (Lei 30), a honey centrifuge (Lei 1,200), a 300 liter bottle (stainless steel) to store honey (Lei 900), a honey matrix of 100 liters capacity (Lei 500) and for pastoral transport a bee hives trailer (Lei 4,000), all these summing about Lei 6,865, without taking into account the expenses with the hives and bee families.

To get about Lei 2,000/month income, a beekeeper must own about 70 hives for having a decent living standard with his family. All these figures are in 2015 prices [26].

Beekeeping - a healthy and pleasant activity as long as the beekeeper enters everyday in the apiary, check the hives and bee families, and run many other activities in clean air, in the middle of nature.

(b)Weaknesses

The small average apiary size and honey yield. In Romania, apiaries are small due to the reduced number of bee families as most of beekeepers have not the necessary financial capital to set up and develop a big bee farm or are part time beekeepers and in this case their time is limited to develop beekeeping at a larger scale. In general, Romanian apiaries are semi-subsistence farms whose size varies between 50 and 100 bee families.

In the year 2004, the apiary size in Romania was below 50 bee families. That time, it was considered that an apiary of about 50 bee families should also improve its performance in honey production by increasing the number of bee families [42, 43].

In 2009, in a field survey run in 21 counties, it was found an average apiary size of 24,6 bees families. Over 80 % of the apiaries had below 50 bees families. Honey yield was 24.9 kg/bee family in the case of the farms having 0 – 50 families. In case of the apiaries with the size 50-100, the yield was 31.1 kg/bee family and in case of the apiaries with over 100 bee families, average production accounted for 39 kg/bee family [12, 70].

In 2011, in a sample of 37 apiaries situated in Ialomitza County, it was found that "more than a half of apiaries have between 50 and 100 bee families with in average 65.24 bee families/apiary. Regarding honey yield, about 40.54 % apiaries obtained 11-20 kg/bee family and just 5.4% apiaries registered 50-60 kg/bee family" [51].

In 2011, in a sample of 16 beekeepers from Teleorman county, it was found that "42.62% beekeepers had between 81-90 bee families/apiary and 14.10 % had between 51-60 bee families/apiary. About 37 % of the apiaries achieved 21-25 kg honey per bee family, 31.25 % carried out 16-20 kg/apiary and 12.5 % recorded 26-30 kg honey per bee family and 18.75 % apiaries produced over 30 kg honey per bee family" [53].

In 2011, in a sample of 20 beekeepers in Calarasi County, "the average apiary size was 72.3 bee families and the average honey yield was 16.71 kg. About 65 % of honey was achieved by the apiaries whose size belonged to 50-100 bee families category and 16.59 % in the largest ones with over 100 bee families" [54].

In South Muntenia region, in a sample of 140 apiarists, it was found that "in the apiaries with over 100 bee families the apiary size was in average 119.72 bee families, in the apiaries with 50-100 bee families, the apiary size was 79.11 bee families and in the apiaries with less than 50 bee families the average apiary size was 40 bee families. A high correlation coefficient was found between apiary size and honey production" [55].

Another study found a similar status of enterprise, enterprise age, profitability, owners' socio-demographic features and apiary size in Romania and France [58].

The non sufficient organization of the beekeepers in associative forms. Except the Association of Romania Beekeepers which operates at the country level, at the county level there are just a few associative forms and the number of beekeepers does not include all of them.

In Romania there are 30 apicultural associations and federations of which by county: Buzau 5, Constanta 4, Mures 3, Prahova 2, Valcea 2, Mehedinti 2, Alba 1, Arad 1, Bihor 1, Caras-Severin 1, Dolj 1, Gorj 1, Iasi 1, Maramures 1, Satu Mare 1, Timis 1 and Vaslui 1 [31].

The different training level of the beekeepers. Even thou the number of beekeepers is continuously increasing, the structure of apiculturists by training level reflects that just about 40 % of their number are experienced beekeepers. All the others either are part time for getting an supplementary income or dilettantes practicing beekeeping as a hobby. To increase apiary size and honey production it requires as more apiculturists to be "certified" as practitioners.

The non sufficient centres for honey collection. In Romania, honey is collected by 20 acquires and 15 commercial societies as mentioned by Ministry of Agriculture. Their number is not enough and more than this the acquisition price is below beekeepers expectations not always covering their production cost [18].

The lack of own Romanian honey brands. Brand creation and certification in Romania is still at its beginning. In order to penetrate in the external market, more honey brands should be created in order to protect it of fake honey.

The blending of various honey qualities leading to honey fake. In order to increase their income, a few beekeepers produce fake honey, using industrial glucose, obtained from maize starch or potatoes, or to add in natural honey maize syrup, gelatine, egg white and methanol obtained from sugar beet or fruit. Also, a few beekeepers nourish their bee families with inverted sugar, glucose and maize syrup [2].

In the EU, despite that there are quality standards for honey, 20% of the samples collected at the frontiers of the EU and at the importers' seats do not respect these standards, including sugar syrup in honey. For eliminating this aspect in honey market, the EU has established new measures to improve testing procedures and to intensify inspections at import. Traceability of honey products must be identified writing on the label the origin of the product and the fake honey producers to be severely sanctioned [10, 68].

(c)Opportunities

The existence of Apimondia or International Federation of Apiculturists Associations is a proof that Romania has a long tradition in beekeeping. One of its presidents was Prof. Dr. Veceslav Harnaj who extended the relationships between apiculturists and associations at international level [7].

The existence of ACA - Association of Romanian Beekeepers created in 1958 as a professional body which is destined to sustain the interests of its members at the level of various institutions in the country [1].

The existence of the Research and Development Institute for Apiculture which is dealing with the development of the scientific research in Romania for helping the beekeeping sector with solutions destined to increase honey production and its quality, to develop the obtaining and use of bee products as natural sources destined to supplement human diet and as a therapeutic mean in various diseases. It has its own brands for a large range of products (nutritive supplements for human use, apicultural biologic material, bio stimulators, medicines, apicultural tools, textbooks, brochures etc.

The ICDA has its own shops to sell apicultural products, also organizes meetings with the apiarists, the national Honey Fair, and provide books, practical guides etc to the beneficiaries [27].

The legislative framework which regulates the development of apiculture in Romania is The Law 383/24 Dec. 2013.

The existence of EU Programme for the development of beekeeping. Beekeeping is an import sector of the EU agriculture. Honey production is more and more required on the EU market to satisfy better consumer and industry requirements and also on other external markets. For this reason, taking into account the diversity of production conditions, beekeeping practices and yields, The EU Commission has set up a *Programme for the development of beekeeping for the period 2017-2019*. By means of this Programme, the national apicultural programmes are enhanced to improve the general conditions of honey and other products production and marketing in the EU [34].

The existence of models of beekeepers associations and of models of Romanian honey brands is an incentive to create new associative forms and brands and to strengthen beekeeping along the product chain.

The training courses delivered to apiculturists have a positive impact on their knowledge and skills and help them to be good managers of apiaries and marketers of their products. They are mainly organized by National Apiculturists Association By means of ICDA-National Institute for Research and Development in Apiculture SA and its authorized branches in the territory. The qualification courses in the profession of "Apiculturist" are accredited by National Authority for Qualification [19].

A large variety of inputs and input prices for apiaries are provided by National Institute for Research and Development in Apiculture SA by means of the Honey Fairs organized annually at its seat and at the level of ACA's branches in the territories.

The EU and Government financial support for beekeeping is offered to apiculturists by means of The National Programme for Apiculture 2017-2019. The financial aid is provided 50 % from the EU and 50 % from the Government for buying: medicines to treat varrooa and nosema diseases, pollen and propolis collectors, pollen dryer, honey heater, bee queens, bee families, boxes to replace the used boxes in pastoral, for purchasing honey centrifugal extractor, wax smelter etc. The beneficiaries could be apiarists and individual or family enterprises, and also cooperatives [35].

The increased honey demand on the EU market is an incentive for all the apiculturists from the EU, including from Romania to produce more honey and of higher quality. With 268,000 tons of honey in 2015, the EU is the 2nd honey producer in the world. However, the EU market is not self-sufficient, which is a reason to import. The extra-EU imports accounted for 194,375 tons in 2015, 75,142 tons coming from China (38.6 %) [25].

The low honey consumption on the domestic market is another incentive to develop honey exports of Romania and in this way to bring foreign currency in the country. The average honey consumption is about 0.5 kg honey/inhabitant/year, because of honey price which is higher in comparison with the price of the refined sugar. In other countries, honey consumption is 1.62 kg /capita in Greece, 1.19 kg/capita in Austria, 1.17 kg/capita in Slovenia and 0.63 kg/capita in Greece [50].

The existence of a numerous rural population could be an advantage to develop business in apiculture and get additional income. In Romania, about 44 % of the population lives in the rural space compared to 25% the EU average [32].

Beekeeping could be a good and healthy business. Romania is an important honey producer of the EU coming on the 4th position. About 50-60 % of honey production is exported mainly in Germany, Italy, France, Poland, Austria, Spain, United Kingdom and Israel. Romanian honey is of high quality, but being exported in bulk, wholesale price is lower than the production costs. For a beginner, the European and Government funds could be accessed based on eligible projects. The financial aid for the period 2017-2019 for apiculture is Lei Thousand 97,626, of which 50 % from the EU and 50 % from the Government. The funds are equally distributed in each year 2017, 2018 and 2019 [6].

The need of the sustainable development of the rural areas

Sustainable rural development aims to improve life quality by improvement and innovation focused on the resources, environment and social equity among generations. The villages and communes should be developed from an economic point of view, preserving the local culture and traditions, social relationships and the beauty of the localities. Within bioeconomy, apiculture could be a chance for the inhabitants of the rural areas giving them an opportunity to earn an additional income from a business with honey and other products and to increase their living standard. As mentioned above, this is stimulated by the Programme for supporting apiculture and financially sustained by the EU and Romanian Government. The projects in apiculture could encourage the local initiative and valorise the resources of the rural space [13, 23].

(d)Threats

The increase of the price for apiary inputs is a challenge and also a threat for apiculturists, whose income depends on honey production and quality, and, more than this, on the climate conditions with a deep impact on pickings. An apiarist should assure corresponding inputs at the level of requirements to develop a good deal. The most expensive inputs are: apicultural pavilion, honey extractor, electricity, diesel etc

The low acquisition price offered by wholesalers and processors both on the internal and external market is also a threat, because the apiarist work along the year should be reimbursed. If the production costs are not covered by income, or if the income is equal to production expenses, the apiarist has nothing to earn.

The fake honey in the internal and external market disadvantages the serious apiculturists who provide honey of high quality. The EU measures to protect honey quality and apiarists' income and profit are welcome.

The imports of low quality honey at "dumping prices" like the one from China is not in the benefit of the local honey producers, as in supermarkets these products are sold at lower prices than the high quality honey. Under the condition that domestic consumption is very low, the question arising is: "Why to import honey?"

The increased competition among the honey producers and exporters. Romania is in a continuous competition with other important honey producers in the EU like Spain, Hungary, Germany, Greece, France, Poland, Austria and also with Ukraine. For this reason, it is important to increase the number of bee families, honey production and quality to preserve the actual beneficiaries and extend its market at international level.

The climate change is another threat because during the last decade Romania's apiculture was facing with extreme phenomena: either with huge rains in the period of trees blooming and pickings for bee families or droughts during summer season affecting the wild flora and agricultural crops. In 2007, 2012, 2014, 2016, bee families, honey production and apiarists' income were deeply affected due to climate change. As agricultural crops, orchards and meadows will continue to be affected by climate change in the future, important measures and actions are required to adapt to this situation [67].

The bees diseases. Bee families health is very important for its development and honey production. For this reason, they should be known, prevented and treated. They could be caused by bacteria, viruses, fungi, parasites, and also by physiological disturbances**,** anomalies and intoxications.

Prevention is more important than treatments, but if it is the case, treatments should be applied immediately in accordance with the pathogenic agents [22].

The use of insecticides and other chemicals in agriculture affects pickings, honey production and bee colonies health. The use of intensive agriculture based on pesticides, insecticides and neonicotonoides, on communication means based on waves, medicines could determine real disasters regarding bee colonies, more exactly what is named: *"Colony Collapse Disorder*", which means practically the disappearance of bees. For this reason, the 45th Apimondia Congress run under the slogan: "***No Bees, No Life!"***, meaning that if bees will die, life will disappear as vegetables and fruit are the result of pollination. For this reason, it is important to preserve the genetic fund of the Romanian bee and avoid the intensive use of chemicals in agriculture [14, 33].

CONCLUSIONS

Apiculture in Romania has good conditions to continue its development taking into account the good race Apis mellifera carpatica well adapted to the variety of flora and pickings in stationary and pastoral, efficient solutions and modern technologies for bee raising and breeding.

The high number of beekeepers and bee families is a guarantee to increase production in the future under the conditions to improve apiary size over 150 bee families.

Also, beekeepers should be aware of the advantages of being members in an association which could protect their interests and help them with advice to increase efficiency along honey market chain.

The development of beekeeping depends on the measure in which the funding coming from the EU and Romanian Government would be efficiently used to grow production and export so that Romania to maintain its position among the top producers and exporters of honey of the EU.

Imports of honey should be reduced or eliminated, as well as fake honey should be identified and the producers and traders punished according to the legislation in force.

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PERSPECTIVES AND BARRIERS IN THE IMPLEMENTATION OF INNOVATIONS IN BULGARIAN AGRICULTURE

Hristina HARIZANOVA-BARTOS, Anie DIMITROVA

University of National and World Economy, 8th December Street, 1700, Sofia, Bulgaria, tel.+35928195529, E-mails: h.harizanova@gmail.com, a.dimitrova@unwe.bg

Corresponding author: *h.harizanova@gmail.com*

Abstract

The implementation of innovation is of great significance for the scientific and technological progress in the agrarian sector. The paper examines the possible prospects for introducing innovations in the agrarian sector of Bulgaria as well as the factors limiting the spread of new practices and innovations in the Bulgarian agriculture. The tasks to achieve the goal are 1) Different perspectives of authors working on the topic have been explored 2) Basic models for introducing innovations have been developed. 3) The attitudes towards the introduction of innovations in the sector are summarized. The collected and analyzed information is based on a project survey NID NI-16/2018(Integrated approach to risk management in the agrarian sector).

Key words*: *innovation, agro innovation, innovative models,

INTRODUCTION

Innovation can be found in all areas of science, technology and the economy, it is a catalyst for competitiveness and growth of business. Agriculture is part of the modern economy and needs updating and modernization as well, and this can be achieved best through the implementation of innovative practices and solutions in the sector. Bulgarian agriculture itself, as part of the world, must also accept innovation in order to make progress. The lack of sufficient quality innovations in Bulgaria's agrarian sector would lead to reduced competitiveness compared to the other countries, which in turn would aggravate trade relations and foreign policy as well as the image of the whole country in front of the world [4]. Innovations are needed for adaptation to the changing external environment and reduction of uncertainty at all levels: international, national, regional, economy [5], [10], [7]. Implementing innovations in the economy is a good strategy for the survival on the national and especially the international market. Greater sustainability, higher production quality and minimization of unnecessary production costs can be achieved through innovative methods for growing different types of crops and animal breeds. New machines and technologies help the precision and speed of production processes and facilitate the farmers. Thus, agricultural productivity enhances competitiveness and creates preconditions for expanding the market share. Every farmer strives simultaneously with increasing the yield and quality of his crop, to reduce and/or limit his/her costs. The goal of science and technology, on the other hand, is to increase efficiency and improve production processes while respecting environmental protection, the effect of their efforts is to create or improve a method, technology, machine, i.e. innovation. Examples of innovations that have increased the competitiveness of the farm are many, as innovations themselves can be extremely different: chemical; biotechnological; informational; biological; technological; new marketing solutions; new robotic manufacturing processes, etc. As bio-agriculture has emerged as a separate niche in the agrarian sector, innovations have also become significant and necessary in modern agriculture.

Innovations have two dimensions: 1) the degree of innovation (i.e. whether the innovation is new to the company, new to the market, new to the industry or new to the world); 2) the type of innovation (i.e. whether it is a process or innovation of product service systems)[9]. In business and in the economy, innovations can become a catalyst for growth. With rapid improvements in transport and communications over the past few decades, old world concepts of factors and comparative advantages focused on the unique investments in the region have become obsolete in today's global economy. The economist Joseph Schumpeter, who contributed significantly to studying the economy of innovations, back in 1943 argued that the industries must continually revolutionize the economic structure from within, i.e. innovations with better or more efficient processes and products, as well as market distribution as the link from the craft store to the factory [9]. The main author's views are outlined in Table 1.

Table 2 Literary review of the main theoretical framework of innovation.

Authors	**Author's views**
[8]	-Innovations in agriculture make it easier to produce more food without increasing the pressure on the environment. - They explore the implications of different combinations of technologies, institutional arrangements and agricultural and environmental policies. - They make a bridge between the world resource management discussion and the real situation of farmers in developing countries. -4 strategic goals: ensuring adequate food production, alleviating poverty, achieving better health and nutrition for the growing population and preserving natural resources. - Opportunities to apply policies and technologies that allow more crops to be produced in smaller areas, with more efficient inputs and under conditions of global change - The need to respect the principles of sustainability through innovations in order to link science and the interaction between farmers and communities is a major discovery.
[3]	-Threshold, diffusion models and the impact of risk, uncertainty and dynamics and the factors for adopting innovations. - They describe the impact of institutions and state interference in adopting innovations. -They define innovation as new methods, customs or devices that perform new tasks. -They differentiate between several categories of policy innovation or modeling. - They give an example with the difference between innovations embodied in capital goods or products (such as tractors, fertilizers and seeds) and those that are invertebrates (i.e. integrated pest management schemes), which is useful for directing public investment towards creating innovations. - Private farms are less likely to invest in generating unsecured innovations because of the difficulty in selling the finished product, so it is an area for public action. - The innovation classification is useful for addressing policy issues and understanding the forces behind the creation and adoption of innovations. -Innovation classification: mechanical innovation, bio-innovation, chemical innovation, agronomic innovation, biotechnological innovation and information innovation. -The economic forces and the state of scientific knowledge have an impact on the forms of innovation created and adopted in different places. -They demonstrate how intellectual property rights and regulations affect the development of innovations and the distribution of benefits stemming from them. - Innovations differentiated from their impact on economic agents and markets: increasing profitability, reducing costs, improving quality, reducing risk and protecting the environment; and extension of the shelf life. Most innovations fall into several of these categories.
[1]	They provide a conceptual framework for the decisions of individual farmers to accept innovation, using an example of new types of crops. - The framework is presented as an opportunity to implement in the dynamics of solutions covering at least several years and includes the farmer's personal perceptions, managerial abilities, and whether he is able to take risks. - The model allows generating potential valuable information from the innovation survey due to the development of ideas over time as well as reducing uncertainty about the long-term sustainability of the innovations. It is based on "Static Mode of Individual Acceptance", "Dynamic Reception Model" and „Bayes theorem“. - In spite of the numerous studies, the results of research in this area are disappointing. Many of the developed statistical models have low levels of explanatory power despite long lists of explanatory variables. - The results of various studies are often contradictory in terms of the importance and impact of each variable. Risk is considered to be a major factor in reducing the rate of perception of innovations.

[6]	-They view innovations as a co-evolutionary process, i.e. combined technological, social, economic and institutional changes, with the production and exchange of technical knowledge not being the only prerequisites for innovation. - They explore additional factors that play a major role, such as politics, legislation, infrastructure, financing and market development. -Innovations are not only the adoption of new technologies but also a balance between new technical practices and alternative ways of organizing. -Agrarian innovations are normatively loaded and managed by different views. - Agrarian innovations are viewed as a result of numerous interactions between components of agricultural systems, supply chains and economic systems, political environment, etc.
[11]	- The variety of observed patterns among different farm categories and differences in socio-economic areas and the environment is underlined. -An attention is drawn to the commonly used methodologies used in surveys for acceptance of innovations and suggestions for improvements of the work by using appropriate economic methods. - The focus is put on accepting and spreading agricultural innovations in less developed countries. -Innovations involving higher fixed costs are easier to accept by large farmers. - Non-scale related innovations are accepted by all groups of farmers, but larger farmers are among the first to implement them. - "Intensity" through the acceptance of new varieties reflects on the quantity of fertilizer per hectare, which is higher in small farms.

Source: own determination based on literature findings from multiple authors.

Based on the theories examined, two models attract the researchers' interest (Figure 1 and Figure 2) of agricultural research and technological diffusion. The first one is the " central source of innovation model" [2]. The central source of innovation model is the most dominant model in the scientific research. On the periphery are farmers who find it harder to adopt new technologies, followed by those who are innovative. At the center are international research institutes in the field of agriculture as well as national agricultural research systems. The information given by the farmers returns to the center via feedback.

Thus, the priorities and programs of the institutions from the center remain focused on technical problems for farmers. A main accent in the system is the transfer of knowledge and technologies from research centers to farmers. The national and international systems for agricultural research are connected via a network of technology and exchange of information. These networks include information exchange on research methods and techniques.

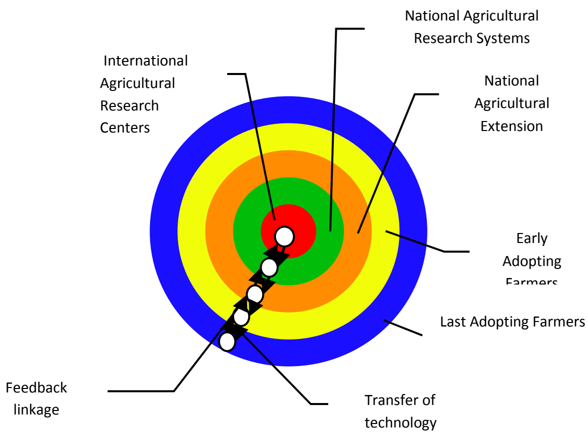

Fig. 1. A central source of innovation model
Source: Adapted by BIGGS, 1990, [2]

The central source of innovation model's characteristics are the following:
- The role of institutions - the most important role is given to institutions and groups of people (of an international or national nature).
- Stages in the field of research and enlargement. Scientists develop technology at the center, which is adapted in the subsequent stages before it is demonstrated to farmers and accepted by them in the final stage.
- Hierarchical structure. The generation process is hierarchical, new technologies and practices are being developed that are transmitted down the chain. Feedback goes back the same way.
- Networks for materials and information. In addition to hierarchical links, the central source of innovation has "neutral" networks for exchange of materials and information. These are two-way exchanges between scientists.

- Sources of innovation The central source of innovation model determines the system's center as a source of innovation.

- Political, financial and institutional concerns. The central source of innovation model does not mention the role that political, economic and institutional factors play in generating, promoting and using agricultural products and technologies. Because of the fact that no such "unscientific" problems are mentioned, the model supports the idea that there is a natural, evolutionary process through which the right technologies and research institutions are introduced, provided that political and financial deviations remain in science.

The second one is the „multiple source model "and it is based on research and diffusion in the historical, political, economic, agroclimatic and institutional context, in which the technological changes are created.

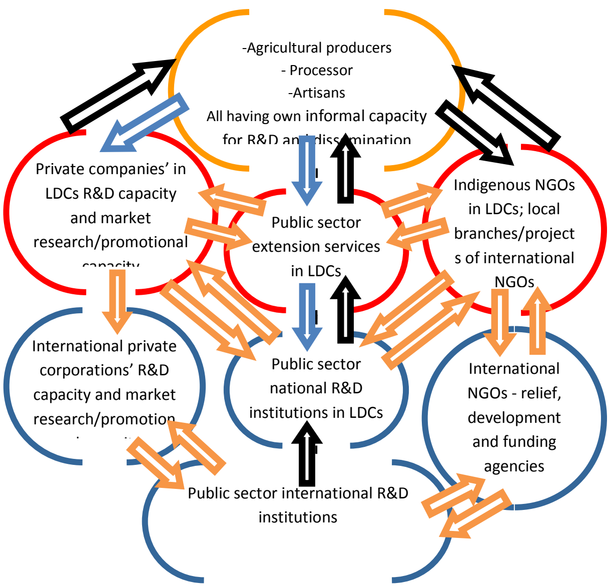

Fig. 2. A multiple source model
Source: Adapted by BIGGS, 1990, [2]

In the multiple source model the main accent is put on the idea that innovations come from different sources. These are various private, public and institutional participants in the research system, as well as farmers, craftsmen etc. in agriculture conducting informal research. Innovations come not only from those identified as "researchers" but also from "practitioners" in the numerous stages of research, expansion and production system. The figure illustrates the wide range of institutions for research and expansion, found in international, national and local research and publicity systems. The arrows illustrate some of their complex connections and two-way flows of information and knowledge. The multiple source model in a historical context, allows a better understanding of the various factors contributing to technological change. The creation of technology in the multiple source model does not have a unique classification of what is "technology" or what is "modern" or "traditional" technology. Technology consists of many old and new components; it has evolved and has been modified over the years. Evidence and reasons for the dominance of the central source of innovation model are presented, but also the importance of the multiple source model for the development of the agrarian sector is also described, as technologies are fundamentally integrated over time with political, economic and institutional events.

MATERIALS AND METHODS

The methodological framework of the report corresponds with the main objective - to analyze and determine the barriers and prospects for introducing innovations in the Bulgarian agrarian sector. The first part of the report addresses some research needs and emerging issues regarding the needs and opportunities for implementation of innovation in the agrarian sector. On the basis of the presented theoretical model, a questionnaire was developed which aims to organize the agrarian types of economic activity according to their susceptibility for perceiving and implementing the innovations in the Bulgarian agriculture and to identify the main obstacles that stop the modernization of the sector. The participants in the survey are experts in the field of agriculture and / or innovation. The results are part of scientific research project NID, NI 16/2018, "Integrated risk management approach in the agricultural sector". Used methods are descriptive statistics and system approach. The survey with questioner was conducted in 2018.

RESULTS AND DISCUSSIONS

The conducted research covered issues related to the susceptibility of the Bulgarian agrarian sector to the introduction of innovations, the factors that have the most impact on the acceptance or rejection of the innovations and the most feasible innovative solutions in the two main sectors of agriculture.

The research identified the susceptibility to innovation both in the plant and livestock sectors. The results show that grain - 65% and oilseed crops - 70% are most prone to innovation in crop production, but the sector has a relatively high level of succession of about 60% and a good attitude towards the innovation. In the livestock sector, the differences in susceptibility to innovation across sectors are more pronounced. The most prone to innovation, according to the research is poultry farming - 75%. Respondent experts in the field have pointed out pigs, sheep and goat farming as well as cattle and buffalo farming as being more prone to innovation by 60%. The research has identified the horse farming sector as the least prone to influence by the novelties by 25%.

The determination of the factors that influence or restrict the implementation of innovations in Bulgarian agriculture is based on an inquiry by farmers and specialists in the field of agrarian policy. The most important factors influencing the introduction of novelties in agriculture are the following factors:

(i)The size of the farm – 80%.

(ii)The willingness of farmers to take risks – 80%.

(iii)Financing by bank and non-bank institutions – 80%.

(iv)Access to information on opportunities for implementation of innovation – 70%.

The least influential factors of the implementation of innovations are the following:

-Access to the labor market – 30%.

-Environmental protection – 40%.

-Infrastructure – 45%.

-User requirements – 45%.

Other factors listed in the assessment of the introduction of innovations are the following: Access to markets; Government policy and support; Specialization of the farm; Processor requirements. They have been evaluated with an impact of 50-60% on the acceptance of innovations in plant and livestock farming.

Respondents point to four main barriers to the implementation of innovation; they have the most negative impact on farm entrepreneurs and are the reason for the slow spread of innovation in the sector. These are:

-The cost of investment for innovation – 75%.

-Lack of information on possible innovations – 70%.

-Low willingness for risk-taking by the farmer – 70%.

-Age of the farm manager – 65%.

Environmental Protection; Competition; farming specialization and the lack of developed infrastructure occupy the last places of factors limiting innovation in the agrarian sector with 30-40%.

It can be summed up that most farmers in Bulgaria are not sufficiently well informed about the innovations in the sector, which may be the result of the country's agrarian policy. The credit conditions offered by banking institutions are unattractive and not flexible enough to meet the needs of farmers, and aging managers with traditional thinking not willing to take risks tend to contribute to the lack of promotion of innovations in Bulgarian agriculture. Figure 3 and Figure 4 showcase the feasibility of innovative solutions in Bulgarian agriculture. They show how the sectors of plant and livestock breeding react to the implementation of identical innovative solutions.

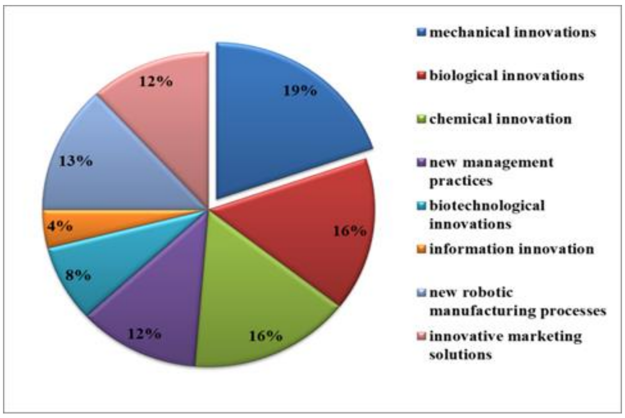

Fig. 3. Feasible innovative solutions in the plant breeding sector.
Source: Own calculation.

Mechanical innovations (machines and equipment) are best accepted in both sectors - plant breeding - 75%; livestock breeding - 70%.

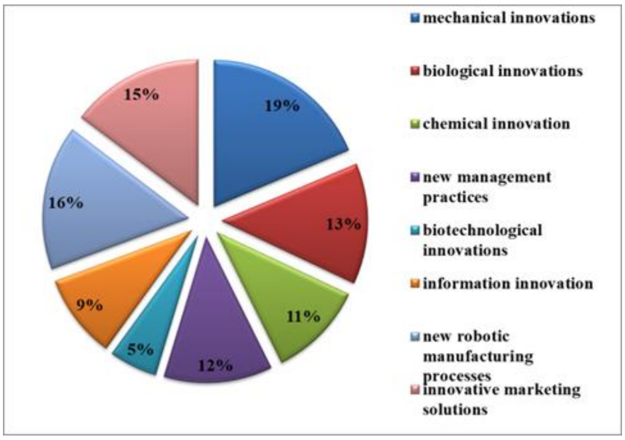

Fig.4. Feasible innovative solutions in the livestock sector.
Source: Own calculation.

After the mechanical innovations in plant breeding the most preferred innovations are: biological innovations (new seed varieties) – 60% and chemical innovations (fertilizers and pesticides) – 60%. In livestock breeding the respondents have indicated the new robotic manufacturing processes – 60% and innovative marketing solutions – 55%, as the most possible ones for implementation in the sector after mechanical innovations.

Biotechnological innovations and information innovations have been identified as the least possible innovative solutions for both sectors, which are estimated by the respondent specialists by no more than 35%.

CONCLUSIONS

From the analysis of the different theories on agrarian innovations and with the aid of the research, it can be concluded that in the different types of economic activity of agriculture the degree of readiness and continuity of innovations is different. Plant breeding was more susceptible, and in particular - oil crops and grain production. In livestock breeding, attitudes towards innovation are more dynamic. Poultry farming is determined as the most innovative sub-sector with 75%, and Horse breeding occupies the last place in both livestock breeding and the entire agrarian sector, with 25% inclination to adopt innovative practices. The factors influencing the acceptance of innovation the most are the size of the farm and the willingness of the farmer to take risks. The most restrictive of the implementation of innovations, according to the research, is the cost of investment for innovation and the lack of information on possible innovations. The possible feasible innovative solutions in Bulgarian agriculture are, for the most part, mechanical innovations. Chemistry and biological novelties are more easily accepted in plant breeding, while livestock breeding has a better attitude towards new robotic processes and marketing decisions.

The prospects for the introduction of innovations in Bulgarian agriculture are increasing every year, the country is getting closer, despite the fact that it is a difficult process, to the European and world practices of modern agriculture. The barriers restricting the introduction of innovative practices in the agrarian sector of Bulgaria are many and different in nature. The traditional way thinking of the Bulgarian farmer is the first thing that needs to be changed so that information on the benefits of innovation can be assimilated, realized and applied in practice.

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TIMESHARE INTEGRATION IN RURAL TOURISM

Elena ILIEVA

College of Tourism – Burgas to University "Prof. d-r Asen Zlatarov" - Burgas, №1 "Prof. Yakimov" Boulevard, 8010, Burgas, Bulgaria, Phone: +35956813761, Mobile:+359887192049, Emails: elena-ilieva@abv.bg

Corresponding author: elena-ilieva@abv.bg

Abstract

The main purpose of the article is to reveal the type and level of timeshare integration in the rural tourism. In this connection the nature and specifics of hospitality timeshare are investigated and briefly explained. Special attention is paid to the main representatives of the timeshare industry in rural areas. The timeshare owner is researched and segmented, whereby the author suggests short customer profiles of them. The timeshare developer, on the other hand, is also explored and the typical timeshare businessman in rural areas is pointed out. In conclusion, the author comments the role and meaning of the timeshare industry for the development of rural areas.

Key words**:** *development, hotel accommodation, rural tourism, timeshare*

INTRODUCTION

Rural tourism plays substantial role for the favorable development of many small towns, villages and suburban areas, transforming them into significant destinations, complete with hotels, timeshare accommodation, car rentals, amusement parks, tour operators, banks and currency exchanges, and many other services that cater to the specific needs of tourists. Rural tourism is considered to be an adequate tool for regional development, contributing to minimization of the negative effects on natural and social environment caused by tourist travel. [1] The specific nature of rural tourism transforms the competition between different providers into cooperation between them, where the problems of small business are very much the problems of rural tourism. In this point of view, corporate and economic globalisation is having a major impact on rural communities around the world. Specific result from the mentioned process is the strongly fragmented tourist market, which leads to a demand for personalized products.[3] Moreover, the significant advances in communication and travel technologies have changed the way rural tourism is evolving and reshaping. The specific accommodation and lodging sector in rural tourism system makes no exception. One of the most recent innovations in hotel product in rural areas is the adopting of the timeshare concept.[8]

The etymological origin of the term „timeshare" is 'shares of vacation time' as mentioned in the English literature. Its meaning is "the process of sharing time" with other people in particular vacation unit. Specific is that each of the owners has the right to use the property in fixed time period during the year. The timeshare concept begins in the 60s and till the beginning of the new millennium it has developed significantly, especially regarding the number of the existing timeshare resorts, the sold vacation intervals and the number of the timeshare owners.

Essential result from this steady development is the appearance of variety types and forms of timeshare in tourist industry, from which an important role in hotel industry expansion plays also the rural timeshare accommodation. Despite all this, timeshare in rural areas seems to be poorly studied and studies doesn`t explain how the timeshare product integrates in the studied area. Furthermore, timeshare is a modern hotel product, which entered the international hotel market in the last 60 years. On the modern stage of hotel industry timeshare exists in different forms such as modern varieties and mixed type of properties, which complicates the current study even more.

MATERIALS AND METHODS

The purpose of this research is to analyze the timeshare integration especially in rural tourism. The purpose of the study requires the following tasks to be performed:
-To explain the content and timeshare meaning and to point out the specific nature of hotel timeshare;
-To indicate the types of hotel timeshare due to different variations of owned vacation interval, holiday unit and period of the contract, and to highlight its specifics in rural tourism;
-To reveal the specifics and the attributes of the rural timeshare product and to mark some of its up-to-date changes;
-To research the timeshare owners and to investigate the profile of the different owner segments, pointing out who are the typical timeshare owners in rural areas;
-To investigate the timeshare developer and show which are the typical businessmen, that invest, manage and maintain timeshare resorts.
The information was further analysed with descriptive statistics such as summary and univariate analysis.

RESULTS AND DISCUSSIONS

Generally, timeshare can be studied also in terms of the broader concept of 'shared ownership' which seems to be very popular over the past years and has developed dynamically. Object of the process of timesharing can be variety of things such as a car, a space of an office, a bicycle or a machine. However, in tourism, it is most often linked to the use of transport vehicles and vacation homes. Studies in the field of hotel timeshare offer plenty of definitions. Our previous studies comparatively analyzed the definitions of timeshare and we concluded that "timeshare is a type of modern hotel product." The most peculiar aspect of this product is the way it is commercialized. While at the classical hotel, the tourist hires a room to stay, in case of timeshare, the tourist purchase and consequently has the right to use a property for vacation for a certain period of time in the future. This is a modern type of hotel accommodation, where the tourist is owner of vacation time. [6]
The purpose of this study is not to cover all aspects of timeshare. The intention is to focus on the most important aspects of timeshare and to present the specific nature and features of this modern hotel product, especially in rural areas.
Practically, in essence, the timeshare product has the form of a long-term contract, concluded "between the timeshare developer and the buyer of vacation time (the so-called 'timeshare owner'). Usually the time period of the agreement varies between 25 and 50 years and the subject of the contract is sharing of vacation time" between co-owners, whereby each of them is granted to use the vacation property for a curtain time period each year. According to the type of the owned time interval, it can be summarized as follows:
•"Fixed-week ownership" – the owner has access to a certain vacation unit for a specified time period every year;
•"Floating week ownership"– the time periods are sold as a floating plan, where the time varies during the seasons or on yearly basis;
•"Flex-week ownership" – usually it relates to a specific timeshare unit and the vacation weeks rotate through the year. This type of timeshare interval, in most cases, floats during off-season and is fixed during high season.
It is fair to admit that all of the mentioned types of the owned interval are present in the timeshare market in rural areas, but in our opinion "the floating week ownership" system is prevailing. This type of ownership gives fair possibility to each of the owners to spend vacation time in the timeshare unit through the different seasons of the year, when countryside and nature have different advantages.
Regarding to the timeshare unit, it can also vary from fixed to floating one. The first type is usually met in single timeshare properties. In this case the owner has access to the same vacation unit for the period in the contract. This case corresponds largely with the feeling

of having a "second home". The second timeshare system, on the other hand, indicates only the type of the timeshare property. Here from essential importance are the size, location and amenities of the timeshare unit. Timeshare in rural tourism represents only the fixed type of the timeshare unit. It can be explained with the motives for the rural timeshare purchase. It is meant to be more like a second home for the purchaser, than just a guaranteed holiday time. The chosen rural area is very often connected emotionally with the timeshare owner – areas near hometown, relatives and friends or it has specific atmosphere, which guarantees individual comfort and experience.

The timeshare price has to be paid upfront, but as it covers a certain amount of future vacations for the timeshare owner, it is higher than a holiday package price. Considering the fact that prices are influenced annually by inflationary processes, it can be concluded, that timeshare protects the timeshare owner from inflation. For comparison, in classic hotels there are different reasons for price deviation, which can affect the tourist in a positive or negative way, but the inflation rate has always strong influence.[9] It is important to mention, that also many macroeconomic factors affect this price, such as expected inflation, personal disposable income, economic growth, etc. [12]

The highest timeshare price at the beginning of the century was indicated in the USA – USD 9,500. In the same time, in Europe the highest prices were recorded in France and Italy (respectively USD 8,700 and USD 8,900). Nowadays, the average timeshare purchase price is USD 19,000,[4] which shows three times rising. It is important to highlight that the timeshare blanket price has a specific nature. There is also an additional component to the purchase price. This is the annual maintenance fee, that the owners must pay usually at the end of the year. This additional tax should cover the timeshare property maintenance and in most cases it varies between USD 200 and USD 1,000 for a vacation week. The average price of a rural timeshare interval is around USD 16,000 per week and it differs due to different seasons, timeshare resort amenities and the type and size of the timeshare unit. In rural timeshares the rate of the annual fee is usually between USD 600 and USD 800, because of the larger common parts in the rural timeshare resort and is always on annual not on bed nights basis, which can be explained with the fact, that the owned intervals are very often 3 weeks and longer.

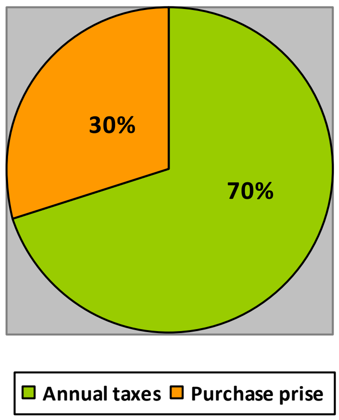

Fig. 1. Structure of the blanket timeshare price in rural areas (period of 50 years in the timeshare contract).
Source: Adapted to WTO, Timeshare – The new force in tourism, own calculation [13]

The timeshare product profile has also developed significantly worldwide. From basically recreational, nowadays the timeshare product is more based on different specific activities. For example, we can identify golf timeshare, ski timeshare, cruise timeshare, caravan timeshare (*Resort Parks International*), rural and eco timeshare etc. In the field of rural timeshare, it can be concluded that this is one of the factors, including theme parks, second home buildings and others, which plays significant role for the awakening interest towards rural areas and rural tourism trough last years. Rural timeshares diversify the rural hotel and lodging product and guarantee the attendance of the rural area, because of the supposed annual holidays of the timeshare owner at the same place every year.

Considerable change in the timeshare product is also indicated connected with the form of existence. Increasingly widespread are the mixed and hybrid forms of timeshare. In this field the most common are condominium hotels and partial ownership timeshares. The most common type of hybrid timeshare product in rural areas is the "partial ownership". As a form of accommodation it developed during the 90s XX in USA and became popular in 1994. Compared to the timeshare concept, which developed during the 60s, XX, this information gives us grounds to believe that the partial ownership is type of the modern or hybrid timeshare products. With this type of timeshare, the accommodation is for longer period of time – usually 3-4 weeks to 3 months per year. The type of ownership is always "deeded/fee simple" and the use of the timeshare unit is on rotational principle among the co-owners. The basic motive for the timeshare purchaser is the possession of a vacation home in rural area, but combined with the advantages of sharing the responsibility for the home maintenance with other people.[7] Big hotel chains are also interested in participating in the timeshare market - Four Seasons, St. Regis and Ritz Carlton are representing the mentioned hotel companies. In rural areas some of the representatives are Marriott (Marriott's Village d'Ile-de-France), Ritz Carlton (Carlton Destination Club) and Hilton (Hilton Grand Vacation Club). According to a study in 2006, the partial ownership sales generated 1.6 billion $ sales revenue. The prices are usually between $200,000 and $1 million, which defines this type of product as up-scaled priced.[5]

The timeshare owner is seen as an individual or a household, which possesses interests in owning holiday property, but due to objective and subjective reasons, prefers to share it with other co-owners. The general profile of the typical timeshare owner is presented in Table 1.

For the purpose of the study the timeshare owners are segmented by their "reason for the purchase", which is closely related with their perception of the timeshare product meaning and with their personal needs, that are satisfied with the purchase.[10]

Generally, segmentation is marketing process, which allows the businessman to form target consumers groups.[2]

Table 1. General profile of the timeshare owner

Demographic characteristics			
Socio-economic		**Life cycle**	
Age	45-55	*Marital status*	Married
Incomes	$35,000-$90,000	*Education*	Highly educated
Gender	Predominantly mail	*Career*	Wide range
Geographic		**Socio-psychological**	
Place of permanent residence	USA and Europe	*Satisfaction*	80%
		Motives	Quality and flexibility
Location of timeshare ownership	North America, Europe, Latin America	*Needs*	Recreation, Experiences, shopping

Source: Adapted to RCI, Resort Timesharing Worldwide [11]

From this point of view, there are four key segments of owners:

-*"Second home owners*" – the timeshare unit is seen as a second home for the purchaser. They visit it regularly and they don`t want to exchange it with other timeshare owners. Usually, the timeshare unit is located near to the place of permanent residence, the hometown or near to the place of residence of relatives. This is the most common representative of the rural timeshare owner.

-*"Exchange peace"* – timeshare unit is seen as an "exchange coin", which gives the timeshare owner the opportunity to visit different holiday homes in a profitable way. Relevant connections with exchange organizations, such as RCI or II, are very important for the purchaser.

-*"Hobby tourism"* – the timeshare unit ownership gives the opportunity for practicing specific activity, which is commonly connected with a hobby of the owner (golf, fishing, surfing etc.). This type of timeshare owners is also widespread in rural areas, because rural places very often give the opportunity for practicing different type of hobby – the presence of a lake suggests the possibility for fishing, the wide green areas – for a golf game, the calm atmosphere of rural areas – for different type of exercises outdoors etc.

- *„Family holiday"* – timeshare purchase aims quality time, spent together with the family. This owner segment is distinguished with the so-called "cluster of motives", connected with the different needs of the family members due to their age, life cycle etc. They are also very common in rural timeshares, mostly because of the calm atmosphere, which gives the basis for recreational time, spent together with the family. The vacation period is tightly connected with the annual family holiday time.

The timeshare developer is a businessman or a company, which invests in the timeshare construction and maintains and manages the timeshare building/resort. The timeshare developer is one of the main players in the timeshare systems, along with the timeshare owner and the timeshare exchange organization, and usually practically owns the timeshare resort (except deeded/fee sample format of ownership). Generally, we can identify four basic representatives of the timeshare developer:

-Specialized timeshare developer - owns and runs only timeshare projects;

-Developer in the area of hotel and lodging industry – the timeshare business stimulates the cash streams, expands the product list, diversify the hotel supply;

-Company with business outside the tourism industry - aims diversification of the investment risk trough investing in different business areas;

-Company with business activity in the field of tourism, but outside hotel and lodging industry - aims development of the tourist product portfolio and guarantee of the company`s standards.

The majority of timeshare developers in rural tourism are represented by the first two groups. The specialized timeshare developer in rural areas is very often small businessman, who had reorganized the village house into timeshare building with reduced number of units and vacation intervals. This is more like a family business to him, which makes him personally connected with the timeshare owners and their needs.

The timeshare developer with business in hotel and lodging industry are mostly represented by the international hotel chains, which we already mentioned. Specific to their timeshare product is that it is part from their wide hotel product portfolio. Usually this large hotel corporations have the so-called "destination clubs", where they integrate the timeshare resorts, including rural timeshares (very often called "timeshares in countryside").

CONCLUSIONS

As a conclusion we can assert that timeshare in rural areas is relatively well developed. It has its own specific characteristics and the main distinctive features are as it follows:

-Timeshare in rural tourism is a modern type of hotel product that practically exists as a long-term contract between a timeshare developer and a timeshare owner.

-The most common interval of vacation time is "the floating vacation week" type of ownership.

-The timeshare unit, where the purchaser has the right to spend vacation each year, is fixed due to specific motives and needs of the timeshare owner.

-The average price of a rural timeshare interval is around USD 16,000 per week and it differs due to different seasons, timeshare resort amenities and the type and size of the timeshare unit.

-As additional component of the blanket timeshare price, the annual fee in rural timeshare resorts covers around 70% of it and on average costs USD 600 to USD 800 per year.

-The profile of the timeshare product has developed significantly and nowadays it is more based on different specific activities.

-The form of existence of rural timeshare is most commonly "the partial ownership" type, where accommodation is for longer period of time – usually 3-4 weeks to 3 months per year.

-The main timeshare owner segments in rural tourism are the so called "second home owners", "the hobby tourism" seekers and "the family tourism" owners, where the motives and need differ.

-The timeshare developer in rural tourism can be split in two groups - specialized timeshare developers and timeshare developers with business, connected with the hotel and lodging industry (predominantly represented by the international hotel chains).

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SUBSTANTIATION THE PARAMETERS OF THE PRIMARY PROCESSING IN INSTALLATION BASED OF RENEWABLE ENERGY

Shavkat IMOMOV, Tulanboy KAYUMOV, Zulfiya MAMADALIEVA

Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, Tashkent, 39, Kori Niyoziy str., Phones:(99891) 4416931, (99890)5124820, (99891)1771155, Emails: shavkat-imomov@rambler.ru, tulanboy85@mail.ru, mamadaliyeva.zulfiya@mail.ru

Corresponding author: mamadaliyeva.zulfiya@mail.ru

Abstract

In this article there are described several mathematic analyses of load to energy installation during process of primary organic waste recycling. There is spoken about the positive influence to work effectiveness of biotechnological construction process of primary processing. Also, we can see some valuable information taken on the basis of the engineering research results for the construction of initial working out.

Key words: *organic waste materials, biomass, screw, knife, norms of loading, heat exchange, mixing quality, methane bacteria, biogas, biotechnology*

INTRODUCTION

For the last period, the appearance of the new generation of the constructions that work out organic waste materials gave an opportunity to work out the organic waste materials extremely [1.2.11].
But the content and shape of biomass that is loaded to them has not been fully studied yet. In the result, one should spend too much energy on anaerobic process in bioreactor and the necessity of research hastening is required [2, 3]. Also, in order to perfect the process of discharge of biogas that has energetic value, the content and features of biomass that is loaded to bio reactors depend on the primary work out in many ways [5.6].
Due to the research works of Dubroskiy found that, in working out the biomass with anaerobe depends on its deterioration, the speed of mixing loading, humidity and daily loading. And their changes badly influence on the development of methane bacteria. In working out the energy constructions that are reclaimed in anaerobic process, we can achieve good qualitative degree of energy and biologic fertilizers taken from them by creating necessary conditions for methane bacteria. And this is included in the work accomplished in the primary process. [4,5.6].

MATERIALS AND METHODS

In the researches carried out for anaerobic reclamation in energy constructions that reclaim organic wastes, Imomov *et al*.(2013), Imomov ans Kaymov (2012) ans Salimov amd Imomov (2017) paid attention to biomass reactor [5.6,9]; Eshonkulov [9]. paid attention to evaluating the biomass depth by layering; Rahmatov and Halilov cited by [6, 9]investigated pulsing mixing and its speed. But in Hoshimoto’s researches on rendering the wastes from pig farms, Dubrovski (1988) complexly emphasized to the installations that get ecologic gas for fermentation of organic wastes to methane. Also, Gridnev and Kovalev (2014) gave their ideas and suggestions on reclamations before loading the biomass to bioreactors [2]. Shodiyev, who nowadays is carrying out his investigations, says that one can achieve optimal parameters when the amount of constructions loading is increased up to 6 times a day as cited by [6].
In most of the modern constructions that get biologic gas, the primary grinding is not accomplished wholly and there isn't take into consideration the speed in the process of primary reclamation. All of these prohibit the qualitative accomplishment of the biomass loaded to bioreactors. That is why, the suggested and specially designed mathematic

model should take into consideration the grinding of changing biomass that is loaded to primary recycling construction and the speed of biomass in the process of humidity and grinding. In the given mathematic model, the size, the humidity of the wastes and the speed of the mass of organic waste in the process of primary reclamation of the regenerated energy construction and the amount of a daily loading of grinding construction are depicted.
In natural conditions, taking into consideration that the number of loadings in primary reclamation construction of biomass that is between 65-99 % moist of the manure of cattle shed is from 1 to 5 times as the size of manure is from 0.8 cm^2 up to 2 cm^2, we consider to carry out 8 experiments so that to decrease mistakes, using the method of "Method of carrying experiments" by Dospexov [3, 7, 8].

RESULTS AND DISCUSSIONS

During designing a mathematic model, the parameters of primary working out process in the construction of reclamation of the following organic waste data are based on the following, x – amount of moist [%], y – speed of liquid mass [m/sec], z – number of daily loading of the construction [day/times], U – grinding [cm^3] and a_0 – carried experiments. We have given the following regression equation on carrying out multi parameters experiments:

$$U = a_0 + ax + by + cz \quad \text{.............................(1)}$$

In determination of the coefficient of unknowns in the above given equation, we use the method of " the least squares" [5]:

$$\varphi(a_0, a, b, c) = \sum_{k=1}^{n} \left(U_k - \left(a_0 + ax_k + by_k + cz_k\right)\right)^2 \quad \text{............................(2)}$$

Due to the method of "the least squares",we get private total numbers by a_0, a, b, c parameters in the second equation.

$$\frac{\partial u}{\partial a_0} = 2\sum_{k=1}^{n}\left(u_k - \left(a_0 + ax_k + by_k + cz_k\right)\right)\cdot(-1)$$
$$\frac{\partial u}{\partial a} = 2\sum_{k=1}^{n}\left(u_k - \left(a_0 + ax_k + by_k + cz_k\right)\right)\cdot(-x_k)$$
$$\frac{\partial u}{\partial b} = 2\sum_{k=1}^{n}\left(u_k - \left(a_0 + ax_k + by_k + cz_k\right)\right)\cdot(-y_k)$$
$$\frac{\partial u}{\partial c} = 2\sum_{k=1}^{n}\left(u_k - \left(a_0 + ax_k + by_k + cz_k\right)\right)\cdot(-z_k)$$
$$\text{................................(3)}$$

Due to sum of finding the extrimum of multi changing functions, equations in the 3rd equation of equalizing the taken sum to zero will be the following:

$$\begin{cases} \dfrac{\partial \varphi}{\partial a_0} = 0 \\ \dfrac{\partial \varphi}{\partial a} = 0 \\ \dfrac{\partial \varphi}{\partial b} = 0 \\ \dfrac{\partial \varphi}{\partial c} = 0 \end{cases} \quad \text{.........(4)}$$

We can compile the following system of equations from the above mentioned 4th equation:

$$\begin{cases} na_0 + a\sum_{k=1}^{n} x_k + b\sum_{k=1}^{n} y_k + c\sum_{k=1}^{n} z_k = \sum_{k=1}^{n} U_k \\ a_0\sum_{k=1}^{n} x_k + a\sum_{k=1}^{n} x_k^2 + b\sum_{k=1}^{n} x_k y_k + c\sum_{k=1}^{n} z_k x_k = \sum_{k=1}^{n} U_k x_k \\ a_0\sum_{k=1}^{n} y_k + a\sum_{k=1}^{n} x_k y_k + b\sum_{k=1}^{n} y_k^2 + c\sum_{k=1}^{n} z_k y_k = \sum_{k=1}^{n} U_k y_k \\ a_0\sum_{k=1}^{n} z_k + a\sum_{k=1}^{n} x_k z_k + b\sum_{k=1}^{n} y_k z_k + c\sum_{k=1}^{n} z_k^2 = \sum_{k=1}^{n} U_k z_k \end{cases}$$
$$\text{...............(5)}$$

where:
n – the number of experiments [times];
x – amount of moist [%];
y – speed of liquid mass [m/sec];
z – the number of daily loadings [day/times];
U –grinding [cm^3].
Relatively to the number of carried experiments, correlation connection due to the parameter changes are calculated due to the following Table 1 and here integrity is taken

as 1 in a million of cases in order to increase the degree of definiteness:
1–if we put the data given in the Table (5) in to the function given in the equation, it will be as the following:

$$\begin{cases} 8a_0 + 6{,}76a + 40b + 24c = 11{,}2 \\ 6{,}76a_0 + 5{,}743143a + 34{,}777143b + 20{,}931429c = 9{,}659429 \\ 40a_0 + 34{,}777143a + 230{,}857143b + 140{,}571429c = 62{,}171429 \\ 24a_0 + 20{,}931429a + 140{,}571429b + 85{,}714386c = 37{,}714286 \end{cases} \qquad \text{..........................(6)}$$

So, from (6) equation we can see from the system of equations that we can get normal equation systems with 4 unknowns from it. When doing the system of these equations, we use the method of "Jordan House" [10,12,13]. The result is equal to the numbers that are ***coefficients*** are higher than 0 and lower than 1. We can see from the solution of the equations the following: *a_0=0.320554, a=0.247105, b=0.011710, c=0.270697* we put them in the system of equations (6) and check the results.

$$\begin{cases} 8.000000 \cdot 0.320554 + 6{,}760000 \cdot 0.247105 + 40.000000 \cdot 0.011710 + 24.000000 \cdot 0.270697 = 11{,}199990 \\ 6{,}760000 \cdot 0.320554 + 5{,}743143 \cdot 0.247105 + 34{,}777143 \cdot 0.011710 + 20{,}931429 \cdot 0.270697 = 9{,}659420 \\ 40.000000 \cdot 0.320554 + 34{,}777143 \cdot 0.247105 + 230{,}857143 \cdot 0.011710 + 140{,}571429 \cdot 0.270697 = 62{,}171367 \\ 24.000000 \cdot 0.320554 + 20{,}931429 \cdot 0.247105 + 140{,}571429 \cdot 0.011710 + 85{,}714386 \cdot 0.270697 = 37{,}714248 \end{cases}$$

So, the difference between them show the mistake in doing the system of equations:

$$\begin{cases} 11.200000 - 11.199990 = 0.000010 \\ 9.659429 - 9.659420 = 0.000009 \\ 62.171429 - 62.171367 = 0.000062 \\ 37.714286 - 37.714248 = 0.000038 \end{cases}$$

We make a mathematic model of the primary working process of the energy construction of reclamation of organic waste by putting the results into the 1st equation.

The mathematical model is:

$$U = 0.320554 + 0.247105 \cdot 6.76 + 0.011710 \cdot 40 + 0.270697 \cdot 24 = 8.956112$$

In checking the essence of a mathematic model, we use Fisher's stati
stics due to the parameters of primary working out process in the energy construction of reclamation of organic waste [3,8].

For that, we put the identified coefficients into the 1st equation (7) and make a equation. For each of the carried experiments we calculate U_t and the resulted are inserted in Table 2.

Formula (7):

$$U_t = 0.320554 + 0.247105x + 0.011710y + 0.270697z \qquad \text{...............(7)}$$

Table 1. Correlation connection between the parameters of primary working out process of the organic waste in the energy construction of reclamation of organic waste

U	x	Y	Z	x^2	y^2	z^2
0.800000	0.750000	2.000000	1.000000	0.562500	4.000000	1.000000
0.971429	0.777143	2.857143	1.571429	0.603951	8.163265	2.469388
1.142857	0.804286	3.714286	2.142857	0.646876	13.795918	4.591837
1.314286	0.831429	4.571429	2.714286	0.691273	20.897959	7.367347
1.485714	0.858571	5.428571	3.285714	0.737145	29.469388	10.795918
1.657143	0.885714	6.285714	3.857143	0.784490	39.510204	14.877551
1.828571	0.912857	7.142857	4.428571	0.833308	51.020408	19.612245
2.000000	0.940000	8.000000	5.000000	0.883600	64.000000	25.000000
11.200000	**6.760000**	**40.000000**	**24.000000**	**5.743143**	**230.857143**	**85.714286**

Source: this table was designed based on the mathematic simulations of results the authors' investigations

Table 1. (continuous) Correlation connection between the parameters of primary working out process of the organic waste in the energy construction of reclamation of organic waste

xy	xz	yz	Xu	yU	zU
1.500000	0.750000	2.000000	0.600000	1.600000	0.800000
2.220408	1.221224	4.489796	0.754939	2.775510	1.526531
2.987347	1.723469	7.959184	0.919184	4.244898	2.448980
3.800816	2.256735	12.408163	1.092735	6.008163	3.567347
4.660816	2.821020	17.836735	1.275592	8.065306	4.881633
5.567347	3.416327	24.244898	1.467755	10.416327	6.391837
6.520408	4.042653	31.632653	1.669224	13.061224	8.097959
7.520000	4.700000	40.000000	1.880000	16.000000	10.000000
34.777143	**20.931429**	**140.571429**	**9.659429**	**62.171429**	**37.714286**

Source: this table was designed based on the mathematic simulations of results the authors' investigations

Table 2. Correlation connection for checking the essence of a mathematic model

№	U	x	y	Z	U_t	$U-U_t$	$(U-U_t)^2$	$(U-\bar{U})^2$
1	0.800000	0.750000	2.000000	1.000000	0.800000	0.000000	0.000000	0.360000
2	0.971429	0.777143	2.857143	1.571429	0.971428	0.000001	0.000000	0.183674
3	1.142857	0.804286	3.714286	2.142857	1.142856	0.000001	0.000000	0.066123
4	1.314286	0.831429	4.571429	2.714286	1.314285	0.000001	0.000000	0.007347
5	1.485714	0.858571	5.428571	3.285714	1.485713	0.000001	0.000000	0.007347
6	1.657143	0.885714	6.285714	3.857143	1.657141	0.000002	0.000000	0.066122
7	1.828571	0.912857	7.142857	4.428571	1.828569	0.000002	0.000000	0.183672
8	2.000000	0.940000	8.000000	5.000000	1.999998	0.000002	0.000000	0.359997
	11.20000	6.760000	40.00000	24.00000	11.19999	0.000010	10^{-12}	1.234281

Note: Ū – average value of the degree of grinding.
Source: this table was designed based on the mathematic simulations of results the authors' investigations

The average value of total growing dynamics of 8 experiments is equal to, 1.4 mm^3.

$$\overline{U} = \frac{U}{n} = \frac{11.2}{8} = 1.4mm^3$$

We calculate it by putting the necessary data in Table 2 into Fisher's equation (8):

$$F = \frac{\left(U_t - \overline{\mathrm{U}}\right)^2}{\left(U - U_t\right)^2} \cdot \frac{k_2}{k_1} \quad ....(8)$$

where:
U – Degree of grinding [mm^3]
$\bar{U}$ – Average value of the degree of grinding 11.2/8=1.4 [mm^3]
U_t – Generalization of the results of all experiments [mm^3]
k_1 – The number of parameters that influence on the process [5,8,9]
k_2 – Value of average results of experiments $k_2=n-k_1-1=8-3-1=4$

$$F = \frac{1.234281}{10^{-12}} \cdot \frac{4}{3} \geq 3$$

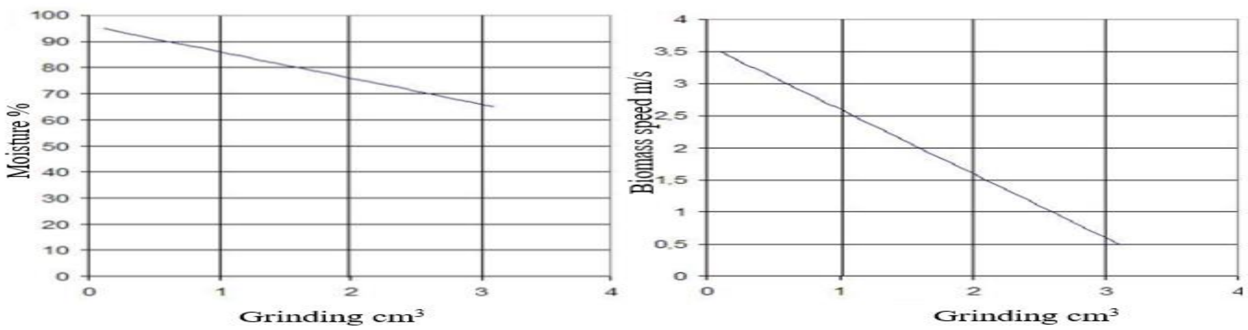

Fig. 1. Drawing of grinding with percent of Moisture and Biomass speed
Source: this figure was designed based on the mathematic simulations of results the authors' investigations

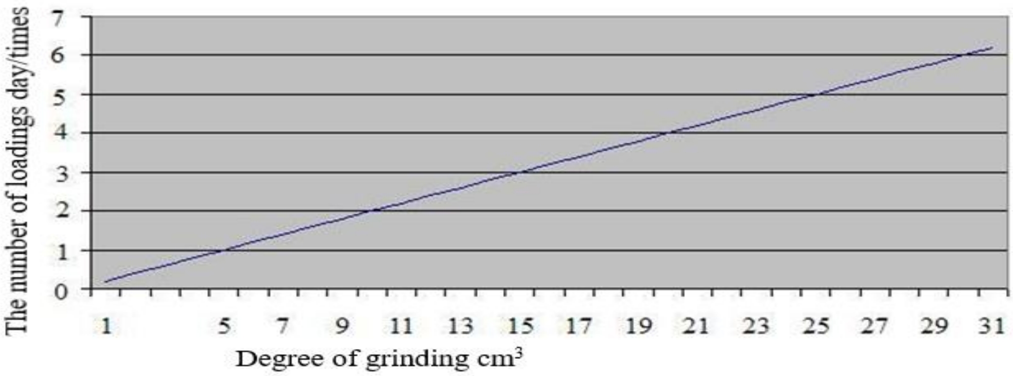

Fig. 2. Drawing of grinding with the number of loadings
Source: this figure was designed based on the mathematic simulations of results the authors' investigations

CONCLUSIONS

We can make the following conclusions out of a drawing compiled on the basis of a mathematic model:

-If biomass moist raises to 1 % , the degree of grinding increases to 0.247105 cm^3.

-If the speed of biomass rises to 1 meters/ second, the degree of grinding also increases up to 0.011710 cm^3.

-If the number of daily loadings is decreased to 1, the degree of grinding rises to 0.270697 cm^3.

-The number of daily loadings influences relatively 9% more on the moist of biomass.

-So, the number of daily loadings due to the biomass speed influences on the degree of grinding 23 to times.

-Also, the raise of the amount of biomass moist (relatively to biomass speed) influences on the degree of grinding to 21 times.

-Due to checking the essence of a mathematic model by Fisher's statistics, its value is F>3 i.e. here we make a rather big value than the number of parameters. It reflexes the processes in a mathematic model correctly.

By creating necessary conditions for metan bacteria in working out of the energy construction of the reclamation of organic waste,i.e.the shape, content and feature changes of biomass loaded into bioreactor by primary working out of biomass economizes the energy and time spent for bioreactor process perceptibly. It also decreases the number of unsuccessful working process of bioreactors and gives an opportunity to control the biomass content.

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GENERAL CHARACTERISTICS OF VINEYARD FARMS IN DENİZLİ PROVINCE

Ayşe KARADAĞ GÜRSOY[1], Mevlüt GÜL[2], M. Çağla ÖRMECİ KART[3]

[1]Iğdır University, Faculty of Agriculture, Department of Agricultural Economics, Iğdır, Turkey, Email: ayse_karadag@yahoo.com
[2]Isparta Applied Sciences University, Faculty of Agriculture Sciences and Technology, Department of Agricultural Economics, Isparta, Turkey, Email: mevlutgul@isparta.edu.tr
[3]Ege University, Faculty of Agriculture, Department of Agricultural Economics, İzmir, Turkey. Email:caglaormeci@yahoo.com

Corresponding author: ayse_karadag@yahoo.com

Abstract

Grapes produced in many provinces of Turkey, with the possibility to evaluate in different ways and also as an agricultural product which is also an important contribution to foreign trades. According to the latest data, Turkey ranks in fifth regarding the total vineyard area and sixth in grape production in the world countries. This study aims to reveal the economic analysis of grape production. In this framework, determining the economic structures, annual activity results of vineyards, and calculating the production costs in the case of Denizli province. It was determined that grape production mostly made in aqueous conditions and goble training production was done in non-irrigated vineyards. Because of this situation, according to the wired training vineyards, it was found that the yield was about 1.6 times higher than the goble training system. It was determined that the labour force was used intensively in both production systems. However, more labour was used in the wired training vineyards than in the goble training system. It was determined that the gross production value be higher in the wired training vineyards. According to these results, it can be said that the wired training system was more advantageous regarding economic criteria.

Key words**:** *viticulture, economic analysis, production cost, labour cost*

INTRODUCTION

Viticulture in Turkey, provide the most favourable climates, as well as the gene centre of the vine, has extremely old and well-established culture of viticulture. The history of the viniculture in Anatolia is quite old, and the archaeological excavations confirm that the viniculture existence about 3500 BC. The inclusion of shapes and reliefs on grapes were the most important indicators of the culture of viniculture in the region. That the relevant figures and reliefs made with grapes in archaeological excavations in Turkey, indicating that the widespread of viticulture are the most important indicators. Indeed it has been found important prehistoric artefacts related to the vineyard during the excavations conducted in all regions in Turkey [10]. Turkey is stated as one of the higher ones in the potential of the world in grape production [1] [11]. Grapes produced in many provinces of Turkey, with the possibility to evaluate in different ways and also as an agricultural product which is also an important contribution to foreign trades. Briefly, viticulture, agricultural production is an important area for Turkey. 2017 statistics show that, Turkey ranks in the 5th regarding the vineyard area and 6th in grape production in the world. This study aims to reveal the economic analysis of grape production. In this framework, determining the economic structures, annual activity results of vineyards, and calculating the production costs in the case of Denizli province. Denizli Province covers 9.77 percent of Turkey's vineyard and carries 11.27 percent of the production alone. These number shows that Denizli province is an important location for grape production. In this study, it was aimed to compare the goble training system and wired training grape production systems economically. Within the scope of the study, crop pattern, average vineyard size, production structures, economic indicators such as gross production value and gross profit for the production period were interpreted according to the production system. According to the literature in Isparta province, studies were comparing the wired and goble training systems economically which were done by [17]. The findings obtained from this study were thought to allow to compare the profitability of investment in two provinces.

MATERIALS AND METHODS

The data obtained from the grape producers in the villages of Denizli Province. The data were obtained from face-to-face interviews using a pre-prepared questionnaire. Also, various statistics, research reports, theses and papers were used as secondary data sources. In 2017; 4.2 million tons of grapes were produced in Turkey, and 11.25% of this quantity was covered by Denizli [18]. In the selection of villages, the villages that were thought to represent the research area according to the officers whose working in the Ministry of Agricultural and Forestry. While determining the number of producers interviewed in the study, the following proportional sample volume formula was used.
If the size of the population was unknown,

$$n = t^2 pq / d^2$$

where:
n: Sample size
p: Probability of occurrence
q: 1-p (or probability of incidence)
d: accepted ± sampling error rate
t (α, sd): The critical value of t table according to the degree of freedom at the level of α significance.
Accordingly, 95 percent confidence interval and a 10 percent margin of error sample size were calculated as 96 producers. Data were gathered from producers by face-to-face surveys. The villages included in the study and the numbers of producers interviewed in these villages were given in Table 1. 52.1% of the interviewed farms had wired training grape production, and 47.90% of them had goble training system. When the distribution by districts was examined, it was seen that all of the vineyards in Buldan district produce with the wired training system.

Table 1. Numbers of interviewed producers in research districts

District	Goble Frequencies	%	Wired Frequencies	%
Buldan	-	-	48	100.00
Çal	33	94.30	2	5.70
Çivril	13	100.00	-	-
Total	46	47.90	50	52.10

Source: own calculation

The results of the face-to-face interviews were first transferred to the computer and were presented as a table with the help of various statistical package programs. These data were interpreted by using the cross-table, arithmetic and weighted averages method. Single product budget analysis method was used to determine production costs. Accordingly, the income-cost situation was calculated only for the grape, not for all crops grown in the interviewed farm. The labour force and machinery power included in the production cost in the grape production shows the amounts used in various operations. These amounts were given in hours. The calculation of the family labour wages was based on foreign labour costs in the research area. The amount of pesticide used in grape production was given as active ingredients. The amount of fertiliser used in grape production was given as the amount the sum of plant nutrients. In case of partial budget analysis, unit machine rental prices were taken as a basis in case producers use their machines. As a result of the grape production, the gross product value was calculated by multiplying the amount of crop and the sales price. Gross profit was calculated by subtracting the variable costs from gross production value [15][17].

RESULTS AND DISCUSSIONS

Table 2 contains the general characteristics of the interviewed producers. The average was 49 years, the education period was seven years, and the agricultural experience was 26 years. According to the production technique,

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it was determined that the goble training systems' grape producers be older and less educated, but their experience period was more than that of the wired training system. It was seen that the farm households were composed of four people.

Table 2. Farmers' characteristics according to the production in interviewed farms

Characteristics	Goble (N=46)		Wired (N=50)		Total (N=96)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Farmers age (year)	54.67	10.29	44.48	9.72	49.36	11.18
Farmers education (year)	6.33	2.49	7.60	3.16	6.99	2.91
Household population (person)	3.96	2.26	4.06	1.17	4.01	1.77
Agricultural experience (year)	31.09	13.08	21.46	9.34	26.17	12.26

Source: own calculation

In Table 3, the distribution of land ownership and the land structure was given in goble training system grape production. The interviewed farms have 7.15 hectares of land with an average of 9.15 plots, 48.85 percent of the lands dedicated to viticulture, 48.71 percent allocated to fields crops, 2.31 percent were covered by horticulture, and the rest of it belongs to the vegetables. The own property was widespread and constitutes 46.68 of the total cultivated land in the interviewed goble training production vineyards. Another important finding was the determination of the rental land in the production of field crops. According to the results, farms have 5.10 hectares of dry land and 2.05 hectares of irrigated land. For this reason, it can be said that producers were able to produce without irrigation or to plant crops with low water demand.

Table 3. The land presence and tenure in interviewed farms according to the goble training system

Crop pattern	Goble (N=46)							
	Plot	Own	Rented	Mutual	Irrigated	Non-irrigated	Total	%
Vineyard	0.58	3.03	0.40	0.07	0.35	3.15	3.49	48.85
Field crops	0.28	1.46	1.98	0.04	1.53	1.95	3.48	48.71
Horticulture	0.05	0.17	0.00	0.00	0.16	0.00	0.17	2.31
Vegetables	0.01	0.01	-	-	0.00	0.00	0.01	0.12
Total	9.15	4.67	2.38	0.11	2.05	5.10	7.15	100.00

Source: own calculation

In Table 4 the distribution of land ownership and the land structure was given in wired training system grape production. The interviewed farms have an average of 6.51 hectares of land consisting of 4.74 plots. The fact that the vineyard production area was higher than the goble training vineyards this can be interpreted as an indication that the grape production was the primary source of income and commercial purpose. Similarly, wired training vineyards have larger land, and this was another important indicator. The most important finding was that the amount of irrigated land in these vineyards was very high both in grape production and other agricultural activities compared to goble training producing farms. According to the structure of the land, it was determined that the farms produce on average 6.06 hectares of irrigated land and only 0.45 hectare of dry land.

Table 4. The land presence and tenure in interviewed farms according to the wired training system

Crop pattern	Wired (N=50)							
	Plot	Own	Rented	Mutual	Irrigated	Non-irrigated	Total	%
Grape	3.98	4.9	0.1	0.4	5.4	0.1	5.5	83.92
Field crops	0.38	0.3	0.4		0.5	0.1	0.7	10.24
Horticulture	0.38	0.2	0.2	0.2	0.1	0.2	0.4	5.84
Total	4.74	5.4	0.6	0.5	6.51	0.4	6.6	100.00

Source: own calculation

Table 5 shows the distribution of land ownership in all the interviewed farms. In the Denizli region, 6.8 hectares of land was owned by an average of 6.82 plots, while 66.2 percent was owned to viticulture. The fact that the vineyard production area was higher than the other agricultural activities in the examined farms can be interpreted as an indicator that grape production was the primary source of livelihood and for commercial purposes. Similarly, the fact that the land amount was too high was another critical indicator. When evaluated according to the structure of the land, it was determined that the farms produce an average of 4.1 hectares of irrigated land and only 2.7 hectares of non-irrigated land.

Table 5. The land presence and tenure in interviewed farms

Crop pattern	Total (N=96)							
	Plot	Own	Rented	Mutual	Irrigated	Non-irrigated	Total	%
Grape	4.84	4.0	0.3	0.3	3.0	1.6	4.6	66.29
Field Crops	1.52	0.9	1.1	0.0	1.0	1.0	2.0	29.59
Horticulture	0.42	0.2	0.1	0.0	0.1	0.1	0.3	4.07
Vegetables	0.04	0.0	-	-	0.0	0.0	0.0	0.06
Total	6.82	5.1	1.5	0.3	4.1	2.7	6.8	100.00

Source: own calculation

Some of the features of interviewed and information about interviewed producers were presented in Table 6 according to the grape production system. According to Table 6, 24 percent of the farms were also deal with livestock activities. It was determined that 47.8 percent of the farms engaged in dairy cattle breeding and 47.8 percent were engaged in feeder cattle breeding. According to the grape production technique, it was seen that animal husbandry was higher in goble training vineyards. It was determined that the state of training related to agriculture or viticulture in goble training vineyards be higher than wired training production.

Regarding owning non-agricultural income, 46.9 percent of the producers were found to be another source of income other than agriculture. As an income source, 55.6 percent of the non-agricultural producers were retired, 26.7 percent of them work as civil servants or contract workers, and the remaining 17.8 percent were tradesmen. According to the grape production structure, 52.2 percent of the goble training vineyards and 42 percent of the wired training vineyards have non-agricultural income. The most crucial point that attracts attention here was that 79.2 percent of the vineyards which have non-agricultural income in the production of goble training were retired, and 47.6 percent in wired training vineyards were public officials or contract workers. It can be said that the average age of producers in goble training vineyards was ten years higher than those producing wired training system. The average annual income from the non-agricultural activities of the interviewed producers was determined to TRY 6,936.42. This figure was calculated as TRY 6,932.96 for the goble training vineyards and TRY 6,939.60 for the vineyards engaged in wired training production. The ownership and use of the computer of the interviewed producers were examined and the distribution according to their production structure was given in Table 6. According to the survey, 43.8 per cent of the grape producers in the research area had computers, and only 36.5 per cent of them used computers. It was found that the rate of computer ownership and computer use was higher in the producers of wired training production. The fact that the producers producing in the wired training system were younger than goble training growers can be explained as the reason why they use the technology more.

Regarding computer use, 39.6 percent of the producers use the internet, and it was found that the rate of internet use was much higher in the wired training system producers. Producers stated that they use the internet for agricultural purposes as a second for game purposes. Only 16.7 percent of producers were reported to have the habit of buying newspapers, it seems quite a low level, but the reading rate was 45.8 per cent, which was indicating that producers have the opportunity to read in the village coffee shop or where they go. According to the grape production technique, when reading habits and reading habits were examined, it was determined that producers who produce goble training vineyards read a regular newspaper more.

Table 6. Livestock breeding, education and non-agricultural income in interviewed farms

	Goble		Wired		Total	
	N	%	N	%	N	%
Livestock breeding status	15	32.6	8	16.00	23	24.0
Dairy cattle	9	60.0	2	25.0	11	47.8
Feeder cattle	5	33.3	6	75.0	11	47.8
Other animal activities	1	6.6	-	-	1	4.4
Training of viticulture or agriculture	11	23.9	5	10.0	16	16.7
Status of having non-agricultural income	24	52.2	21	42.0	45	46.9
Retired	19	79.2	6	28.6	25	55.6
Civil servant or contract worker	2	8.3	10	47.6	12	26.7
Tradesmen	3	12.5	5	23.8	8	17.8
Average non-agricultural income (TRY)	6,932.96		6,939.60		6,936.42	
Ownership of computer	13	28.3	29	58.0	42	43.8
Use of computer	11	23.9	24	48.0	35	36.5
Having the habit of buying newspapers	9	19.6	7	14.0	16	16.7
Regularly reading newspaper rate (%)	26	56.5	18	36.0	44	45.8

Source: own calculation

The distribution of the grape varieties preferred by the interviewed producers was given in Table 7. Production was carried out with more than one variety in the vineyards. There were many varieties of grapes with local names. The most preferred Sultani Seedless grape was a standard grape variety with a good yield. The bunches were of medium size (300-400 g) and normal frequency. The grains were small (1.2-1.8 g), green-yellow, thin-skinned [3]. It matures in mid-season, and its yield varies between 5-10 tonnes ha^{-1} [9]. It was determined that 80.21 percent of the interviewed grape producers cultivate Sultani Seedless grapes. According to the production system, this ratio was seen as a highly preferred rate of 98 per cent, especially in wired training production. The

Razaki grape varieties, which were known as Anadolu Razaki, Karaburun Vine, Rezaki, Rosaki, have a larger bunches (400- 500 g), conic and infrequent branches. The grains were yellowish light green and large (5 g), long elliptical and 2 - 3 cores, sweet and odourless. The yield per hectare varies between 10-16 tonnes. Harvesting time begins at the end of August - beginning of September [9]. It was determined that 47.92 percent of the grape interview producers raise this variety. According to the production system, especially in wired training system grape producers preferred this variety with the rate of 76 per cent. Çalkarası was a type of grape used both as fresh and wine [13]. Çalkarası Denizli was one of the black varieties of local wine of our country, especially grown in Çal district and its name was taken from this district. Grains were of medium size, an ellipsoidal shape, fleshy and juicy grape variety [7]. It was determined that 14.58 percent of the interviewed grape producers cultivate this variety. It was seen that this type has a higher share with the ratio of 26.09 percent in the goble training system where the vineyards were located in Çal District. Red Globe was a new kind for Turkey, and it can be used in fresh export. It harvests in a late season. The bunch was conical, very large (1,000 g) and full grain. Grain was purplish red round, very coarse (12-14 g), 3-4 cores [12]. Results shows that 11.46 percent of the interviewed producers preferred this variety. According to the type of production, it was determined that this ratio be more preferred especially in wired training vineyards. Chamomile was hazy grey-black colour, the grains were large (6 g) and elliptical, the crust thickness was medium, the sweet flavoured, bunches were conical and large (450-550 g) [8]. Chamomile was harvesting late, at the end of September and mid-October [4]. According to the findings 10.42 per cent of the producers grown this grape variety in their vineyards. It was determined that this type be preferred only in goble training vineyards. Alphonse Lavallee was a 3-4 seeded, grape-tapered conical, coarse (550-600 g), full-grain grape variety. Grain was purplish black, flattened round and coarse (7-9 g). The harvesting period was in the middle season [12]. The study shows that 6.25 percent of the grape farmers prefer this grape variety. According to the type of production, it was determined that this ratio be more preferred in wired training vineyards. İri kara (Large black) was mostly cultivated in Eskişehir region with conic shaped rounded black grains [5]. According to the results in the research area 5.21 per cent of grape producers preferred this variety. According to the type of production, it was determined that this type be preferred in goble training vineyards. Mevlana was a variety for fresh consumption; the average bunch weight was 470 g, white grains, very large (7 g), elliptical shape. It matures at the end of August [9]. It was determined that 4.17 percent of the interviewed grape producers have this type. According to the type of production, this variety only found in the wired training production. Superior was a seedless fresh, also known as Sugraone. The bunches were large (470 g), frequent or very frequent. The grains were green-yellow, coarse (5 g), short oval and seedless. The yield per hectare was medium (12-14 tonnes). It was an early variety that harvests in late July [9]. It was determined that 4.17 percent of the grape interview producers have this type. According to the type of production, this type was seen only in wired training vineyards. Siyah Üzüm (Black Grapes) known as Siyah Parmak (black finger), functional female flowering, medium grain (346 g) and the bunches were medium-large, black colour, cylindrical grain, 2-core, fresh variety [14]. It was determined that 2.08 percent of the grape interview producers have this type. According to the type of production, this variety was only found in goble training vineyards. Apart from these, a small number of producers have also mentioned other grape varieties, such as white, Aşı Kara and Kona, which were their local names but have not been included in the study since there was no information available in the literature. Regarding grape production system wired training vineyards preferred market/ commercial varieties which have a higher market share such as sultana, Razaki, Red Globe.

Table 7. Grape varieties in the interviewed vineyards

	Goble		Wired		Total	
Grape varieties	N	%	N	%	N	%
Sultani Seedless	28	60.87	49	98.00	77	80.21
Razaki	8	17.39	38	76.00	46	47.92
Çalkara	12	26.09	2	4.00	14	14.58
Red globe	2	4.35	9	1,8.00	11	11.46
Chamomile (Öküzgözü)	10	-	-	-	10	10.42
Alphonse Lavallee	**1**	2.17	**5**	**10.00**	**6**	**6.25**
İri kara (Large black)	4	8.70	1	2.00	5	5.21
Mevlana	-	-	4	8.00	4	4.17
Süper yol (Superior-Sugraone)	-	-	4	8.00	4	4.17
Siyah Üzüm (Black Grape)	2	4.35	-	-	1	2.08

Source: own calculation

In order to obtain more quality and healthy products; the need for fertiliser, fertiliser, application method should be determined correctly. Increasing the use of fertiliser will also play an essential role in meeting the plant nutrient requirements by reducing the risks. Measures to increase fertiliser efficiency were essential both regarding the product, environmental and economic aspects [2]. Effective and balanced fertilisation with other necessary cultural processes in the vineyards improves the physical, chemical and biological structure of the soil; as well as the development of the plant ever year by regenerating plant nutrients into the soil [16][19]. For this reason, in order for the development of vineyard usually, it was necessary to return the nutrients that it removes from the soil every year to the soil. Vineyards were fertilised with both organic and inorganic fertilisers [6]. The fertiliser types, the average amount of fertiliser and hectare costs were given in Table 8 according to the production system. When evaluated in total, it was determined that the producers use 244.9 kg 15-15-15 fertiliser, 187.9 kg animal manure, 82.3 kg powder sulphur, 68.8 kg Diammonium Phosphate and 62.3 kg 33 percent ammonium nitrate per hectare regarding quantity.

Regarding the monetary value of fertilisers it was determined that the examined vineyards have the highest fertiliser cost per hectare was TRY 308.6 in 15-15-15 fertiliser, following by TRY 162.1 sulphur, TRY 83.2 potassium sulphate, TRY 72.9 Diammonium Phosphate, TRY 67.5 urea and TRY 66.7 33 per cent ammonium nitrate. Also, small amounts of ammonium sulphate, organic fertiliser, potassium sulphate, chicken manure, eco-9, 20-20-0, 26% ammonium nitrate, root fertiliser and potassium nitrate were used in the vineyards. In wired training vineyards, it was determined that the producers use 255.9 kg 15-15-15 fertiliser, 89.8 kg powder sulphur, 82.2 kg Diammonium Phosphate and 61.4 kg 33 percent ammonium nitrate per hectare regarding quantity. Regarding the monetary value of fertilisers it was determined that the examined wired training vineyards have the highest fertiliser cost per hectare was TRY 340.36 in 15-15-15 fertiliser, following by with TRY 185.9 sulphur, TRY 101.5 potassium sulphate, TRY 87.1 Diammonium Phosphate and TRY 87.1 33 percent ammonium nitrate. In goble training vineyards, it was determined that the producers use 470 kg animal manure, 226.3 kg 15-15-15 fertiliser, 69.7 kg powder sulphur and 63.9 kg 33 percent ammonium nitrate per hectare regarding quantity.

Table 8. Fertilisers types and quantities used by interviewed grape producers

Fertiliser	Goble Quantity ($kg\ ha^{-1}$)	Price ($TRY\ kg^{-1}$)	Cost ($TL\ ha^{-1}$)
15-15-15	226.3	1.18	267.0
20-20-0	15.4	0.98	15.1
(33 %) Ammonium Nitrate	63.9	1.02	65.2
Ammonium Sulphate	18.0	0.71	12.8
(26%) Ammonium Nitrate	16.2	1.40	22.7
Animal Manure	470.0	0.08	37.6
Diammonium Phosphate	46.1	1.06	48.9
Eko-9	0.00	0.00	0.00
Soil Fertilizer	07.2	1.00	07.2
Sulphur (Powder)	69.7	1.86	129.6
Organic Fertilizer	12.1	1.48	17.9
Potassium Nitrate	1.2	1.30	1.6
Potassium Sulphate	14.6	3.68	53.7
Chicken Manure	24.9	0.15	3.7
Urea	63.1	1.38	87.1
Fertiliser	**Wired Quantity ($kg\ ha^{-1}$)**	**Price ($TRY\ kg^{-1}$)**	**Cost ($TL\ ha^{-1}$)**
15-15-15	255.9	1.33	340.3
20-20-0	3.7	1.33	4.9
(33 %) Ammonium Nitrate	61.4	1.12	68.8
Ammonium Sulphate	37.2	1.12	41.7
(26%) Ammonium Nitrate	0.00	0.00	0.00
Animal Manure	22.0	0.08	1.8
Diammonium Phosphate	82.2	1.06	87.1
Eko-9	10.1	1.25	12.6
Soil Fertilizer	0.00	0.00	0.00
Sulphur (Powder)	89.8	2.07	185.9
Organic Fertilizer	37.4	1.19	44.5
Potassium Nitrate	1.8	1.25	2.3
Potassium Sulphate	26.3	3.86	101.5
Chicken Manure	18.3	0.15	2.7
Urea	37.8	1.48	55.9
Fertiliser	**Total Quantity ($kg\ ha^{-1}$)**	**Quantity ($kg\ ha^{-1}$)**	**Quantity ($kg\ ha^{-1}$)**
15-15-15	244.9	244.9	244.9
20-20-0	8.0	8.0	8.0
(33 %) Ammonium Nitrate	62.3	62.3	62.3
Ammonium Sulphate	30.1	30.1	30.1
(26%) Ammonium Nitrate	6.0	6.0	6.0
Animal Manure	187.9	187.9	187.9
Diammonium Phosphate	68.8	68.8	68.8
Eko-9	6.3	6.3	6.3
Soil Fertilizer	2.7	2.7	2.7
Sulphur (Powder)	82.3	82.3	82.3
Organic Fertilizer	28.0	28.0	28.0
Potassium Nitrate	1.6	1.6	1.6
Potassium Sulphate	22.0	22.0	22.0
Chicken Manure	20.8	20.8	20.8
Urea	47.2	47.2	47.2

Source: own calculation

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Regarding the monetary value of fertilisers, it was determined that the interviewed goble training vineyards have the highest fertiliser cost per hectare was TRY 267.0 in 15-15-15 fertiliser. It was calculated that sulphur cost was TRY 129.6, urea cost was TRY 87.1, 33 percent ammonium nitrate cost was TRY 65.2 and potassium sulphate cost was TRY 53.7 per hectare.

Table 9 shows the grape production technique in the vineyards according to the production system. In the interviewed wired training vineyards, the soil processing activities were done on average six times per year from February to May. Plough, disc harrow, cultivator and roller were used for soil cultivation. In the wired training vineyards, it was found that the fertilisation was done at 2.06 annual averages from January to June. It was determined that 103.6 kg of nitrogen, 89.9 kg of phosphorus, 42.1 kg of potassium and 89.8 kg of sulphur be used per hectare as plant nutrient during the production period. In the wired vineyards fertilisation was done by manually or fertiliser machine, cultivator and drip irrigation system and chemical spraying was done with the help of an atomiser averagely 15 times between March and September. It was determined that producers use an insecticide, fungicide and metallic copper against various diseases and pests. In the wired training vineyards producers used 3.29 kg of insecticide, 1.58 kg of fungicide and 5.17 kg of metallic copper averagely in the research area. The pruning was carried out on average once a year in January with the pruning shears. In the wired vineyards hoeing was done 1.41 times averagely between the months January and April with a hoe, rotavators or cultivator. It was determined that irrigation was done eight times a year between May and September by drip irrigation. In the research region, the grape harvest was made in September, and the transportation was carried out by the merchant. In the goble training vineyards, the soil processing activities were done on average four times per year from March to June. Plough, disc harrow, cultivator and roller were used for soil cultivation.

Table 9. Production technique in interviewed vineyards

Operation	Time	Number	Tool	Quantity
Goble				
Soil preparation	March-June	4	Plough, disc harrow, cultivator, roller	-
Fertilisation	January-June	1.26	Manually, fertilisation machine, cultivator, atomiser	N 106.6 - P 64.2 - K 44.5 - S 69.7 Kg ha^{-1}
Pesticide spraying	March- September	6	Atomizer, pulverisator / back pomp	7.27 İnsecticide - 3.32 Fungicide 30.69 metallic copper (Kg ha^{-1})
Pruning	February- March	1	pruning shears	-
Hoeing	March-June	1.47	manually, hoeing machine, cultivator	-
Irrigation	June- July	0.54	drip, flood and spraying irrigation	-
Harvest	September	1	merchant	-
Transport	September	1	Trailer	-
Wired				
Operation	**Time**	**Number**	**Tool**	**Quantity**
Soil preparation	February- May	6	Plough, disc harrow, cultivator, roller	-
Fertilisation	January-June	2.06	Manually, fertilisation machine, cultivator, drip irrigation	N 103.6 - P 89.9 - K 42.1 - S 89.8 Kg ha^{-1}
Pesticide spraying	March- September	15	Atomizer,	3.29 İnsecticide - 1.58 Fungicide - 5.17 metallic copper (Kg ha^{-1})
Pruning	January	1	pruning shears	-
Hoeing	January- April	1.41	manually, hoeing machine, cultivator	-
Irrigation	May- September	8	Drip and flood irrigation	-
Harvest	September	1	merchant	-
Transport	September	1	Trailer	-

Source: own calculation

In the goble training vineyards, it was found that the fertilisation was done at 1.26 annual averages from January to June. It was determined that 106.6 kg of nitrogen, 64.2 kg of phosphorus, 44.5 kg of potassium and 69.7 kg of sulphur were used per hectare as plant nutrient during the production period.

It was determined that fertilisation was done by manually or fertiliser machine and cultivator. It was determined that pesticide spraying was done with an atomiser average six times between March and September in the goble training vineyards. It was determined that producers use an insecticide, fungicide and metallic copper against various diseases and pests. In the goble training vineyards, producers used 7.27 kg of insecticide, 3.32 kg of fungicide and 30.69 kg of metallic copper averagely in the research area. The pruning was carried out on average once a year in February or March with the pruning shears. Hoeing was done 1.47 times between March and June averagely with a hoe, rotavators or cultivator. It was determined that irrigation was done 0.54 times a year between June to July with the drip irrigation system or traditional flood irrigation. In the research region, the grape harvest was made in September, and the transportation was carried out by the merchant (Table 9).

Table 10. Variable costs in grape production according to the production system in interviewed vineyards

Cost types	Goble		Wired		Total	
	Amount (TRY ha^{-1})	%	Amount (TRY ha^{-1})	%	Amount (TRY ha^{-1})	%
Labour cost	2,408.3	56.13	4,013.7	**61.98**	3,419.0	60.34
Fertilizer cost	774.6	18.05	958.9	14.81	890.6	15.72
Pesticide cost	391.4	9.12	342.1	5.28	360.3	6.36
Irrigation cost	46.9	1.09	294.6	4.55	202.8	3.58
Machinery cost	368.6	8.59	434.2	6.70	409.9	7.23
Other variable cost	300.5	7.00	432.4	6.68	383.5	6.77
Variable cost	4,290.3	100.0	6,475.9	100	5,666.2	100.0

Source: own calculation

Table 10 shows the distribution of variable cost according to the production system. In general, it was determined the interviewed vineyards have to TRY 5,666.2 total variable costs. 60.34% of the variable costs were composed of labour costs, 15.72% were fertiliser costs, 7.23% were from machinery cost, 6.77% were from other variable cost, 6.36% were pesticide costs and the remaining 3.58% were from irrigation costs in the grape production. According to the production system, it was determined that the cost of labour in wired training be higher in both proportional and value (Table 10).

Also, fertiliser, irrigation, shrinkage and other costs were higher in wired training than the goble training vineyard as the monetary value (Table 10).

Table 11. Profitability indicators in interviewed vineyards

Profitability indicators	Goble	Wired	Total
Yield (tonnes ha^{-1})	4.86	18.33	13.34
Grape selling price (TRY kg^{-1})	1.79	0.74	1.24
Gross production value (TRY ha^{-1})	8,705.4	13,565.9	16,544.8
Variable cost (TRY ha^{-1})	4,290.3	6,475.9	5,666.2
Gross profit (TRY ha^{-1})	4,415.1	7,090.0	10,878.6

Source: own calculation

Table 11 shows some profitability indicators according to the grape production system. In total vineyard had 13.34 tonnes of grape yield, they sold the grape to an average of TRY 1.24, and they had a gross production value of TRY 16,544.8 per hectare. After deducting the variable costs, the gross profit of the grape production was calculated as TRY 10,878.6. This rate was found to be TRY 7,090 per hectare for wired training production and TRY 4,415.1 for in goble training production (Table 11).

CONCLUSIONS

The purpose of this study was to reveal the economic analysis of the vineyards by comparing wired and goble training production system in Denizli Province. The data of the study was obtained from grape producers of two different production system in Denizli Province. It was determined that grape production mostly made in aqueous conditions and goble training production was done in non-irrigated vineyards. Because of this situation, according to the wired training vineyards, it was found that the yield was about 1.6 times higher than the goble training system. It was determined that the labour force was used intensively in both production systems. However, more labour was used in the wired training vineyards than in the goble training system. When an evaluation was made regarding profitability indicators, It was determined that the gross production value be higher in the wired training vineyards. According to these results, it can be said that the wired training system was more advantageous regarding economic criteria.

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UPDATING SOIL TYPES DIFFERENCES OF ERODED SLOPE LANDS WITH DIGITAL ELEVATION MODEL (DEM)

Valerii KOLIADA, Pavlo NAZAROK

National Scientific Center "Institute of Soil Science and Agrochemistry Research named after O.N. Sokolovsky", 4 Chaikovska, str., Kharkiv, 61024, Ukraine. Phone/Fax: +380 (57) 704-16-69. E-mail: koliadavalerii@gmail.com, pavelnazarok@gmail.com

Corresponding author: koliadavalerii@gmail.com

Abstract

The purpose of this work is to demonstrate the algorithm of actions for modern erosion-combating optimization of the land use structure by the example of a specific 30.01 ha study area with the help of updating the eroded soil type differences. Description and refinement of soil type difference was carried out by the way of making soil profiles, half-soil profiles and further surface interpretation on a base of laboratory soil samples results. The creation of a generalized digital elevation model (DEM) also has been taken into account to highlight the determination of slope gradient and the shape of the slope using the archive cartographic material of the scale of 1:10 000. Based on the obtained map of the slopes gradient and the generalized digital model of relief, contours of additional soil type differences were revealed, and appropriate recommendations for their use to precise farming, depending on their belonging to a certain eco-technological groups were presented. Such kind of information in the form of data files provides necessary support for programming the input of fertilizers or soil tillage operations on slopes in system of precise farming.

Key words**:** *erosion, digital elevation model (DEM), soil differences, agro-technological groups*

INTRODUCTION

Water erosion on the slope lands is not a degradation process that had happen in Ukraine by accident. It is a natural and inevitable result of mismanagement of agriculture production system during the last 50 years [3]. For the modern sector of agricultural production in Ukraine that is characterized by a mosaic structure of land use, caused by the consequences of the reform in 1990-ties aimed at dividing the lands of collective farms into appropriate set of private ownership plots. At the same time, a certain part of the land plots continues to be used by the owners, and some are leased to large producers of agricultural products with the possibility of further prolongation with getting a maximal profit.

Such economical conditions and a relatively high number of sloping lands in agricultural production provoke a spreading of erosion processes in Ukraine.

The fact that the soil protection system of land use in slope areas includes previously eroded erosion structures (in the form of trees, terraces, forest belts, etc.) in most cases have become unusable and operated in limited mode (or even does not functioning at all). Taking into account this fact we can confirm conclusions about the prevailing prerequisites for activating the intensification of run-off processes or otherwise, high demand in implementation of soil-conservative contour reclamation system of land use on these territories [10].

In conditions of a limited financial source of material assets, owners of slope lands prefer instead of additional capital investments to combat the emergence and development of water erosion processes, to concentrate production on more plain territories and to take the slope areas out of circulation. At the same time there is a saving of sources and resources, which can be directed to other needs of the economy, namely, the purchase of fertilizers, seeds and fuel.

Among the common ways to combat erosion processes, the organizational and agro-technical measures in the arsenal of land users can be noted, including the soil-conservative contour reclamation system of land use mentioned above, change in the direction of vehicle movement during tillage; removal of the most steep part of the field from the land structure; optimal timing of sowing; regime of moisture supplement with crop rotation selection and the way of processing agricultural machinery and others [9].

MATERIALS AND METHODS

The research method included geographic information analysis of the terrain using the Quantum GIS® program [1, 2, 7]. The digital terrain model (DEM) was built on the basis of topographic map data of scale 1: 10 000. Soil differences were determined with the help of a morphological description of the embedded sections, the boundaries between the differences were determined by describing the half-profiles and soil surface inflows, the eco-technological groups were determined on the basis of the slope steepness gradient and degree of soil erosion.

The study site was presented by a field site under hayfields with an area of 30.01 ha on the slope of a convex shape (VV classification according to FAO) of the southwest exposure with an average steepness value of up to 3 degrees [5, 8]. Type of the soil – is a chernozem ordinary loamy with light-clay composition with different degrees of soil erosion.

The purpose of this work was to demonstrate the algorithm of actions for modern erosion – combating optimization of the land use structure by the example of a specific field plot of an irregular geometric shape with an area of 30.01 ha, by clarifying and refining the eroded soil differences and creating a digital relief (elevation) model (DEM).

Study area has been chosen among many others in east-south part of Harkiv region, in Barvinkove town, Ukraine (Fig.1).

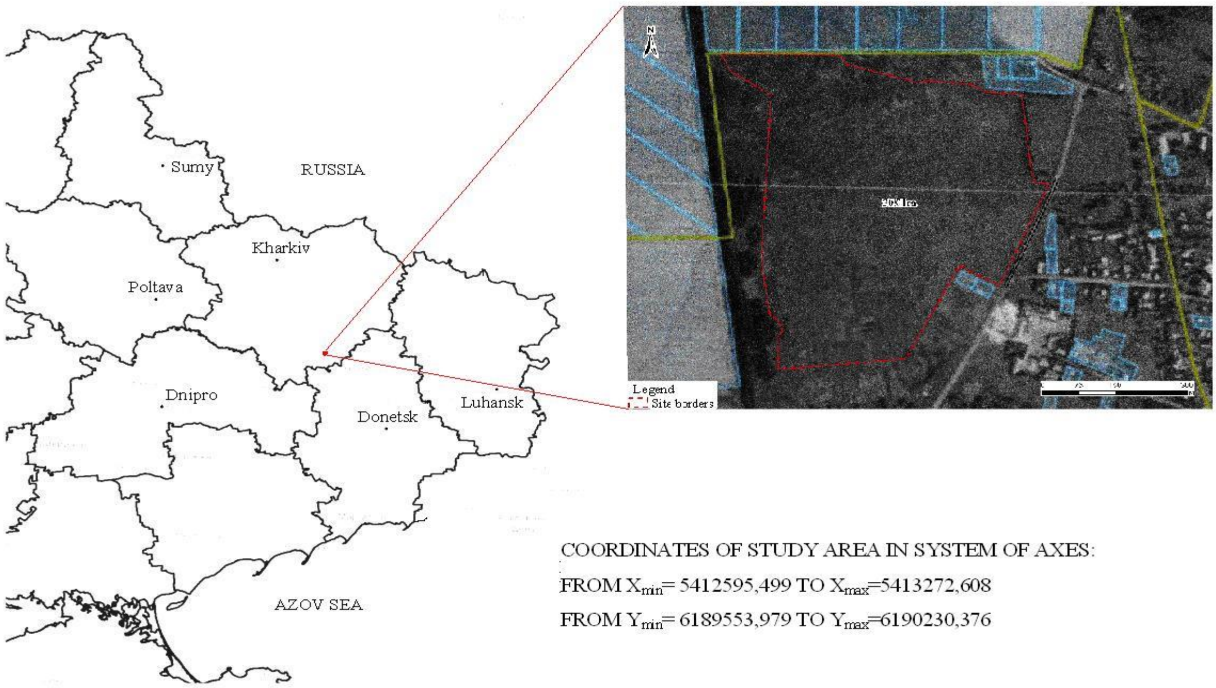

Fig.1. Map of study area (t. Barvinkove, Kharkiv region, Ukraine, 2017).
Source: Google and Bing Satellite Imagery

In order to increase the information content of the cartographic material, soil profiles were indicated on all the schemes and maps, although the places of their bookmarking varied as the soil cover was studied with the help of soils samples analyze from soil profiles and half-profiles based on the obtained generalized digital elevation model presented on cartographic scheme (Fig. 4).

To create such scheme two transitional maps in QGIS environment were created (Fig. 2).

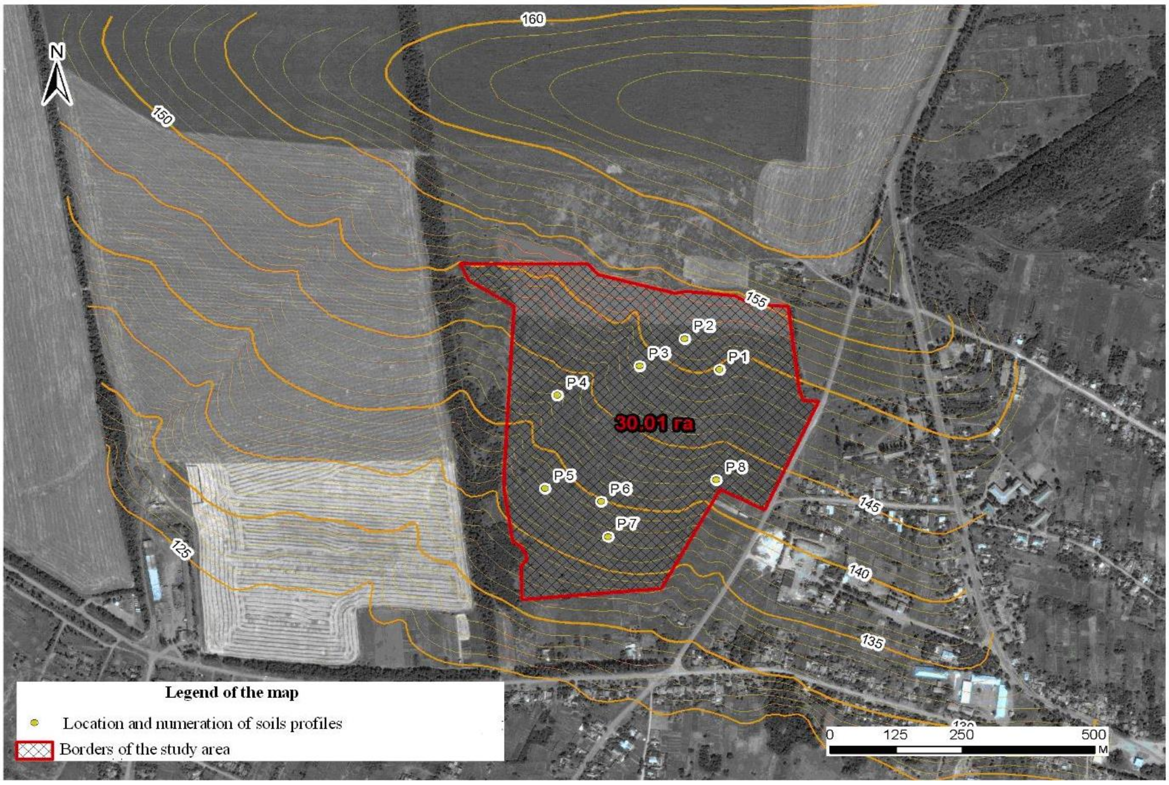

Fig.2. The map of the study area with location of soil profiles and allocated diagonals of altitudes (topographic map of scale 1:10 000).
Source: Google and Bing Satellite Imagery

RESULTS AND DISCUSSIONS

Based on the geographical information analysis of the terrain, the distribution of the territory was carried out according to existing altitudes and appropriate requirements for implementation in precise farming were revealed. With the help of mathematical modeling of erosion processes, cartograms of potential soil erosion for the territory of the site have been created and zones of increased erosion hazard with potential soil erosion of up to 3-5 t/ha per year have been identified.

It is established that according to analyses of selected soil samples from soil profiles of this area such three types of soil are presented below:

(i)Chernozem ordinary slightly eroded heavy loam and light-clay (code 65 e);

(ii)Chernozem ordinary moderately eroded heavy loam and light-clay (code 66 e);

(iii)Meadow (deposited) chernozems and meadow chernozem heavy loam and light clay soils (code 209 e).

The next step of the research is the generalization of the images obtained on the basis of the digital elevation model (DEM) of relief with the selected soil profiles spots and slope gradient degree [4, 6]. Results of such interpretation are presented below (Fig.3).

Since the aim of this study was to describe in detail the algorithm for improving the soil differences based on the additional material obtained in the form of the results of the geo-morphological description of soil profiles, half-profiles and laboratory analysis of the samples, no detailed explanation was planned for the origin of theses identified eroded soils.

It is possible to assume at the hypothesis level the fact that possible erosion preventive influence of nearby relief elements such as roads, forest belts, and trees was not as efficient as it should be and provoked soil run-off processes during the last years.

Prior to research, the land in this area was mostly of the heavy loam and light clay chernozem but without considering the deg
ree of run-off processing.

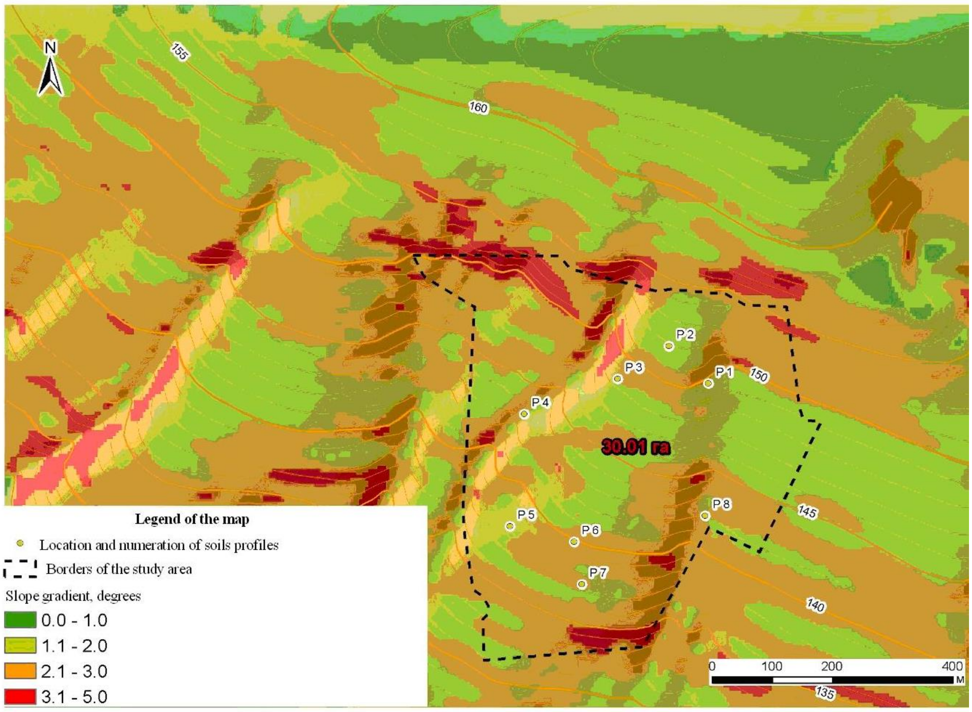

Fig.3. Map of the digital relief map for the research site with the allocation of slope gradient (in degree) in current QGIS version.

As a result of the processing of laboratory analysis data and descriptive information on soil profiles, it was possible to distinguish three soil differences, which differed in humus content, degree of run-off processes, and consequently in the thickness of the humified upper soil profile.

The generalization of the research area included the definition of the shape of the slope, the identification of transitional zones for soil material, as well as the removal and sedimentation zones (Fig.4).

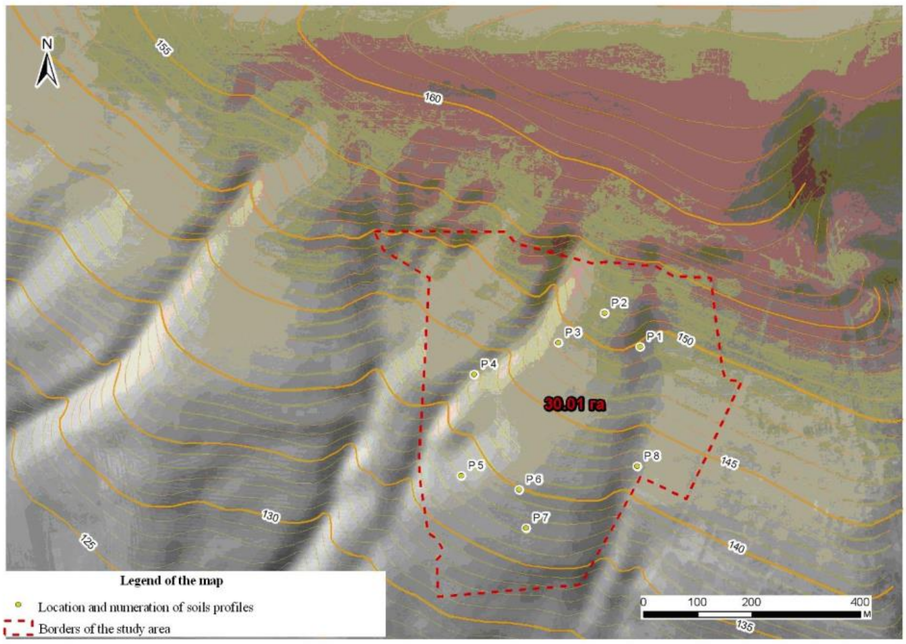

Fig.4. Cartographic scheme of generalized digital elevation model with positive (light) and negative (dark) relief curvatures of research area in current QGIS version.

It is established that the whole surface of the slope is represented by differences of different erosion degree. The zone of removal of soil materials is formed in the upper part of the site (spots of soil profiles 2 and 3 on the scheme), transition (run-off) passes from top to bottom in the western and eastern parts (spots of soil profiles 1 and 4), dividing the site into th

ree parts visible on the scheme. In these parts of the plot, visible traces of flushing are shown leading down the slope. The tabulation of other spots (soil profiles 5-7) confirmed the assumption of the continuation of the zone of removal on south of the lower boundary of the experimental site with the accumulation of soil material on the territory next to spot of soil profile 8.

The surface has an aligned character with an general inclination angle of from 1-2 to 2-3 degrees, in contrast to the negative curvatures of up to 3-5 degrees in north-west upper top and south east bottom parts of study area, which borders on the road – a natural barrier to transition and accumulation of the removed soil material. The analysis of the percentage ratio of soil differences showed that chernozem ordinary slightly eroded heavy loam and light-clay (code 65e) occupies 62.3% of the site area; chernozem ordinary moderately eroded heavy loam and light-clay (code 66e) occupies 37.0% of the site area; meadow (deposited) chernozem and meadow-chernozem heavy loam and light-clay soils (code 209e) - the area of 0.7 % of the site area (Fig.5).

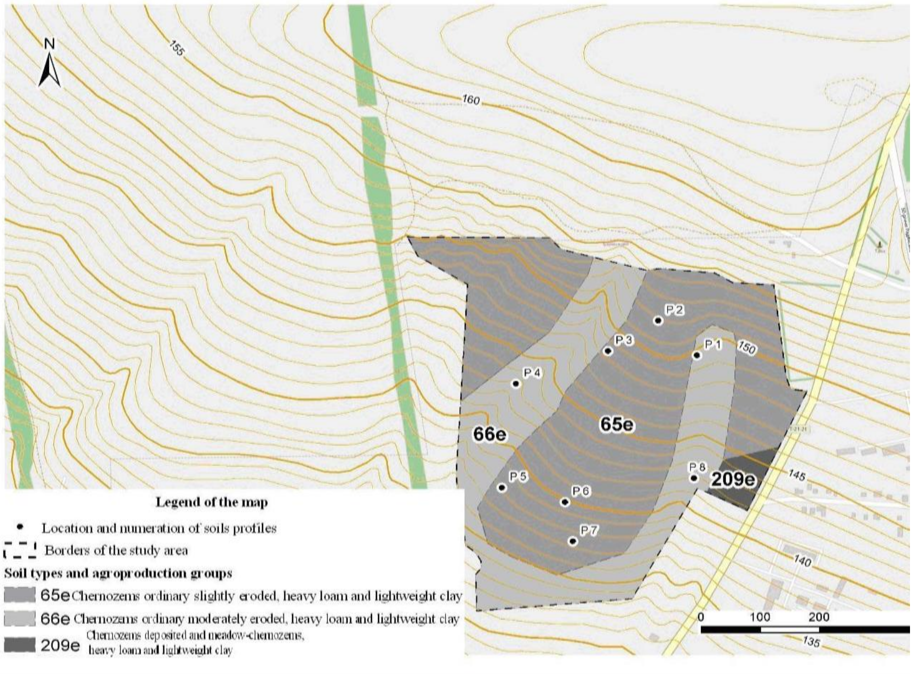

Fig.5. Updated mapping scheme of study area with selected soil differences in current QGIS version.

Since all the listed soil types are situated on the slopes with gradient from 0° to 5°, they belong to the two eco-technological groups. The first eco-technological group of soils consists from lands with steepness of slopes 0-3°. In the frame of this group – are lands that suitable for intensive use in agriculture. Lands of this group are not or subject to weak water erosion with a length of the runoff line is 300-400 meters and potential intensity of soil run-off is nearly 5 t/ha per year.

The second eco-technological group consists of lands that are subject to weak and moderate soil erosion. Slope gradient varies from 3 up to 5°. The length of the runway is 400-600 meters. Potential soil run-off intensity does not exceed 6-10 t/ha per year.

The last one – third eco-technological group presents lands with slope gradient more than 5°. The length of the run-off exceed 600 meters and potential soil run-off intensity exceed 10 t/ha per year. In case of further plans for their cultivation and other technological operations strongly recommended withdraw them from agriculture production for the amelioration and "forestization" periods. The lands are presented here with moderately and highly eroded soil types with no possibility to organize tillage and other technological operations.

After determination within a slope a set of plots with high amount of ravines on a small scale, next part of activities should include a territory of a large scale terrain for a whole area of watershed.

Since first eco-technological group of lands has almost no limitations for a crops growing, for a second one a recommended minimal percentage of perennials is above 50 % and crops rotations oriented on soil protection and excluding crops, growing in wide inner rows (sunflower, beet, corn and other).

According to all stated above, crops cultivation on slopes should be based on biological and technological soil-protecting principles. Hayfields, as well as perennials in crops rotation, provide additional amount of nitrogen and soil organic matter. This is strengthening the surface with cover in form of roots and crops residues and help to reduce previous dynamic of erosion processes.

This data and information about area percentage of different soil erosion degrees are present a valuable tool to take into account at the preparatory stage of optimization of eco-technological groups of particular field in the system of precise farming.

CONCLUSIONS

Modern land use, based on outdated schemes of production sites location, requires their verification in order to refine the degree of developing dynamics of erosion processes and last information about the area of eroded soils. One of the ways of such check-in is to refine the data about the differences between results of soil run-off erosion processes, whose can be eliminated by input of fertilizers after implication in operational programs of precise agriculture.

DEM (digital elevation model) is lined up with other software environments for downloading into the land-use optimization technology or software; DEM in such case clearly shows the classification of the study area slope gradient forms; borders between different eroded soil types and organize appropriate soil-protective land use.

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RAPESEED OFFER OF OLT COUNTY, IN NATIONAL AND REGIONAL CONTEXT (2008 – 2016)

Dragoș Mihai MEDELETE[1], Radu Lucian PÂNZARU[1], Dan BODESCU[2]

[1]University of Craiova, Faculty of Agronomy, 19 Liberty, 200421, Craiova, Romania, Phone: +40 741 180 976, Fax: + 40 251 418 475, Emails: medelete@yahoo.com, rlp1967craiova@yahoo.com
[2]USAMV Iași, Faculty of Agriculture, 3 Mihail Sadoveanu, Iași, Romania, Phone/+40 744 708 173, Fax +40 232 219 175, Email: danbodescu@uaiasi.ro

Corresponding author: rlp1967craiova@yahoo.com

Abstract

Due to its characteristics, Olt County has a high potential for agricultural activity. Starting from this, adding the regional framework of existence, the paper presents the rapeseed offer in the context in which this culture is currently an extension. Regarding the cultivated area, the following aspects were highlighted: at national level, the indicator variation of amplitude was 432,035 ha (4.10 times for the minimum level of indicator, 19.60% decrease when is compared to the maximum level for the indicator); there is a variation of amplitude at regional level of 48.306 ha, which was a increase of 3.20 times the minimum level (2013), and a decrease of 23.81% when we compare to the maximum level (2010), at the county level the variation amplitude of the surface area was 23,904 ha, which exceeded the minimum level of indicator (2012) by 3.56 times and was 21.92% lower than the maximum level (2010). Regarding total rapeseed production, there is a national variation amplitude of 1,135,268 t, which exceeded 7.21 times the minimum (2012) and was lower by 12.19% of the maximum term (2016); at regional level, the variation amplitude was 91,440 t, which exceeded 4.71 times the minimum term (2013) and was lower 17.33% with the maximum level (2016); at the county level: the recorded amplitude reached 41,675 t, which exceeded the 4.46 times the minimum term (2012) and was lower than the maximum term (2010) by 18.34%. If we refer to the average production yield per unit of production (kg / ha), the following conclusions can be drawn: at national level, the variation amplitude was 1,478 kg / ha, which exceeded 1.09 times the minimum (2009) was lower than the maximum term (2016) by 47.87%; at regional level the indicator has a variation amplitude of 1,415 kg / ha, which exceeded the minimum period (2013) of 1.11 times and was lower compared to the maximum period (2016) by 47.30%; at the county level, the amplitude of variation of the indicator was 1,255 kg / ha, which was lower than both the minimum (2013) and the maximum (2016) with 0.87 and 50.22%. Olt County represents a decisive producer of rapeseed for the Region South West Oltenia, by the weights held at the cultivated area level (47.63%) and the total production (46.44%). The decrease in the share for total production compared to the cultivated area at regional level, is explained by lower average yield per hectare for the county with 0.33% compared to the regional one.

Key words*: *rapeseed, offer, average production, total production, area

INTRODUCTION

Rapeseed (Colza or Autumn Rapeseed) is at the time, one of the most important oleic species worldwide, growing for 42-48% oil-rich seeds, oil used in human food, margarine and in industry [9]. The functional properties of rapeseed protein isolate (RPI) has limited its utilization by the food industry [6].

Autumn rapeseed for oil is important as industrial raw material, food, animal feed and agro-technologically [2]. It can be shown that from a tone of rapeseed, 42% is used for oil production, and 56% for the production of fodder used in the feeding of various species (cattle, pigs, poultry). Rape oil has the iodine index 94-112 and can be used in the textile, leather, plastic, lacquer, paints, inks, detergents, printing, lighting or lubricating oils, paint oil, candles, in the manufacture of antifouling agents, as an adjuvant to pesticides, as hydraulic fluids. The fortified rapeseed oils revealed higher antioxidant capacity and an increase in oxidative stability in comparison with the refined rapeseed oil [7].

By its specificity, rapeseed is part of the oleaginous plant line, which is based on the production of raw materials made from sunflower, soybean, oil rapeseed and castor oil [8].

The rapeseed is a plant specific to the temperate climate with mild winters, cool and humid summers, being one of the world's most important species plant for oil, cultivated for its oil rich seeds [3].

For increasing rapeseed economic yield in farmer's fields, it needs to promote their technical knowledge about crop management too [1]. Floral bud number determines seed yield potential of rapeseed [4].

The variation in annual yields for agricultural crops and livestock production leads to a variable agricultural products supply.

In the long run, the supply of agricultural products is relatively stable, depending on the volume of annual agricultural produce, the level of stocks accumulated over time, the impact of agricultural policies etc.

So, the supply depends on production, and has different relation to demand depending on a number of conditions and particularities of agricultural products, depending on the level of solvency of the demand, the psychological factors etc.

MATERIALS AND METHODS

For the conventional work there were used classical economic indicators, cultivated area (ha), total production (t) and average yield (kg / ha). These indicators are presented for three reference levels: national level (Romania), regional level (South West Oltenia Region), county level (Olt County). Based on this, the comparison (%) between the three levels was achieved: the regional one compared to the national one, the county one with the regional ones. The dynamic series analyzed consists of nine terms, i.e. the time period between 2008 and 2016. The method of analysis used was the comparison. This method, appreciates the results of an agricultural holding, and compares them with the reference bases that can be called. The comparison can be made in time, in space, or it can be a mixed one [5].

RESULTS AND DISCUSSIONS

Table 1 shows the data on the evolution of the areas planted with rapeseed during the period 2008-2016 [10].

Table 1. Cultivated area (ha)

Year	National level		South West Oltenia region			County Olt		
	Eff.*	Dynamic Ibm**	Eff.*	Dynamic Ibm**	% compared to the national level	Eff.*	Dynamic Ibm**	% compared to the regional level
2008	364,978	100	32,939	100	9.02	16,559	100	50.27
2009	419,900	115.05	35,594	108.06	8.47	19,254	116.28	54.09
2010	537,330	127.97	63,395	178.11	11.79	30,613	158.99	48.29
2011	392,668	73.08	36,227	57.14	9.23	14,143	46.20	39.04
2012	105,295	26.82	15,539	42.89	14.76	6,709	47.44	43.18
2013	276,596	262.69	15,089	97.10	5.46	8,730	130.12	57.86
2014	406,705	147.04	21,414	141.92	5.27	11,072	126.83	51.70
2015	367,885	90.46	31,625	147.68	8.59	15,153	136.86	47.91
2016	455,953	123.94	41,187	130.24	9.03	17,325	114.33	42.06

Source: *http://statistici.insse.ro/shop/index.jsp?page=tempo3&lang=ro&ind=AGR108A (20.112017)
** own calculation.

At national level, the area planted with rapeseed ranged from 105,295 ha in 2012 to 537,330 ha in 2010. From the surface point of view, the years can be grouped as follows: with areas up to 300,000 ha - 2012 and 2013 (276,596 ha); with areas ranging from 300,001 to 400,000 ha - 2008 (364,978 ha), 2015 (367,885 ha) and 2011 (392,668 ha); with areas over 400,000 ha - 2014 (406,705 ha), 2009 (419,900 ha), 2016 (455,953 ha) and 2010 (537,330 ha). The evolution over time of the indicator was uneven, characterized by increases from 2008 to 2010 (+15.05 and + 27.97% compared to the terms

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of comparison), decreases in 2011 and 2012 (-26.92 and -73.18%), increases in 2013 and 2014 (+162.69 and + 47.04%), decreases in 2015 (-9.54%) and increases in 2016 (+ 23.94%).

For the South West Oltenia Region, the cultivated area recorded an extreme of 15,089 and 63,395 ha for the years 2013 and 2010. There are years when the indicator did not exceed 25,000 ha (2012 - 15,539 ha and 2014 - 21,414 ha), and years with surface levels from 25,001 to 45,000 ha (2015 - 31,625 ha, 2008 - 32,939 ha, 2009 - 35,594 ha, 2011 - 36,227 ha and 2016 - 41,187 ha).

If we refer to the evolution of the indicator, for the period 2008-2016, its non-uniform trend is observed.

After a two-year period (2009 and 2010), when the indicator is overtaking the reporting bases (1.08 and 1.78 times respectively), there is a three-year period in which it decreases (2011-2013, decreases by 42.86, 57.11 and 2.90 % compared to the terms of reference), then three years in which the trend is upward (2014-2016, 41.92, 47.68 and 30.24% exceedance levels).

Olt County is characterized by variations in the area from 6,709 ha in 2012 to 30,613 ha in 2010. Only in 2013, under 10,000 ha (8,730 ha) were cultivated, and for the rest of the years the dynamic series indicator was between 10,001 and 20,000 ha as follows: 11,072 ha in 2014, 14,143 ha in 2011, 15,153 ha in 2015, 16,559 ha in 2008, 17,325 ha in 2016 and 19,254 ha in 2009.

As a result of the state of affairs, it can be estimated that the evolution of the indicator was fluctuating: increases in 2009 and 2010 by 16.28 and 58.99% compared to the comparison term, decreases for 2011 and 2012 (-53.80 and -52.56% respectively) increases from 2013 to 2016 (outturns of 1.30, 1.26, 1.36 and 1.14 respectively of the bases of comparison).

The region cultivated between 5.27 and 14.76% of the surface area of rapeseed at national level (2014 and 2012 respectively). For the rest of the dynamic series, there is still a level comparable to 2014 (5.46% in 2013) and a level that shows a share higher than 10% (2010 - 11.79%).

The other terms of the dynamic series ranged from 6% to 10% as follows: 8.47% in 2009, 8.59% in 2015, 9.02% in 2008, 9.03% in 2016, 9.23% in 2011 (Figure 1). For Olt County, fluctuating contributions are as follows: below 40% for 2011 (39.04%), between 40 and 50% for 2016, 2012, 2015 and 2010 (42.06, 43.18, 47.91 and 48.29% respectively), over 50% in the years 2008, 2014, 2009 and 2013 (50.27, 51.70, 54.09 and 57.86%, respectively - Figure 1).

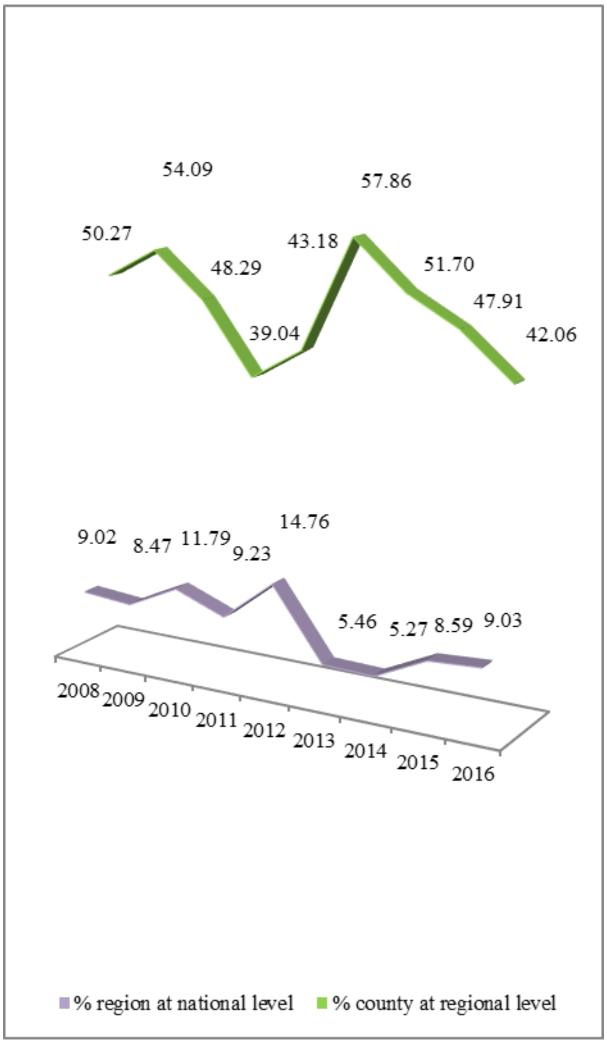

Fig. 1. South West Oltenia, Olt County
- weights within the national and regional area (%)
Source: Own calculation and design.

The data for total production are presented in Table 2 [10].

Total rapeseed production in Romania ranged between 157,511 t in 2012 and 1,292,779 t in 2016.

Table 2. Total production (t)

Year	National level		South West Oltenia region			County Olt		
	Eff.*	Dynamic Ibm**	Eff.*	Dynamic Ibm**	% compared to the national level	Eff.*	Dynamic Ibm**	% compared to the regional level
2008	673,033	100	59,539	100	8.85	27,429	100	46.07
2009	569,611	84.63	50,568	84.93	8.87	25,064	91.38	49.56
2010	943,033	165.56	109,138	215.82	11.57	51,029	203.59	46.76
2011	738,971	78.36	60,912	55.81	8.24	27,113	53.13	44.51
2012	157,511	21.31	20,303	33.33	12.89	9,354	34.50	46.07
2013	666,097	422.89	19,156	94.35	2.87	11,049	118.12	57.68
2014	1,059,121	159.00	51,502	268.86	4.86	27,826	251.84	54.03
2015	919,473	86.81	73,621	142.95	8.01	35,379	127.14	48.06
2016	1,292,779	140.60	110,596	150.22	8.55	43,681	123.47	39.49

Source: *http://statistici.insse.ro/shop/index.jsp?page=tempo3&lang=ro&ind=AGR109A (20.112017)
** own calculation

For the rest of the dynamic series, the following positions were recorded: between 500,000 and 700,000 tons: 2009, 2013 and 2008 (569,611, 666,097 and 673,033 t respectively); from 700,001 to 1,000,000 t: 2011, 2015 and 2010 (738,971, 919,473 and 943,033 t respectively); over 1,000,000 t - 2014 (1,059,121 t). If we refer to the dynamics of the indicator, we see the alternation of the periods of decrease and increase of total production as follows: -15.37% in 2009, + 65.56% in 2010, -21.64% in 2011, -78.69% in 2012, + 322.89% in 2013, + 59.0% in 2014, -13.19% in 2015 and + 40.60% in 2016.

At regional level, the total yield of rapeseed ranged from 19,156 t in 2013 to 110,596 t in the year 2016. With regard to the situation specific to the other terms of the dynamic series, the following positions are found: from 20,000 to 61,000 t in the years 2012, 2009, 2014, 2008 and 2011 (20,303, 50,568, 51,502, 59,539 and 60,912 t respectively); over 73,000 t in the years 2015 and 2010 (73,621 and 109,138 t respectively). If we analyze the dynamics of the indicator, we can observe its fluctuating evolution, with declining or increase compared to the reference period: 2009, 2011, 2012 and 2013 (-15.07, -44.19, -66.67 and -5.65% respectively); 2010, 2014, 2015, and 2016 (2.15, 2.68, 1.42, and 1.50 times).

For Olt County, total rapeseed production had variable levels ranging from 9,354 tons in 2012 to 51,029 tons in 2010. For the other component sequences of the dynamic series, positions are as follows: below 20,000 t - 2013 (11,049 t); between 20,000 and 30,000 t for 2009, 2011, 2008 and 2014 respectively (25,064, 27,113, 27,429 and 27,826 t); from 30,001 to 44,000 t in the years 2015 and 2016 (35,379 and 43,681 t, respectively). The dynamics of total rapeseed production in Olt County is characterized by a fluctuating evolution. In this respect, it is noteworthy: the 2009 decrease (-8.62% compared to the previous term of the dynamic series), the increase for 2010 (2.03 times the reporting base), the downward trend of 2011 and 2012 (-42.87 and -65.50% compared to the terms of reference), the growth period of 2013, 2014, 2015 and 2016 (+18.12, +151.84, +27.14 and + 23.47% respectively).

Regarding the regional and county contributions to the national and regional level of the indicator (Figure 2) it can be seen that: at national level, the region had variable contributions (weights): below 5% for the years 2013 and 2014 (2.87% respectively, between 5% and 10% (2015, 2011, 2016, 2008 and 2009 - 8.01, 8.24, 8.55, 8.85 and 8.87% respectively), over 10% (2010 and 2012 - 11.57 and 12.89%, respectively) ; at regional level, the county is registered with variable contributions (contributions) as follows: below 40% in 2016 (39.49%), between 40 and 50% in 2011, 2008, 2010, 2015 and 2009 (44.51, 46.07, 46.76, 48.06) and 49.56% respectively), over 50% in 2014 and 2013 (54.03 and 57.68% respectively).

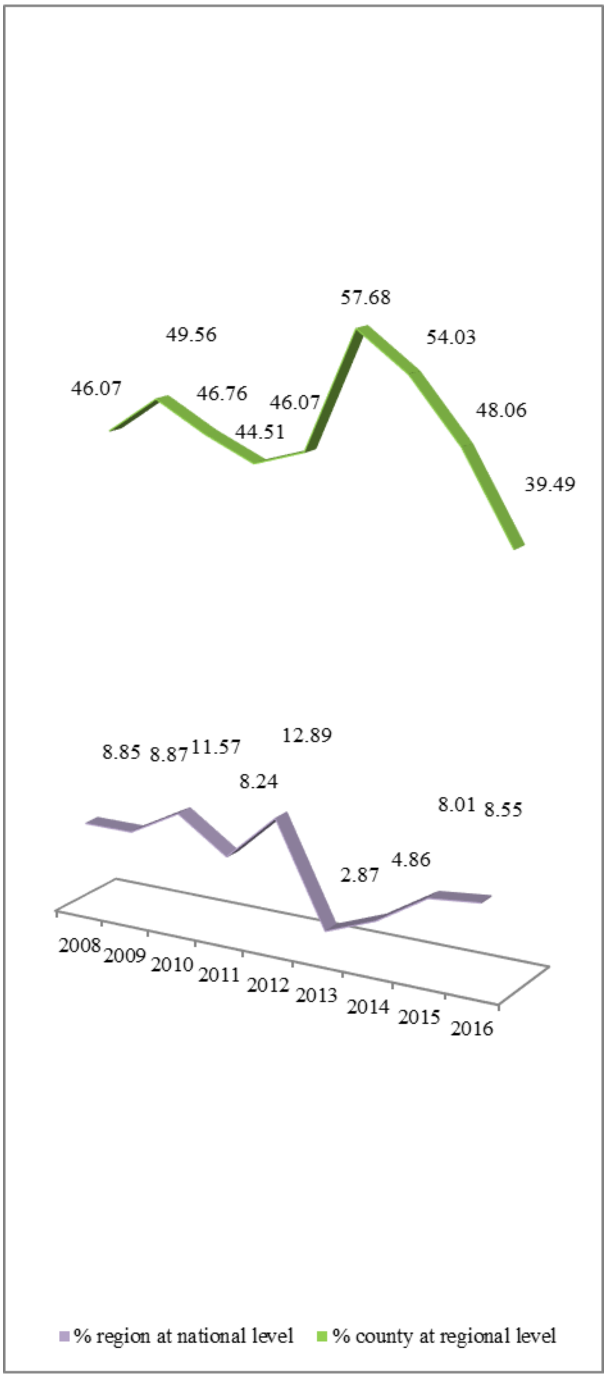

Fig. 2. South West Oltenia Region, Olt County - shares in total national or regional production (%)
Source: Own calculation and design.

Table 3 shows the specific situation for the average production [10].
In the case of Romania, the average yield was between 1,357 kg / ha (2009) and 2,835 kg / ha (2016). The rest of the dynamic series components were positioned below 2,000 kg / ha in the years 2012, 2010, 2008 and 2011 (1,496, 1,755, 1,844 and 1,882 kg / ha); over 2,000 kg / ha - 2013, 2015 and 2014 (2,408, 2,499 and 2,604 kg / ha respectively). Analyzing the dynamics of the indicator, there are decreases compared to the terms of comparison in 2015, 2012 and 2009 (-4.03, -20.51 and -26.41% respectively), and their exceedances in 2011, 2014, 2016, 2010 and 2013 (1.07, 1.08, 1.13, 1.29 and 1.60 times respectively).
For the South West Oltenia Region, average production varied from 1,270 kg / ha in 2013 to 2,685 kg / ha in 2016 years. Between these limits, the terms of the dynamic series were positioned as below: 2,000 kg / ha in 2012, 2009, 2011, 2010 and 2008 (1,307, 1,421, 1,608, 1,722 and 1,808 kg / ha respectively); over 2,000 kg / ha in 2015 and 2014 (2,328 and 2,405 kg / ha respectively). The evolution of average production for 2008-2016 is characterized by decreases in 2009 compared to 2008 (-21.49%), increases in 2010 (+21.18%), decreases for 2011, 2012 and 2013 (-2.38, -22.25 and -2.83%), followed by an increase of 89.37% in 2014 compared to 2013, a decrease of 20% in 2015 by 3.20% compared to the previous term, and finally by 2016 a 15.34% increase compared to the year - 2015.
Analyzing the average production of Olt County, the fluctuation limits of 1,266 and 2,521 kg / ha are established for the years 2013 and 2016 respectively. Above 2,000 kg / ha is 2015 and 2014 (2,335 and 2,513 kg / ha respectively). Less than 2,000 kg / ha are: 2009, 2012, 2008, 2010 and 2011 (1,302, 1,394, 1,656, 1,667 and 1,917 kg / ha respectively). The dynamics of the indicator is characterized by uneven evolutions, decreasing in 2009 compared to 2008 (-21.38%), increases in 2010 and 2011 (+28.03 and + 14.99%), decreases in 2012 and 2013 (-27.28 and -9.18%), an increase in 2014 (+ 98.50%), a decrease for 2015 (-7.08%) and an increase for the year 2016 (+ 7.97% compared to the year 2015).
The positioning of the regional average production levels compared to the national situation reveals subunit levels for most of the years of the dynamic series (2008, 2010, 2011, 2012, 2013, 2014, 2015 and 2016 -

98.05, 98.12, 89.32, 87.37, 52.74, 92.36, 93.16 and 94.71%, respectively) except for 2009 (1.04 times the comparison base - Figure 3).

Table 3. Average yield (kg/ha)

Year	National level		South West Oltenia region			County Olt		
	Eff.*	Dynamic Ibm**	Eff.*	Dynamic Ibm**	% compared to the national level	Eff.*	Dynamic Ibm**	% compared to the regional level
2008	1,844	100	1,808	100	98.05	1,656	100	91.59
2009	1,357	73.59	1,421	78.59	104.72	1,302	78.62	91.63
2010	1,755	129.33	1,722	121.18	98.12	1,667	128.03	96.81
2011	1,882	107.24	1,681	97.62	89.32	1,917	114.99	114.04
2012	1,496	79.49	1,307	77.75	87.37	1,394	72.72	106.66
2013	2,408	160.96	1,270	97.17	52.74	1,266	90.82	99.69
2014	2,604	108.14	2,405	189.37	92.36	2,513	198.50	104.49
2015	2,499	95.97	2,328	96.80	93.16	2,335	92.92	100.30
2016	2,835	113.44	2,685	115.34	94.71	2,521	107.97	93.89

Source: *http://statistici.insse.ro/shop/index.jsp?page=tempo3&lang=ro&ind=AGR110A (20.112017)
** own calculation

Olt County exceeded the reference period (the regional level of the indicator) for the years 2015, 2014, 2012 and 2011 (+0.30, +4.49, +6.66 and 14.04%, respectively) but did not reach this for the years 2008, 2009, 2010, 2013 and 2016 (-8.41, -8.37, -3.19, -0.31 and -6.11% respectively).

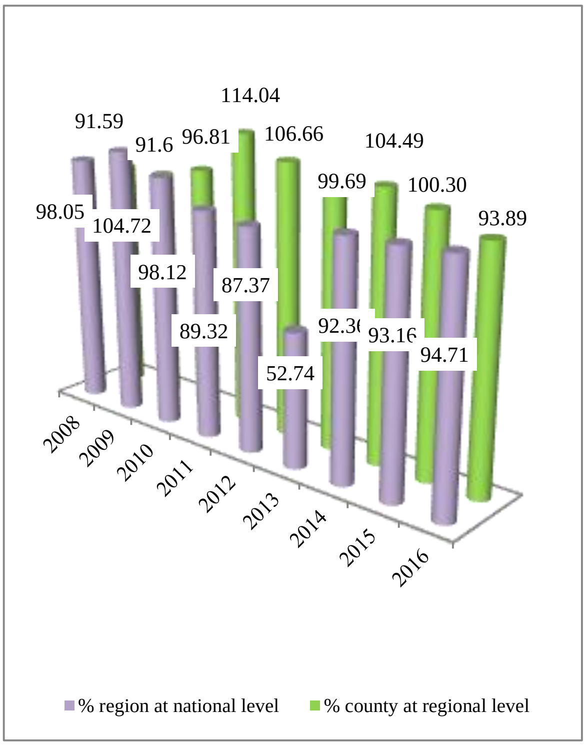

Fig. 3. South West Oltenia Region, Olt County - positions relative to national and regional average production (%)
Source: Own calculation and design.

CONCLUSIONS

Based on the data presented in the previous chapters, a series of conclusions can be drawn regarding the rapeseed offer at national, regional and county level.

Regarding the cultivated area, the following aspects are highlighted:

-at the national level: the indicator's amplitude variation was 432,035 ha (4.10 times the minimum, 19.60% decrease, compared to the maximum level of the indicator); the dynamics of the indicator was uneven;

-at regional level: a variation amplitude of 48,306 ha was observed, which represented 3.20 times increase of the minimum level (2013) and a decrease of 23.81% compared to the maximum level (2010); the dynamics of the indicator was fluctuating;

-at county level: the surface variation amplitude was of 23,904 ha, which exceeded the minimum indicator level (2012) by 3.56 times and was 21.92% lower than the maximum level (2010); the dynamics of the indicator was variable.

Regarding total rapeseed production, it is worth mentioning:

-at national level: a variation amplitude of 1,135,268 t, which exceeded 7.21 times the minimum term (2012) and was lower by 12.19% of the maximum term (2016); the dynamics of the indicator was uneven:

-at regional level: the variation amplitude was of 91,440 t, which exceeded 4.71 times the minimum term (2013) and was lower 17.33% with the maximum level (2016); the dynamics of the indicator was variable;
-at the county level: the registered amplitude reached 4,1675 t, which exceeded the 4.46 times the minimum term (2012) and was lower than the maximum term (2010) by 18.34%; the evolution of the indicator was fluctuating.
If we refer to the average production output per unit of production (kg / ha), the following conclusions can be drawn:
- at national level: the variance amplitude was 1.478 kg / ha, which exceeded 1.09 times the minimum (2009) and was lower than the maximum (2016) with 47.87%; the dynamics of the indicator was uneven, with growth trends for three of the last four years for the dynamic series;
-at regional level: the indicator has a variation amplitude of 1,415 kg / ha, which exceeded the minimum period (2013) of 1,11 times and was lower compared to the maximum term (2016) by 47,30%; the evolution of the indicator over time has been fluctuating;
-at the county level: the amplitude of the indicator variation was 1.255 kg / ha, which was lower than both the minimum (2013) and the maximum (2016) by 0.87 and 50.22% respectively; the dynamics of the indicator was variable.
Finally, Olt County is an important producer of rapeseed for South West Oltenia by the weights held at the cultivated area level (47.63%) and the total production (46.44%). The decrease of the share for total production, compared to the cultivated area, at regional level is explained by the lower average yield per hectare by 0.33% compared to the regional one. As well as at national and regional levels, there is an increase in performance for the last three years of the dynamic series.

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RESEARCHES ON THE CAPACITY OF MARKETING AGRICULTURAL CROP PRODUCTION IN THE SOUTH-WEST OLTENIA REGION

Ana Ruxandra MICU, Valentina TUDOR, Eduard Alexandru DUMITRU

University of Agronomic Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest, Romania, Phone: +40213182564, Fax: +40213182888, Mobile: +40744647410, Emails: micuanaruxandra@yahoo.com, valentina_tudor@yahoo.com, dumitru.eduard@iceadr.ro

Corresponding author: dumitru.eduard@iceadr.ro

Abstract

Further, the vegetal sector encounters serious problems and is often dependent on a number of factors such as climate, whether the crops are irrigated or not. This factors can make a difference between gain and loss. There are other factors such as economic factors where this market is extremely volatile, but also a number of other factors described in this paper. This case study was carried out on a sample of 60 farms with a vegetal profile showing the level of this region compared to the national average, identifying the main strengths and weaknesses that farmers in this region have. Account should also be taken of the marketing capacity of agricultural crop production. Interviewing the representatives of 60 agricultural crops we could analyse a number of relevant issues for this sector through which we can contribute with a series of solutions and recommendations.

Key words*: agriculture, agricultural holdings, vegetable sector*

INTRODUCTION

South-West Oltenia is located in the south-western part of Romania, comprising 5 counties (Dolj, Olt, Vâlcea, Mehedinţi and Gorj), and the relief from the south of the region favors agriculture, Oltenia is a traditional area in plant cultivation. [1] [3] [5]
This region is characterized by moderate temperate continental climate, with the mention that in Mehedinţi County there is a moderate temperate continental climate with submediterranean influences, which causes the winters to be milder. [2] [4]
Regarding the hydrographic network, this region is crossed by a series of important rivers such as Olt and Jiu, but also by the Danube River. At the same time the soil types are suitable for crops, comprising clay soils, soils brown and reddish brown forest soils and alluvial soils chernozem type (favorable for vegetable crops). [6] [7] [8]
In the South-West Oltenia region of the 2.2 million inhabitants, more than 50% of them are in the rural area and the area of the region is 29,212 km2. Also, the agricultural area in 2014 was over 1.79 million hectares, of which almost 70% in the utilization category. [9] [10].

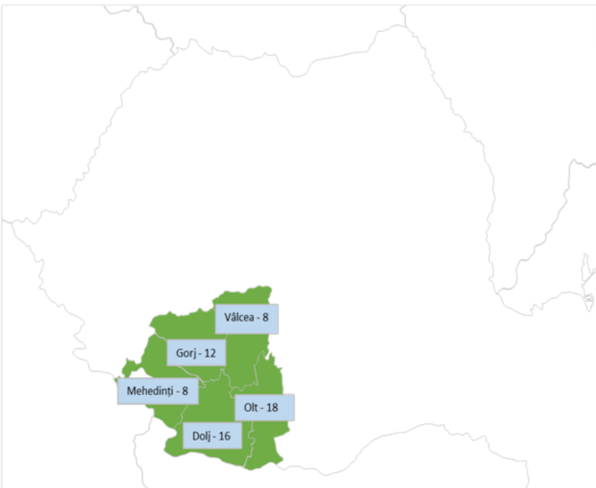

Fig. 1. Distribution of respondents by county
Source: processing own data.

They were interviewed to obtain data 60 representative of the profile of the agricultural farms in South-West vegetable Oltenia. Using this indirect method, a qualitative research was carried out on the situation of this plant sector in the South-West Oltenia Region compared to the data recorded at national level. We note that 15 relevant questions were

addressed, determining the profile of the respondent, among which we note the following:
-Male, over 45 years old;
-No higher education;
-It has a medium-sized holding;
-It has a turnover over of 150,000 euro/year.

MATERIALS AND METHODS

Research is based on information gathered from farmers in the South-West Oltenia region, using the interview method, consisting of a set of 15 questions applied to 60 interviewees. The data obtained through the interview were compared with data retrieved by the Ministry of Agriculture and Rural Development and the National Institute of Statistics. The quantitative and qualitative method has also been used in the present paper, using technical and economic indicators such as: production, average output, average price, income obtained.

RESULTS AND DISCUSSIONS

Analysing the structure of the sample we can see that of the cultivated area by the 60 farms studied (17,907.13 hectares), 58% is cultivated with cereals, 37% with oil plants and 5% with leguminous plants. In terms of cereals, the respondents opted, especially for the cultivation of wheat and corn, with a weight of 34% and 21% respectively of the total area exploited by these farms with vegetal profile (Figure 2).

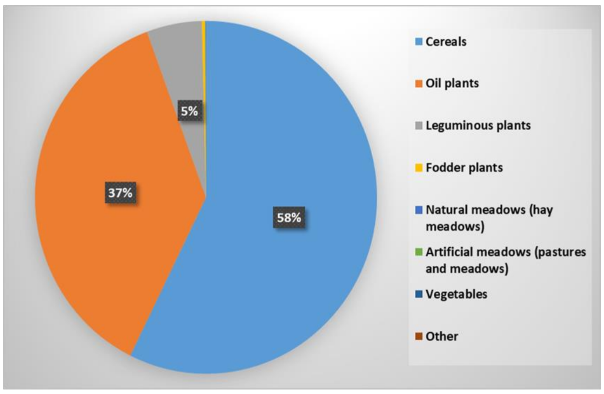

Fig. 2. Structure of crops for the year 2017 in the South-West Oltenia Region
Source: own calculations.

Also, in the case of oil crops, the preferred plants by the South-West Oltenia farmers were rape and sunflower, accounting 19%, respectively 18% of the total area cultivated.
Comparing the national average production with that of the interviewed group (South-West Oltenia Region), we can see that in the case of wheat, sunflower and corn crops the yields are similar (wheat - 4.8 t/ha, sunflower - 2.7 t/ha, corn 5.8 / 5.6 t/ha) (Figure 3).

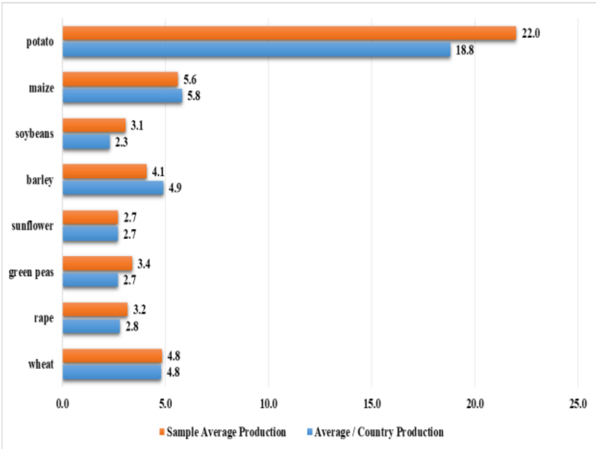

Fig. 3. Comparative analysis of the yields recorded in 2017 for the main crops taken into account (tone / hectare)
Source: MADR data, own calculations;

In the case of barley and barley crops, there is a significantly lower production for farmers in the South-West Oltenia region, which obtained an average of 4.1 tonnes per hectares, compared to the national average production of 4.9 tonnes/ha in 2017 (Fig. 3).
In contrast, for the other cultures surveyed, the average production at the sample level was significantly higher than the national average production, so for the rape crop the difference was 13.2%, the peas 25.6%, 33.5% soybean, 17% in favor of the productions registered by the farmers in the South-West Oltenia region (Fig. 3).
Concerning average prices, it is found that the average prices obtained by farmers in South-West Oltenia were significantly lower than the average recorded by local authorities. For example, in the case of potato crops, where the largest difference is recorded above 160%, the average selling price was only 500 lei/tons compared to the average country price over 1,300 lei/tons (Fig. 4).

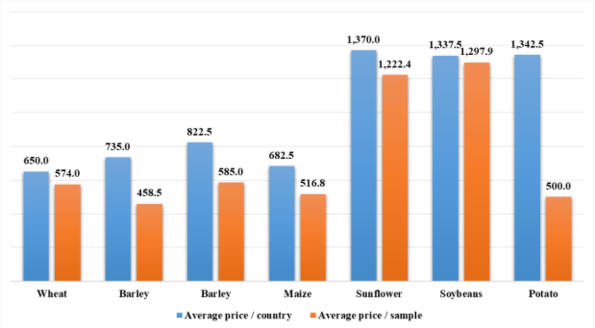

Fig. 4. Comparative analysis of average prices obtained in 2017 for the main agricultural crops (lei / ton)
Source: MADR data, own calculations.

Another major difference was recorded in the case of barley crops, which in 2017 the average country price was of 735 lei/tons (about 60% higher), compared to the average price obtained by farmers in the South Region -Vest Oltenia which was 458 lei/tons (Fig. 4).
The smallest price difference was recorded for soybean production, where the average country-wide average price was 3.1% higher than the average farmer's price in South-West Oltenia (Fig. 4).

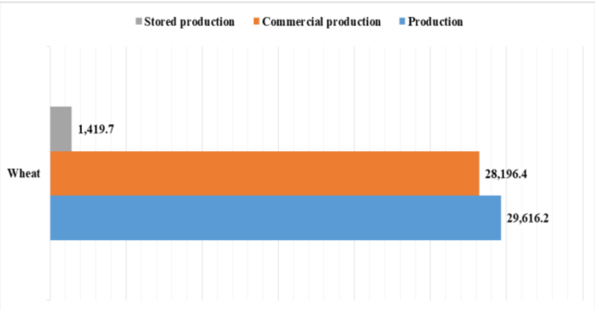

Fig. 5. The degree of marketing of wheat production obtained in 2017 in the South-West Oltenia region
Source: Interview Data Processing.

Analyzing the level of marketing of wheat production made in 2017 in the sample analyzed, we see that the total amount of wheat produced by 29,616.2 tons to the amount of 28,196.4 tons marketed and sold by over 95% of the production obtained, while only 5%, representing 1,419.7 tons, was stored for subsequent commercialization (Fig. 5).
Analyzing the degree of marketing of the maize production obtained in 2017 in the analyzed sample we can see that from the total quantity of 20,885.8 t corn produced 13,940.4 tons.

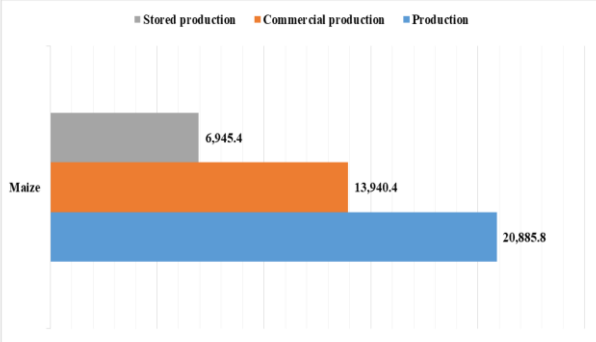

Fig. 6. The marketing degree of the maize production obtained in 2017 in the South-West Oltenia region
Source: Interview Data Processing.

This means that about 66.7% of the remaining 33.3%, representing 6,945.4 tonnes, was stored for subsequent commercialization (Fig. 6).

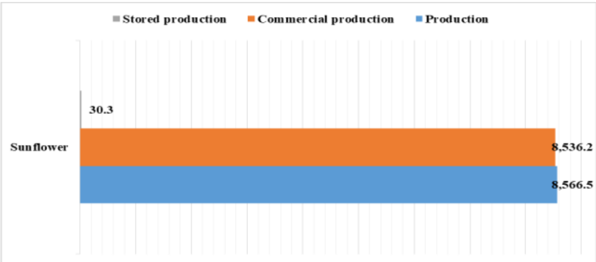

Fig. 7 . The marketing degree of sunflower production obtained in 2017 in the South-West Oltenia region
Source: Interview Data Processing.

Analyzing the commercialization of the sunflower production obtained in 2017 within the analyzed sample, we can see that of the total quantity of sunflower produced of 8,566.5 tons, a quantity of 8,536.2 tons was sold, selling thus about 99% of the production obtained, while the remaining 1%, representing only 30,4 tons, was stored for subsequent commercialization (Fig. 7).

Table 1. The degree of marketing of other vegetable crops in the South-West Oltenia region

Culture	Production (tons)	Traded production (tonnes)	Stored production (tons)	The degree of marketing of total production (%)
Rape	11,036.9	11,036.9	0.0	100.0
Barley	1,015.8	941.5	74.3	92.7
Oat	133.4	109.5	23.9	82.1
Potato	3,0	31.0	0.0	100.0
Green peas	2,072.4	2,072.4	0.0	100.0
Soybean	932.8	932.8	0.0	100.0

Source: Interview Data Processing.

In the case of other crops, we can see a 100% marketing level such as rape, potatoes, peas or soybeans, while only cereal crops such as barley and oats have a marketing degree of 92.7% and 82.1% (Table 1).

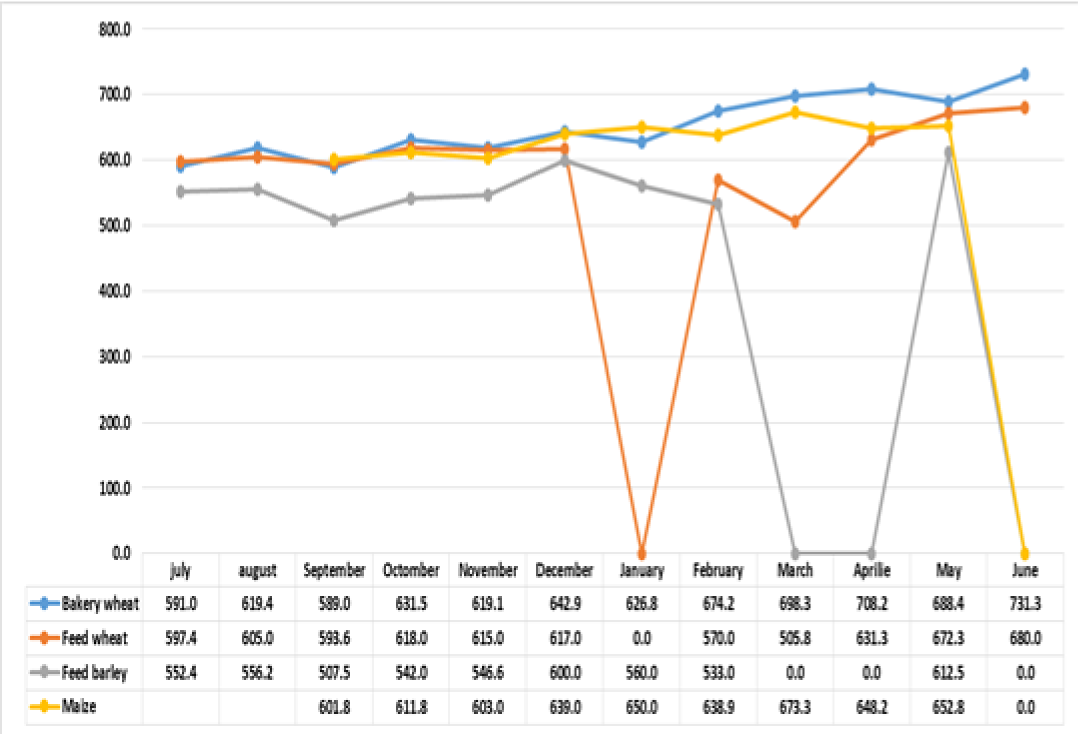

Fig. 8. The evolution of the average trading price on the main representative markets (FOB Oltenia (lei/to)
Source: General Directorate of Customs, Romania.

Analyzing the evolution of the average trading price on the main representative markets for bread wheat for the year 2017, the optimal trading month was June (one month before the new production), obtaining an average price of 731.3 lei/ton (Fig. 8.).
And if used as feed wheat is observed that the best trading month was June with an average price of 680 euro/ton (Fig. 8.).

Table 2. Estimates of incomes obtained by farmers in South-West Oltenia

Culture	Prod.	Aver. price	Aver. trading price FOB Oltenia	Rev. obtained	Rev. obtained FOB Oltenia	FOB differ. / Rev. obtained %
	(tons)	(lei/tons)	(lei/tons)	lei	lei	%
Wheat	29,616.2	574.0	731.3	16,998,787.4	21,658,001.6	27.4
Maize	20,885.8	516.8	680.0	10,794,204.3	14,202,350.8	31.6
Barley	1,015.8	458.5	673.3	465,704.7	683,965.3	46.9

Source: Interview Data Processing.

Estimating revenue of farmers in the study of the South-West Oltenia, we can say that if they had chosen to vandals production period would be best achieved total revenue of 21,658,001 lei, 27.41% more than in the case of the sale of the production immediately after the harvest at the price of 573.97 lei/tons (Table 2).

As far as maize production is concerned, by FOB trading, revenue would have been higher by 31% than in the case of post-harvest sales of production. The same situation is encountered in the case of barley crops, where the revenues would have been over 46% higher, reaching the value of 683,965 lei, compared to the income obtained by selling it immediately after the harvest (Table 2).

CONCLUSIONS

The South-West Oltenia region enjoys favourable conditions for the cultivation of fertile plants, especially for cereals and oil plants. Noteworthy the high share of oil crops, influenced by the high sales price, but also especially the sales markets for these products.

However, we note that average yields for cereal crops, average country production is higher than average production at the sample level, due to the poorly developed irrigation system in this region, which influences the produced productions. However, in the case of rape, average sample production was higher than average/country production, where climatic factors were a key factor.

Concerning the average selling price of agricultural products, there are significant differences, so that for all the analysed crops, average/country prices exceed average prices/sample, influenced by a number of important aspects such as negotiation power, of the trading points, in the context of the place where grain trading is located at the Constanta Port at a significant distance from the South-West Oltenia Region. Another important factor determining the sales price is the quality of the products sold compared to what is on the market.

It is noticed that farmers in the South-West Oltenia region choose to store certain agricultural products for marketing in the optimal periods of the year in order to obtain a better selling price. In order to obtain the best selling price, an essential criterion is the conditioning, sorting and storage facilities, but the construction of these facilities is quite expensive, given that farmers choose sale of production from the spot to pay the loans taken is to set up crops or to set up future crops.

Revenues from the storage of agricultural products and their sale during the optimum period would bring considerable profit, but this is hardly to be implemented by the Romanian farmer, which has a number of problems that prevent him from doing so.

A viable solution for increasing the profitability of these holdings in the South-West Oltenia region would be their association, which would allow them to acquire inputs at more attractive prices, but also to build storage facilities. The use of maritime transport on the Danube would significantly reduce the transport costs in the South-West Oltenia region in Constanta Port, but for this purpose facilities should be created by the Romanian state, taking into account any changes of any kind.

Also, the repositioning of Russia in the top of the grain exporters with a well-established program and by massive investments in agriculture lately, make the price demanded by Romania somewhere on the same level, especially in a market where the main selection criterion is the price.

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EFFECTIVENESS OF SOIL AMENDMENTS IN RESTORING THE CHEMICAL PROPERTIES OF SOILS SUBJECTED TO DIFFERENT INTENSITIES OF EROSION IN NSUKKA, SOUTH EASTERN NIGERIA

Ojimgba ONWUCHEKWA

Abia State University, Faculty of Agriculture, P.M. B. 7010, Umuahia, Abia State, Nigeria, E-mail: onwuchekwao@yahoo.com

Corresponding author: onwuchekwao@yahoo.com

Abstract

The effectiveness of soil amendments in restoring the chemical properties of soils subjected to different intensities of erosion in S.E Nigeria was studied in the field. The experiment was arranged as a split-plot in a randomized complete block design. The main plot treatments were the four erosion levels viz, E_1 (slightly eroded with average annual soil loss of 3.28 t/ha/yr), E_2 (slightly eroded with average annual soil loss of 3.96 t/ha/yr), E_3 (eroded with average annual soil loss of 46 t/ha/yr) and E_4 (severely eroded, with average annual soil loss of 147 t/ha/yr). The sub-plot treatments were: control (no amendment), inorganic fertilizer, NPK (F), poultry manure (PM), rice shavings mixed with poultry manure (RS+PM), rice shavings mixed with fertilizer (RS+F) and rice shavings alone (RS). Poultry manure (PM) alone and RS + PM significantly increased the soil organic carbon, total nitrogen, exchangeable bases and cation exchange capacity. Generally, organic residues proved superior to inorganic fertilizers in restoring the chemical properties of the eroded soils. However, PM restored the chemical properties of the eroded (E_2) and severely eroded (E_3) soils to the level obtained in the very slightly eroded soil (E_1).

Key words: *soil amendments, chemical properties, restoring, erosion*

INTRODUCTION

Soil erosion has become a concern worldwide, causing serious problems for food production and other agricultural crops. Soil erosion occurs when environmental factors wear on and remove soil particles. It is also at the heart of other environmental issues. The extent and damage caused by soil erosion in southeastern Nigeria have reached an alarming proportion that the result is untold hardship and frustration to the people of the affected areas. Soil erosion implies the physical removal of topsoil by various agents, including falling raindrops, water flowing over and through the soil profile, wind velocity, and gravitational pull. Soil erosion, therefore, is a serious and widespread problem in many tropical developing countries [17]. Accelerated erosion is one of the most prevalent forms of soil degradation in the world [26]. Every minute, an estimated 10 hectares of agricultural land is lost to erosion throughout the world [19].

The damages caused by soil erosion are manifested in detrimental changes in the chemical properties of the residual eroded soils. Soil loss also results in loss of Ca, Mg, Na, K and O.M. in runoff and eroded sediments [12] as well as an exposure of very acidic subsoils.

Studies on soil management practices for restoring the properties of eroded soils lag far behind those aimed at measuring the amount of soil loss per se. Restoration of degraded soils is a high priority in global scale. When soil carbon pool in degraded cropland increased by one ton, crop yield would increase by 20–40 kg ha^{-1} for wheat, 10–20 kg ha^{-1} for maize, and 0.5–1 kg ha^{-1} for cowpeas. Substantial studies have reported the restored productivity of de-surfaced soils by amending with fertilizer or manure [26]. The use of waste materials as soil amendments has received increased attention in recent years for agronomic applications as well as soil reclamation projects. Adding these materials to soils can be viewed as serving a dual purpose: (1) for disposal of solid waste from municipalities and agricultural operations and (2) as a means to improve chemical and physical soil properties which in turn promotes improved crop performance [24]. [25] found that using crop residues and animal manure on crop almost always has the desired effect, because both contain nitrogen, potassium, and other essential elements [10]. [13] also reported that rice shavings and poultry manure increased the organic carbon and total nitrogen concentrations of a degraded soil and the plots amended with organic wastes had about 90% higher mineralization rate than the unamended or inorganic fertilizer-treated plots. He further observed that rice shavings and poultry manure were important sources of exchangeable bases and organic carbon which contributes significantly to the CEC of soils [8]. [5] noted that crop residues and animal manure not only fertilize the soil, but also provide other benefits that are not immediately evident such as increased soil aggregation which will make the soil to be tilled more easily, increased nutrient and water movement, and enhance root penetration thereby increasing substantially the productivity of the soil [24]. The objective of this study is to determine the relative effectiveness of soil amendments in restoring the chemical properties of different levels of erosion in SE Nigeria.

MATERIALS AND METHODS

This study was carried out on run-off plots established at the University of Nigeria, Nsukka Teaching and Research Farm (Latitude 06^0 51’ N; Longitude 07^0 24’ E, mean elevation 400 m above sea level). The soil is an Ultisol belonging to Nkpologu series. The vegetation is derived savannah and the parent material consists of deeply weathered colluvium over false – bedded sandstone [16]. Based on years of runoff studies, the plots were demarcated into classes showing degree of degradation as in [18] as shown in Table 1.

Table 1. Main plot treatment with various erosion levels and average soil loss t ha^{-1} yr^{-1}

S/No	Level of Erosion	Treatment	Soil Loss
1	Slightly eroded soil (E_1	Grass cover (*Panicum maximum*)	Average soil loss of 3.28 t ha^{-1} yr^{-1}
2	Slightly eroded soil (E_2)	Legume cover (*Centrosema pubescens*)	Average soil loss of 3.96 t ha^{-1} yr^{-1}
3	Eroded soil (E_3)	Plots cropped to Arable crops, maize followed by cassava without surface residue	Average soil loss of 45.9 t ha^{-1} yr^{-1}
4	Severely eroded soil (E_4)	Bare plots since 1974	Average soil loss of 146.7 t ha^{-1} yr^{-1}.

Source: Ojimgba, 2013

The classification of sites as eroded is based on [22] and [18]. These plots with various degradation levels constituted the main-plot treatment. The organic amendments constituted the sub-plot treatments thus:

Control – No Amendment = C
Complete Fertilizer (alone) = F
Rice Shavings (alone) = RS
Rice Shavings + Complete Fertilizer = RS + F
Rice Shavings + Poultry Manure = RS + PM
Poultry Manure (alone) = PM

Field Methods

Table 2. Nutrient composition of the organic amendments

Nutrient Elements	Organic amendments	
	Rice shavings (RS)	Poultry manure (PM)
Total N (%)	0.73	2.86
Organic carbon (%)	32.11	22.94
Organic matter (%)	55.36	39.55
Ca^{2+} (Cmol kg^{-1})	0.80	5.40
Mg^{2+} (Cmol kg^{-1})	0.92	1.28
Avail P (Cmol kg^{-1})	0.55	1.82
Na^{+} (Cmol kg^{-1})	2.00	3.50
K^{+} (Cmol kg^{-1})	8.00	18.00
C:N	43.99	8.02
C:P	58.38	12.60

Source: Ojimgba, 2013

This was carried out on the run-off plots. Planting was done under zero tillage system. Each main plot measures length and width, 21.5 m x 3 m, while the subplot measures 3 m x 3 m.

Incubation period of 4 weeks was allowed after incorporating the soil amendments before planting. Maize (*Zea mays* L) was planted at a spacing of 75 cm x 25 cm as a test crop.

Two seeds were planted hill^{-1} and thinned down to one after one week.

Table 2 shows the nutrient contents of the organic amendments.

Details of the subplot treatments are given below:

(i) C = no treatment

(ii) F = 270 g N + 72 g P + 162 g K/9 m^2, equivalent to 300 kg N + 80 kg P + 180 kg K) ha^{-1}

(iii) RS = 9 kg RS/9 m^2 ,equivalent to 10 t ha^{-1}

(iv) RS + F = 4.5 kg RS + (135 g N + 36 g P + 81 g K/9 m^2), equivalent to 5 tons RS + (150 kg N + 40 kg P + 90 kg K) ha^{-1}

(v) RS + PM = 4.5 kg RS + 4.5 kg PM/9 m^2 equivalent to 5 tons RS + 5 tons PM ha^{-1}

(vi) PM = 9 kg PM/9 m^2, equivalent to 10 tons ha^{-1}

Data collection centered on ten (10) stands in the subplot. The data obtained were analyzed statistically according to [23]. These subtreatments were randomized within the main plots. The experiment was replicated three times.

Main Plot	(e)	=	4
Subplot Treatments	(a)	=	6
Replications (blocks)	(b)	=	3

Laboratory Studies. Before adding amendments and after harvesting, soil samples were collected from all plots, air-dried, and sieved through a 2mm mesh for routine analysis. The following properties were determined: soil reaction pH, organic carbon, organic matter, total nitrogen, exchangeable bases, cation exchange capacity, exchangeable acidity, base saturation, aluminium saturation and available phosphorus.

These chemical properties of the soil were also measured on the treated plots after harvesting. The procedures that were used for these determinations were outlined below:

Soil Reaction (pH)

Soil pH was determined in O.1 N potassium chloride (KCI) solution using a soil:liquid ratio of 1:2:5. After 20g of soil sample was weighed into plastic beakers, distilled water of KCI was added and stirred for 30 minutes, then the pH values were read off using a glass electrode pH meter [21]; [14].

Organic Carbon (OC)

This was determined by the Walkley and Black method as modified by [3] in which the soil organic matter was oxidized using 1N $K_2Cr_2O_7$ solution and conc. H_2SO_4, and the percentage organic carbon found by titrating with IN ferrous ammonium sulphate solution [15].

Organic Matter (OM)

This was determined from Walkley and Black method. The organic matter content was determined by multiplying the percentage organic carbon by the conventional “Van Bemmelen factor” of 1.724. The use of this factor is based on the assumption that soil organic matter contains 58% carbon [3].

Total Nitrogen (N)

This was determined by the micro-Kjeldahl method [7] using $CuSO_4/Na_2SO_4$ catalyst mixture. The ammonia (NH_3) from the digestion was distilled with 45% NaOH into 2.5% boric acid and determined by titrating with 0.05N HCl.

Exchangeable Bases

Calcium (Ca) and magnesium (Mg) were determined by the complexometric titration method described by [9]. Sodium (Na) and potassium (K) were determined from 1N ammonium acetate (NH_4 OAC) using the auto electric flame photometer [4].

Cation Exchange Capacity (CEC)

CEC was determined by the neutral normal ammonium acetate leaching method [8]. O.1N KCl solution was used to counter – leach, and from the KCl leachate, cation exchange capacity was determined by titration with standard O. 1N NaOH solution.

Exchangeable Acidity (EA)

Exchangeable acidity (H^+ and Al^{3+}) was determined using the titrimetric method of

[14]. The Effective Cation Exchange Capacity (ECEC) was determined by calculation. (ECEC = ∑ bases + KCl – extractable (Al + H) values).

Base Saturation (BS)

Base saturation (BS) was calculated by multiplying total exchangeable bases (TEB) by 100 and dividing by the corresponding cation exchange capacity value.

$$\text{Percentage base saturation} = \frac{\text{TEB x 100}}{\text{CEC}}$$

Aluminum Saturation

Aluminum saturation was also calculated by multiplying exchangeable aluminum value by 100 and dividing by the corresponding cation exchange capacity (CEC) value.

$$\text{Al. saturation} = \frac{\text{Exch } Al^{3+} \text{ x } 100}{\text{CEC}}$$

Available Phosphorus

Available phosphorus was determined by the [6] extractant method – Bray’s Method 11 (0.03N ammonium fluoride x 0.1N HCI). The ppm phosphorus was determined using a photo-electric calorimeter [20].

RESULTS AND DISCUSSIONS

Chemical Properties of the Amendment Materials

The nutrient concentrations in the poultry manure and rice shavings are presented in Table 2. Chemical analysis carried out showed that poultry manure had more nitrogen (N) than rice shavings. The values obtained were 2.86 and 0.73% for poultry manure and rice shavings, respectively. Organic matter derived from organic carbon was higher in rice shavings than poultry manure. However, poultry manure had higher base concentrations (Ca, Mg, Na and K) than rice shavings. The values of C:N and C:P ratios obtained were 43:99 and 58:38 for rice shavings, and 8.02 and 12.6 for poultry manure, respectively. The low C: N ratio of poultry manure accounts for its higher rate of mineralization than rice shavings.

Amount of Nutrients Added to the Soil from Amendments

The amount of nutrients supplied by amendments to the soil varied from one treatment to the other. Generally, RS supplied the least amount of N, P, and K, while PM almost supplied greater amount of N, P, Ca, Mg and Na, except that the N concentration was a little lower than that of RS + F. The order in which the nutrients were supplied is PM > RS + PM > RS + F > F > RS.

Some Chemical Properties of Eroded Residual Soils

Table 3 shows the changes in soil chemical properties as a result of erosion before adding soil amendments. Generally, the observations made from the results show that the chemical properties of the soils were low and the values decreased with increase in erosion depth so that E_3 and E_4 had lower values than E_1 and E_2. The soils are generally acidic in soil reaction. In all cases, soil pH in water was greater than the corresponding pH in 0.1N KCl solution. The pH values obtained ranged between 4.70 and 4.23, and 4.27 and 3.71 for soil pH in water and KCl, respectively. The soil pH as shown in Table 3 was strongly to very strongly acidic. These low pH values were partly because the soils were heavily leached due to heavy rainfall. According to [2] low acidity may influence the rate of soil erosion in that basic element which influence aggregation is leached resulting in increased erosion. This confirms that removal of topsoil by erosion consequently exposed very acidic subsoils [18]. Therefore, increase in soil loss results in a decrease in the nutrients status of the soils. However, the values of the total exchangeable bases Na^+, Ca^{++}, Mg^{++}, K^+) were relatively low as well as nitrogen and organic carbon. The low values of the total exchangeable bases in all the erosion levels are because of high rainfall which leaches these nutrients out of the soil solum. [11] working in northern Nigeria and [12] Western Nigeria also observed losses of Ca, Mg, Na and total N in runoff and eroded sediments. The differences were significant at $P<0.05$. The available phosphorus obtained was low values of less than 7 ppm, was recorded for the eroded soils. Therefore, the more hazardous the erosion is on soils, the lower the values of phosphorus. The eroded soils $E_1$and E_2 gave statistically higher nutrient values than the highly eroded E_3 and severely eroded E_4 in the following significant order : $E_1 = E_2 > E_3 > E_4$.

Table 3. Some chemical properties of the eroded soils before adding amendments (0-20 cm depth)

Erosion levels	H_2O	PH KCl	O.C.	O.M.	N	C:N	Na^+	Ca^{++}	Mg^{++}	K^+	Al^{++}	H^+	EA	CEC	ECEC	BS	Al.Sat	Avail. p
			%	%	%		Cmol (+)kg^{-1}	Cmol (+)kg^{-1}	Cmol (+)kg^{-1}	Cmol (+)kg^{-1}	Cmol (+)kg^{-1}	Cmol (+)kg^{-1}	Cmol (+)kg^{-1}	Cmol (+)kg^{-1}	Cmol (+)kg^{-1}	%	%	ppm
E_1	4.70	4.27	1.04	1.79	0.12	8.67	0.12	1.6	0.95	0.25	0.8	0.4	1.2	4.5	4.12	65	17.7	6.6
E_2	4.69	4.23	1.08	1.86	0.13	8.31	0.11	1.5	0.97	0.25	0.6	0.4	1.0	4.3	3.83	66	14.0	6.0
E_3	4.52	3.97	0.91	1.57	0.09	10.11	0.12	1.0	0.60	0.13	1.2	0.4	1.6	3.5	3.45	53	34.3	4.8
E_4	4.23	3.71	0.62	1.07	0.07	8.86	0.12	0.6	0.56	0.10	2.0	0.4	2.4	3.4	3.78	41	58.8	3.7
F-$LSD_{0.05}$	0.16*	0.18*	0.15*	0.25*	0.02*	0.55*	0.00*	0.33*	0.16*	0.06*	0.44*	0.0^{NS}	0.44*	0.39*	0.19*	8.31*	14.4*	0.91*

EA = Exchangeable acidity, CEC = Cation Exchange Capacity, ECEC = Effective Cation Exchange Capacity, BS =Base Saturation, E=Erosion,
* = Significant at 5% level of probability
Source: Ojimgba, 2018

Effects of amendments on chemical properties of soils

(A)Organic Carbon, Total Nitrogen, pH and Available Phosphorus

There were changes in organic carbon, total nitrogen, pH and available P due to incorporation of inorganic fertilizer and wastes (Table 4). Some increase in pH of the amended soils was observed for some treatments. For example, the pH of the slightly eroded soil (E_1) with average soil loss of 3.28 t ha^{-1} yr^{-1} treated with Poultry Manure was raised slightly from 4.69 to a mean of about 5.02 (H_2O) and 4.33 to 5.01 (KCl).

Table 4. Changes in organic carbon, total nitrogen, phosphorus and pH levels of eroded soils following amendmen

Erosion Levels	Amendments	pH		O.C %	O.M %	Total N %	Avail P (ppm)	C:N
		H_2O	KCl					
E_1 (3.28 t/ha/yr)	C	4.69	4.33	1.00	1.72	0.11	7.0	9.09
	F	4.67	4.33	1.68	2.90	0.20	84.8	8.40
	RS	4.91	4.48	2.29	3.95	0.27	56.4	8.48
	RS + F	4.79	4.31	2.17	3.74	0.28	70.6	7.75
	RS + PM	5.00	4.95	2.38	4.10	0.30	113.0	7.93
	PM	5.02	5.01	2.50	4.31	0.36	169.5	6.94
	F-$LSD_{0.05}$	0.1*	0.2*	0.3*	0.6*	0.1*	31.6*	0.4*
E_2 (3.96 t/ha/yr)	C	4.62	4.29	1.02	1.76	0.15	6.4	6.80
	F	4.77	4.39	2.00	3.45	0.32	50.8	6.25
	RS	4.97	4.40	2.36	4.07	0.34	56.1	6.94
	RS + F	4.83	4.38	2.20	3.79	0.37	56.5	5.95
	RS + PM	4.98	4.43	2.48	4.28	0.43	113.0	5.77
	PM	5.01	4.99	2.60	4.48	0.45	169.0	5.78
	F-$LSD_{0.05}$	0.1*	0.2*	0.3*	0.6*	0.1*	32.7*	0.3*
E_3 (45.9 t/ha/yr)	C	4.26	3.62	0.93	1.60	0.09	5.1	10.33
	F	4.57	4.01	1.76	3.03	0.18	36.7	9.78
	RS	4.69	4.11	1.94	3.35	0.20	39.6	9.70
	RS + F	4.62	4.03	1.84	3.17	0.23	34.0	8.00
	RS + PM	4.96	4.40	2.10	3.62	0.27	45.0	7.78
	PM	5.40	5.13	2.21	3.81	0.31	50.3	7.13
	F-$LSD_{0.05}$	0.2*	0.3*	0.3*	0.5*	0.04*	9.1*	0.8*
E_4 (146.7 t/ha/yr)	C	4.42	3.60	0.58	1.00	0.06	3.4	9.67
	F	4.47	3.90	1.76	3.03	0.15	31.0	11.73
	RS	4.79	4.00	1.84	3.17	0.18	17.5	10.22
	RS + F	4.69	3.98	1.79	3.09	0.20	22.6	8.95
	RS + PM	4.97	4.32	1.92	3.31	0.23	42.4	8.35
	PM	5.03	4.93	2.07	3.57	0.27	50.9	7.67
	F-$LSD_{0.05}$	0.2*	0.3*	0.3*	0.5*	0.04*	10.0*	0.88*

Source: Ojimgba, 2018

However, the severely eroded soil (E_4) bare plots since 1974 with average soil loss of 146.7 t ha^{-1} yr^{-1}, that is the control, was raised from 4.42 to 5.03 (H_2O) and 3.60 to 4.93

when treated with poultry manure.

[1] opined that the application of different types of organic manures reduced the acidic levels of the soils. Generally, all the amendments increased the organic carbon concentration of the soil, but the magnitude of increase was more for poultry manure than the other amendments (Fig. 2). The total nitrogen content of the soil also increased in the same trend as organic carbon content. Generally, organic carbon content increased from 1.00 to 2.50, 1.02 to 2.60, 0.93 to 2.21and 0.58 to 2.07% for E_1, E_2, E_3 and E_4, respectively following amendments. The C:N and C:P ratios of PM, RS+PM, and RS+F were lower than those obtained for the rest of amendments. The amendments also increased P values from 28.3 to 169.5, 42.0 to 169.0, 21.1 to 50.3 and 15.0 to 50.9 ppm for E_1, E_2, E_3 and E_4, respectively (Table 4).

PM was better than the other amendments in supplying phosphorus as shown in the Table.

[1] observed an increase in soil nutrients with the application of organic manures to the acid soil and nutrient depleted soil. Also, the authors added that the application of different types of organic manures enhanced soil organic C, total N, available P, exchangeable K and CEC better than NPK fertilizer in the soils.

(B)Exchangeable Bases and Cation Exchange Capacity (CEC)

As with the organic carbon and total nitrogen contents (Table 4), application of residues increased the exchangeable bases as well as the CEC of the eroded soils (Table 5).

Table 5. Effects of amendments on exchange properties of eroded soils in Nsukka, Nigeria

Erosion Levels	Amendments	Na^+	Ca^{++}	Mg^{++}	K^+	Al^{++}	H^+	EA	CEC	ECEC	BS	Al.Sat.
		Cmol $(+)kg^{-1}$	Cmol $(+)kg^{-1}$	Cmol $(+)kg^{-1}$	Cmol $(+)kg^{-1}$	Cmol $(+)kg^{-1}$	Cmol $(+)kg^{-1}$	Cmol $(+)kg^{-1}$	Cmol $(+)kg^{-1}$	Cmol $(+)kg^{-1}$	%	%
E_1	C	0.11	1.5	1.0	0.20	0.4	1.2	1.6	5.0	4.41	56	8.0
(3.28	F	0.14	2.6	2.9	0.25	0.8	0.4	1.2	7.5	7.09	78	10.7
t/ha/yr)	RS	0.33	2.9	2.3	0.30	0.8	0.8	1.6	9.5	7.43	61	8.4
	RS + F	0.38	3.1	2.7	0.36	0.8	0.4	1.2	9.0	7.74	73	8.9
	RS + PM	0.42	3.5	3.2	0.41	0.4	0.4	0.8	9.2	8.33	82	4.4
	PM	0.49	4.6	4.0	0.49	0.2	0.2	0.4	11.5	9.98	83	1.7
	$F\text{-}LSD_{0.05}$	0.1*	0.6*	0.6*	0.1*	0.2*	0.2*	0.3*	1.3*	1.1*	6.5*	1.9*
E_2	C	0.11	1.3	0.9	0.21	1.2	0.8	2.0	4.6	4.52	55	26.1
(3.96	F	0.24	2.5	2.0	0.27	0.8	1.6	2.4	6.5	7.41	77	12.3
t/ha/yr)	RS	0.27	2.9	1.6	0.31	0.8	0.4	1.2	8.0	6.28	64	10.0
	RS + F	0.29	3.3	1.9	0.33	0.8	0.4	1.2	7.8	7.02	75	10.3
	RS + PM	0.36	3.6	2.6	0.37	0.4	0.4	0.8	8.6	7.73	81	4.7
	PM	0.43	4.1	3.3	0.43	0.4	0.2	0.6	9.7	8.86	85	4.1
	$F\text{-}LSD_{0.05}$	0.1*	0.6*	0.5*	0.04*	0.2*	0.3*	0.4*	1.0*	0.9*	6.5*	4.6*
E_3	C	0.13	0.9	0.7	0.09	1.2	0.4	1.6	4.18	3.42	44	28.7
(45.9	F	0.20	1.3	1.5	0.19	1.2	0.4	1.6	4.5	4.79	71	26.7
t/ha/yr)	RS	0.22	1.8	1.3	0.22	1.2	0.4	1.6	6.9	5.14	51	17.4
	RS + F	0.26	2.1	1.7	0.25	0.8	0.4	1.2	6.5	5.51	66	12.3
	RS + PM	0.30	2.6	2.0	0.30	0.8	0.0	0.8	7.0	6.00	74	11.4
	PM	0.33	3.4	2.5	0.34	0.4	0.2	0.6	8.2	7.17	80	4.9
	$F\text{-}LSD_{0.05}$	0.04*	0.5*	0.4*	0.1*	0.2*	0.1*	0.3*	0.9*	0.7*	8.1*	5.4*
E_4	C	0.12	0.7	0.5	0.06	2.2	0.6	2.8	3.5	4.18	39	62.9
(146.7	F	0.16	1.0	1.5	0.15	1.6	0.4	2.0	4.0	4.81	70	40.0
t/ha/yr)	RS	0.19	1.7	1.1	0.19	2.0	0.0	2.0	6.3	5.18	51	31.7
	RS + F	0.23	1.9	1.8	0.22	1.6	0.4	2.0	6.0	6.15	69	26.7
	RS + PM	0.27	2.5	2.1	0.24	0.4	0.8	1.2	7.3	6.31	73	5.5
	PM	0.29	2.9	2.2	0.25	0.4	0.4	0.8	7.5	6.44	75	5.3
	$F\text{-}LSD_{0.05}$	0.04*	0.5*	0.4*	0.04*	0.5*	0.2*	0.4*	1.0*	0.5*	8.4*	12.6*

* = Significant at 5% level of probability
Source: Ojimgba, 2018.

As noted in this Table, PM and RS+PM were important sources of these exchangeable bases (Na, Ca, Mg, and K). These bases contributed highly to the CEC of the soils. Among the different erosion levels, the highest increase in exchangeable bases was observed for Poultry Manure (PM) treatment, followed by Rice Shavings plus Poultry Manure (RS+PM), while the lowest increase was from the Fertilizer treatment (F).The percentage base saturation also increased significantly and the values obtained ranged between 56 and 83, 55 and 85, 44 and 80, 39 and 75%, for E_1, E_2, E_3 and E_4 (Table 5). Similarly, the CEC increased from 5.0 to 11.5, 4.6 to 9.7, 4.18 to 8.2 and 3.5 to 7.5 cmol (+) kg^{-1} for the erosion levels E_1, E_2, E_3 and E_4, respectively.

Organic matter influenced these chemical properties more than the unamended control (Table 6). Therefore, there was positive correlation between the selected chemical properties and organic matter content of the severely eroded soil (E_4). Hence, the table showed significant correlation at $P < 0.05$ between organic matter and the selected chemical properties of the soils.

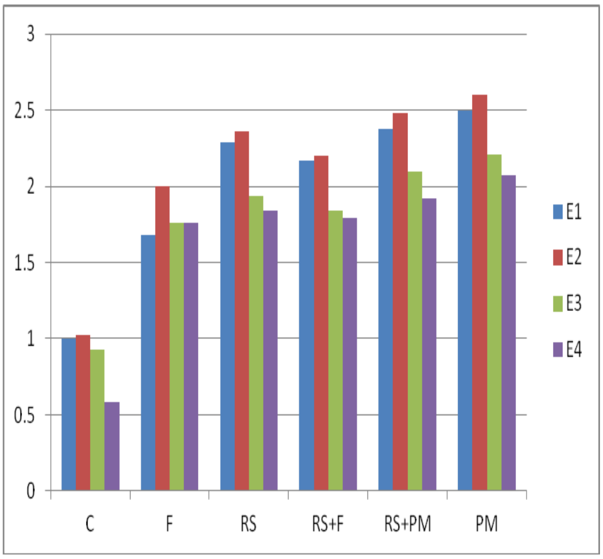

Fig. 1. Effect of amentments on organic carbon in Nsukka eroded soils
Source: Ojimgba, 2018

Table 6. Correlation between selected chemical properties and organic matter contents of the severely eroded soil (E_4)

Dependent variable	Correlation coefficient (r)
Total Nitrogen (%)	0.91*
Sodium (**Na**) (Cmol (+) kg^{-1})	0.79*
Calcium (Ca) (Cmol (+) kg^{-1})	0.76*
Potassium (K) (Cmol (+) kg^{-1})	0.93*
Magnesium (Mg) (Cmol (+) kg^{-1})	0.85*

* = Significant at $P < 0.05$
Source: Ojimgba, 2018

CONCLUSIONS

The major emphasis of this study was to evaluate the relative effectiveness of organic and inorganic fertilizers in improving the chemical properties of an eroded soil for better crop yield, and also to ascertain to what extent the productivity could economically be restored by the application of these amendments. The
evaluation of these amendments for use in restoring the productivity of eroded soils in the field has not been studied in Nigeria. Therefore, it may be necessary to point out that knowledge of this will contribute immensely to improving the productivity of abandoned eroded soils.

This study was conducted in the greenhouse and validated in the field. Poultry manure alone, and rice shavings mixed with poultry manure also significantly increased the soil organic carbon, total nitrogen, exchangeable bases and cation exchange capacity when incorporated into the eroded soils. The magnitude of increase was greater in organic waste-treated than on inorganic fertilizer-treated plots. The application of organic wastes restored the productivity of the eroded (E_3) and highly eroded (E_4) soils to almost the level obtained in the slightly eroded soils (E_1 and E_2). Improvements in the chemical properties of the highly eroded (E_4) soil compared to the unamended control were observed following amendments with residues.

It is strongly recommended to use poultry manure for restoring the chemical properties of the eroded soils for near optimum soil productivity, seeing that it had the best desired effect on improving the chemical properties of the eroded soils.

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RELATIVE EFFECTIVENESS OF LAND USE SYSTEMS IN IMPROVING THE ORGANIC MATTER AND PHYSICAL PROPERTIES OF SOILS IN IKWUANO SOUTH EASTERN, NIGERIA

Ojimgba ONWUCHEKWA, Amajuoyi CHINONSO PATIENCE

Abia State University, Faculty of Agriculture, Umuahia Campus, Nigeria, Email: onwuchekwao@yahoo.com

Corresponding author: onwuchekwao@yahoo.com

Abstract

The relative effectiveness of land use systems in improving the organic matter and physical properties of Ikwuano soils were evaluated. The study was conducted on an excavation site, a forest land, bush fallow land of five years, a refuse dump as well as that of the continuously cultivated land. However, organic matter content was significantly high on the refuse dump site and also clay content was high in excavation site, while sandy loam dominated other land use systems. Bulk density and micro porosity values of the soil under different land use systems increased with increase in depth. Also, total porosity and hydraulic conductivity decreased with increased in depth. Therefore, the variations between bulk density and total porosity is attributed to the results of organic matter obtained on refuse dump, bush fallow land, forest land as well as continuously cultivated land use systems. Under excavation land use, the soil was (P<0.05) more compact than other land use systems and this was due to low bulk density. However, refuse dump site (RD) gave significantly the highest values of soil organic matter and physical properties than the other land use systems at the various soil depths, whereas excavation site gave statistically the least value in the order : RD>FL>BF>CC>EX.

Key words: *land use systems, soil physical properties, organic matter, Ikwuano, Nigeria*

INTRODUCTION

The Land use system involves the modification, arrangements as well as activities and inputs which people undertake in certain land cover type to produce food and raw materials, as well as to change or maintain such land. Modification in land use, therefore, brings about changes in soil properties in addition to productivity overtime [7]. According to [24], land use can be derived from the practice of designating permitted use of land based on mapped zones and which dissociates one set of land use from another.

Land use systems affect the distribution as well as provision of plant nutrient elements in the soil. This is due to the direct change in soil properties which also influenced the soil biological activities [9]. However, urbanization which includes housing, industry, commercial enterprise, roads and so on, is a form of land use system [5], incuding continuous cropping, bush fallowing [2] and refuse dump site [4].

In addition, [36] observed an effective and positive modification of the soil physical properties by the forest land use system. This, therefore, helped to develop the tree biomass and also had brought about increase in availability of the plant nutrients [16]. The degradation of soil properties is usually attributed to the conversion of forests and pasture land to crop land. This has caused a drastic change in the distribution and stability soil aggregates. Continuous cropping decreases aggregate stability of soils thereby increasing the bulk density [8].

The excavation activities degrade the environment and pose a serious threat to the lives of residents around the site [11]. The excavations are done without any attempt to reclaim the exposed surfaces on the sites, leaving wide holes where water accumulates. In some places where the water table is high, artificial ponds can be formed. Vegetation is usually the first consult of partial destruction during excavation. The excavation site is characterised by absence of vegetation. Also, damage is more widespread during the time of excavation development as well as operations [11]. However, excavation demands the use of machines, whose emphasis is on the natural environment such as soil compaction, increased rate of leaching, soil erosion and depletion of soil fertility [30]. Excavation sites are also characterized by destruction of natural landscape, creating open space in the ground and generating heaps of sand wastes that cannot be easily disposed off [11]. Excavation has drastically reduced the organic matter accumulation in the soil, and as well decreased soil porosity [35] and increased bulk densities [34].

In addition, the organic component of the soil is made up of plant and animal residues at various stages of decomposition. Also, soil organic matter serves as a reservoir of plant nutrients for crops, improves soil aggregation, increases nutrient exchange between soil and plant and retains soil moisture, reduces soil compaction and increase soil infiltration rate [22]. In the findings of [4], it was observed that soil under forest land had a higher organic matter than soil under continuously cultivated land. They also observed that organic matter decreased with increase in depth. [22] observed a high soil organic matter values in soil from bush fallow land, and the organic matter contents decreased as the depth increased. [4] therefore recorded high organic matter contents from soils found at refuse dump sites.

In Abia State, land is used for many purposes as a result of the increasing demand for industrialization and development, yet studies are scarce on the effects of land use on soil properties. The scarce information has not addressed the issue of comparisons of two or more locations [25]; [32]. Therefore, this study was conducted to investigate the effects of refuse dump site, excavation site, bush fallow, continuous cropping and forest land on the soil physical properties as well as organic matter.

MATERIALS AND METHODS

The Study Area

This research was conducted in Ikwuano Local Government Area of Abia State, Nigeria. This study site located within latitude $5^{0}26$'N and longitudes $7^{0}34$'E [1]. The average population density of this location according to [10] is 491 inhabitants per square kilometre. Therefore, Ikwuano Local Government Area occupied a total area of 281 km^2 [10].

Site Description

Within the location, five land use systems were examined. These are enumerated below: forest land (FL), five years bush fallow land (FB), refuse dump site (RD), continuously cultivated land (CC) and excavation site (EX). The forest has existed for over 60 years with trees such as Iroko, Mahogany, *Gmelina arborea* (Gmelina), *Mangifera indica, Irvingia gabonensis, Treculia africana,* etc. While the five year bush fallow land has trees such as *Dialium guinese* (Ukwa), *Chromolaena odorata* (slam weed), etc.

The continuously cultivated land has been under cultivation with cassava, maize, melon, fluted pumpkin, while the refuse dump site as well as excavation site were used for refuse disposal and mining of laterite for road construction and housing, respectively.

Land Use Systems

[21] classified land use systems into: Agricultural land use system, continuously cultivated land, bush fallow land, forest land and Urban / Industrial land use system.

Agricultural Land Use Systems

This simply entails the use of land for agricultural purposes. It refers to different agricultural practices that land is used for. Such agricultural practices that can be carried out in the land include: continuous cropping, agroforestry, bush fallow system, plantation farming, etc. The type of agricultural use to which a given land in a place is put depends on the prevailing weather condition of the given place.

Continuously Cultivated Land

This is a land that has been put under constant cultivation for crops. The land is used for cultivation of temporary crops or forage for pasture.

Bush Fallow Land

The bush fallow land is described as that piece of land which has been previously cultivated for a considerable period of time and is then left under natural or uncultivated for a longer period to restore the fertility of the soil [19] due to the need to plant up a bigger land area to produce more food, the long fallow periods have Shrank to a few years. The reason is due to the increasing population and its attendant decline in land available for bush fallow system [3]. Bush fallow land is dominated by herbaceous weed species which include, *Chromolaena odorata, Pentaclethra macrophylla, Calopognium mucunoides,* etc. Bush fallow land helps in restoration of soil fertility, serves as a source of raw materials for crafts, medicine, etc. [19] and helps to protect the soil from erosion and moisture loss [22].

Forest Land

[39] defined forest land as a minimum area of land of 0.05 – 1.0 hectare with tree crown cover of more than 10 – 30 percent with trees that have the potential to reach a minimum height of 2 -5 meters at maturity. According to [12], Forest includes natural forests and forest plantations. Forest lands are often home to many animal and plant species and biomass per unit area is high compared to other vegetation communities. Forest land is dominated by trees like *Gmelina arborea* (Gmelina), *Mangifera indica, Irvingia gabonensis, Treculia africana,* etc.

Excavation

This is a site used for mining of minerals or materials like laterite, limestone, etc. The excavation activities degrade the environment and become a serious problem to the lives of residents around the site [11]. The excavations are done without any attempt to reclaim the exposed surfaces on the sites, leaving wide holes where water accumulates. In some places where the water table is high, artificial ponds can be formed. Vegetation is usually the first consult of partial destruction during excavation. The excavation site is characterised by absence of vegetation. Damage is more extensive at the time of excavation development and operations [11]. Excavation requires the use of machines, which stress on the natural environment such as soil compaction, increased rate of leaching, soil erosion and depletion of soil fertility [30]. Excavation sites are also characterized by destruction of natural landscape, creating open space in the ground and generating heaps of sand wastes that cannot be easily disposed off [11].

Excavation has drastically reduced the rate of accumulation of organic matter in the soil, decreased soil porosity [35] and increased bulk densities of soil [34].

Refuse Dump Site

This is a site for the disposal of waste materials by dumping or burial. It is the oldest form of waste treatment. Refuse dumpsites have been the most common methods of organized waste disposal and remains so in many places around the globe. In developing countries, open dumpsites are commonly used due to low budget for waste disposal as well as non-availability of trained man power [38]. Solid wastes are generally collected and placed on top of the ground which often becomes breeding grounds for rats, mosquitoes, flies, etc. They generate unpleasant odour and windblown debris [38].

Soil Sample Techniques

Soil sample technique that was used in this study is shown below. Three (3) soil sampling points were selected randomly within the land use systems. Soil samples were collected at 0 – 20 cm and 20 – 40 cm depths using augar. There were a total of six (6) samples collected from each land use system and a grand total of thirty (30) bulk samples from the five (5) land use systems. Also, two (2) core soil samples were collected from at 0 - 20 cm and 20 – 40 cm depths from the sampling points. A total of six (6) core soil samples were collected and analyzed for. Soils from similar sampling point were later bulked together to form ten (10) samples in all. These samples were used to determine the physical properties of soil in this study area

Soil Sample Preparation

Therefore, the soil samples that were collected with soil augar were air-dried in the laboratory and later sieved through a 2 mm sieve to remove gravels and stones. The sample used for organic matter determination was further crushed, while the samples for mean weight diameter were only sieved through 4.75mm sieve.

The core used to collect the soil samples were covered at the base with a cheese cloth and saturated in water for the determination of bulk density and saturated hydraulic conductivity of the soil.

Laboratory Analysis

These following soil properties were determined: particle size analysis (Bouyoucos hydrometer method) as simplified by [15].

Bulk density; by the method described by [6].

Soil Water Content

Water content at field capacity (FC) as well as permanent wilting point (PWP) were determined using saturation water percentage based estimation methods / models.

The Model are:

FC = 0.1649 + 1.4493

$R^2 = 0.6055$

Pmp = 0.43235P – 7.8315

$R^2 = 0.5965$

Where:

FC = field capacity (%)

PMP = permanent wilting point (%)

SP = saturation water point (%)

Saturation water point is calculated as follows:

$$SP = 100 \text{ X } M\theta + \frac{(Msa + Mso)}{Mso}$$

$$\text{Where: } Mso = \frac{100 \text{ x } Msa}{100 + \theta \text{ r}}$$

θr = air – day (resident moisture) (%)

Mθ = mass of water observed (g)

Msa = mass of air – dry soil (g)

Mso = mass of oven – dry soil (g)

However, available water content were subtracted from the values of field capacity (FC) and permanent wilting point (PWP) with the formula (AWC = FC – PWP).

Total Porosity

Total porosity from bulk density value assuming particle density to be 2.65 kg m^3 for mineral soils.

$$Pt = \left[\frac{(1 - Bd)}{Pd} \right] \text{ X } 100$$

In addition, macro porosity (Pma) was calculated from volumetric moisture content at field capacity (FC) as described by [18] using the equation below:

Pma = Pt – FC

Micro porosity (PM_1) was calculated as the difference between total porosity and macro porosity.

Pm_1 = Pt – Pma

Aggregate Stability

Also, the indices used to determine aggregate stability include the following: mean weight diameter (MWD) and dispersion ratio (DR). The mean weight diameter (MWD) is an index used to measure macro aggregate stability and was determined by the wet sieving method of [14]. It was calculated with the formula as follows:

$$MWD = \sum_{i=1} X_i \; W_1$$

Where:

Xi = mean diameter of each fraction size separated by sieving

W1 = proportion of the total weight sample occurring in the corresponding size fraction

N = Number of size fractions.

The dispersion ratio (DR) as described by [33] was used as an index to determine micro aggregate stability. It determines the ease with which the soil particles will be brought into suspensions by the action of water.

$$DR = \frac{\text{\% silt + clay in water dispersed sample X 100}}{\text{\% silt + clay in calgon dispersed sample}}$$

Saturated Hydraulic conductivity (Ksat) was determined by the constant head parameter method.

Organic Matter Content

The organic matter of the soil in the study site was determined by Walkely and Black method as modified by [23].

Soil pH

Soil pH was determined in 1:2.5 and water suspension ratio [20].

Statistical Analysis

However, data was collected and analyzed statistically. Also, significant differences between treatment means of various experiments were tested at $P \leq 0.05$ using the Fisher's least – significant differences (F – LSD), according to the procedures of [37]. Therefore, analysis of variance (ANOVA) was used to compare the effects of the land use systems on the measured soil physical properties. In addition, significant difference at 5% level of probability was used. Also, correlation was used to describe the relationship between organic matter and the soil physical properties.

RESULTS AND DISCUSSIONS

Effect of land use systems on soil physical properties

The effect of land use systems on physical properties of soils of Ikwuano, Abia State, Nigeria at 0-20 and 20-40 cm depths was summarised in Tables 1 and 2, respectively. The results from the study show significant differences among the treatment means at P<0.05.

Particle Size Analysis

The results presented in Tables 1 and 2 also summarize the effect of land use systems on the particle size distribution at various soil depths, 0 - 20 cm and 20-40cm, respectively. Generally, the results from the Tables indicated that the soil textures were slightly affected significantly (P<0.05) by the various land use systems. In addition, the results obtained from the refuse dump (RD), bush fallow (BF) and forest land (FL) were statistically similar and having sandy loam texture, while excavation site (EX) and continuously cultivated land (CC) were statistically different (P<0.05) having sandy clay loam and loamy sand at various soil depths, respectively. Also, Tables 1 and 2 show the values of silt which were significantly different and ranged between 2.47% (EX) and 16.47% (CC) for 0-20cm depth and 1.80% (EX) and 16.17% (CC) for 20-40cm soil depth, respectively. The excavation site gave significantly the least results of sand and silt in both Tables. However, the least results of sand and silt in EX as well as the highest values of clay obtained in EX may be due to the exposure of the acidic subsoil during excavation of soils according to [29].

However, textural class of the soils varied from sandy loam to sandy clay loam with sand predominating in all land use. Also, the sandy nature of the soils could be attributed to their being derived from unconsolidated sand deposit which was formed over coastal plain sand and sedimentary rocks [29].

Table 1.Land use systems and their effects on the physical properties of soils of Ikwuano L. G. A. of Abia State (0 - 20 cm Depth)

	Particle Size Analysis										
Land Use System	Total Sand %	Slit %	Clay %	Textural class	Bulk Density Mgm^{-3}	Total Porosity %	Macro Porosity %	Micro Porosity %	Ksat cm/min	MWD mm	DR %
EX	63.60	2.47	33.63	SCL	1.61	39.43	12.10	27.33	0.34	0.33	62.87
RD	72.57	9.73	17.70	SL	1.16	66.30	33.97	32.33	1.08	2.20	30.70
CC	77.13	16.47	6.40	LS	1.48	44.30	25.53	18.77	0.78	1.24	49.97
BF	72.47	8.73	18.80	SL	1.31	50.57	29.50	21.07	0.83	2.03	40.77
FL	71.67	12.07	16.27	SL	1.22	53.83	32.60	21.23	1.05	2.02	40.27
F-$LSD_{0.05}$	1.44*	2.39*	2.12*		0.22*	0.93*	0.91*	0.27*	0.03*	0.05*	1.15*

FL=Forest land, BF=Four years bush fallow land, RD= Refuse dump site, CC= Continuously cultivated land, EX=Excavation site, SCL=Sandy clay loam, SL=Sandy loam, LS=Loamy sand, Ksat=Saturated hydraulic conductivity, MWD=Mean weight diameter, DR=Dispersion ratio, * = significant at 5% probability
Source: Ojimgba and Amajuoyi, 2018

According to [26], soil with high sand and low clay content have high pollutant leaching potentials, because high percentage of sand on top soil will encourage sandy loam soil. In addition, [4] found that refuse dump site affects the particle size distribution of the soil and the changes lead to sandy loam texture. Therefore, the changes observed in the texture of the soil could be due to the vegetative cover as well as the top soil that were removed during excavation which consequently raised the clay content.

Also, increase in soil depth resulted to an increase in clay content and this is an indication of clay translocation [2], in addition to dissolution as well as leaching of clay materials because of rainfall effect, argillation or clay lessivage and sorting of soil materials [28]. [13] indicated that clay contents of deeper depths increase with increase of cultivation year due to either increase of clay translocation from the surface horizon or exposure of clay by run-off. The significant differences are shown in excavation site and continuous cultivated land.

Table 2.Land use systems and their effects on the physical properties of soils of Ikwuano L. G. A. of Abia State (20 -40 cm Depth)

	Particle Size Analysis										
Land Use System	Total Sand %	Slit %	Clay %	Textural class	Bulk Density Mgm^{-3}	Total Porosity %	Macro Porosity %	Micro Porosity %	Ksat cm/min	MWD mm	DR %
EX	53.90	1.80	44.30	SCL	1.67	32.93	5.03	27.90	0.308	0.24	63.03
RD	71.53	9.30	19.20	SL	1.24	64.30	30.07	33.63	1.016	2.04	30.37
CC	75.80	16.17	8.30	LS	1.55	41.50	22.50	19.00	0.648	1.04	50.70
BF	70.90	9.30	19.80	SL	1.37	48.43	27.20	21.33	0.748	1.55	42.50
FL	71.10	10.10	18.80	SL	1.28	51.83	30.10	21.73	0.976	1.72	41.47
F-$LSD_{0.05}$	1.58*	2.29*	1.14*		0.03	0.19*	0.54*	0.44*	0.020*	0.06*	1.27*

FL=Forest land, BF=Four years bush fallow land, RD= Refuse dump site, CC= Continuously cultivated land, EX= Excavation site, SCL=Sandy clay loam, SL=Sandy loam, LS=Loamy sand, Ksat=Saturated hydraulic conductivity, MWD=Mean weight diameter, DR=Dispersion ratio, * = significant at 5% probability
Source: Ojimgba and Amajuoyi, 2018.

Bulk density, Total porosity, Saturated hydraulic conductivity

Tables 1 and 2 also show significant difference (P<0.05) existing between the bulk density values of the land use systems. The results indicated that refuse dump site (RD) had significantly the least bulk density results of 1.16 and 1.24 Mgm^{-3} which were better than those of the other land use systems for 0-20 and 20-40cm soil depths, respectively. The difference among the mean values were in the following significant order: RD>FL>BF>CC>EX. The significantly (P<0.05) highest bulk density values of 1.67 and 1.61 Mgm^{-3} were observed in the excavation site at 0 – 20 and 20 – 40 soil depths, respectively. This high bulk density values may be due to exposure of subsoil during excavation.

Tables 1 and 2 also summarise the different land use systems and their effect on the total porosity as well as saturated hydraulic conductivity of Ikwuano soils at 0 – 20 and 20 – 40 depths. The results obtained show that there are significant differences existing between the various land use systems. For example, excavation site (EX) recorded significantly (P<0.05) the least total porosity and saturated hydraulic values of 32.93% and 0.308 cm min^{-1} as well as 39.43% and 0.34cm min^{-1} at 0 -20 and 20 – 40cm soil depths, respectively. Refuse dump site gave significantly the highest values of total porosity (64.3 and 66.3%) and saturated hydraulic conductivity (1.02 and 1.08 cm min^{-}

[1]), Tables 1 and 2, respectively. The relative improvement in total porosity values was in the order: RD>FL>BF>CC>EX. Similarly, the saturated hydraulic conductivity values was in the following significant order: RD>FL>BF>CC>EX.

The decrease in bulk density and increase in total porosity as well as saturated hydraulic conductivity in the refuse dump site may be attributed to the increase in organic matter content in this land use system. [31] made similar observations. [27] stated that doses of organic matter applied to the soil increased total pore volume, decreased bulk density and favours the transmission of water under saturated condition. [17] also observed that the incorporation of organic wastes statistically increased soil hydraulic conductivity, but the magnitude of increase could be attributed to the rate of application.

The high bulk density and low porosity and hydraulic conductivity observed in excavation site (EX) is similar to the findings of [21]. He, therefore, attributed this to the low organic matter as well as the removal of vegetative cover from the soil including large scale use of machineries on the site.

Water-stable aggregate

Tables 1 and 2 summarise the water-stable aggregate measured by the mean weight diameter (MWD) as indicated in all the land use systems. There were significant differences (P<0.05) existing between the values of the mean weight diameter of the various land use systems as seen in the results. However, the highest mean weight diameter results were obtained in refuse dump site (RD), whereas the rest of the land use systems gave significantly lower values at the various soil depths. In addition, excavation site gave statistically the least value in the order : RD>FL>BF>CC>EX. This may be connected with the lowest organic matter content observed under excavation site (EX). Therefore, the values obtained at the various land use systems indicated that the stability of EX was the lowest followed by CC. The low values of MWD observed may be attributed to tillage with traditional hoeing as well as clean weeding together with reduction in organic matter content [17].

Also, excavation site gave significantly higher dispersion ratio than the other land use systems, while bush fallow (BF) and forest land (FL) had statistically similar values at 0 – 20 and 20 – 40 cm soil depth.

Soil organic matter and pH

Also, Figures 1 and 2 summarize the organic matter as well as pH contents of the various land use systems at soil depths of 0 – 20 and 20 – 40 cm in Ikwuano, Nigeria. Generally, the results from the study show that refuse dump site (RD) had statistically (P<0.05) higher organic matter and pH values than the other land use systems, while excavation site (EX) gave statistically the least values. The relative improvement in organic matter including pH values was in the following significant order : RD>FL>BF>CC>EX.

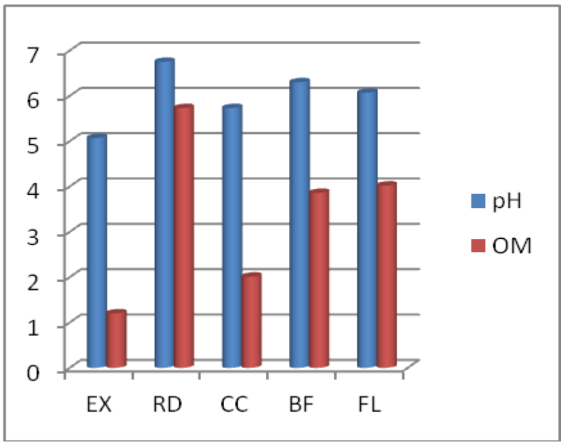

Fig. 1.Organic matter and pH values of soils in the various land use systems at 0 - 20 cm depth in Umudike, Ngeria
Source: Ojimgba and Amajuoyi, 2018.

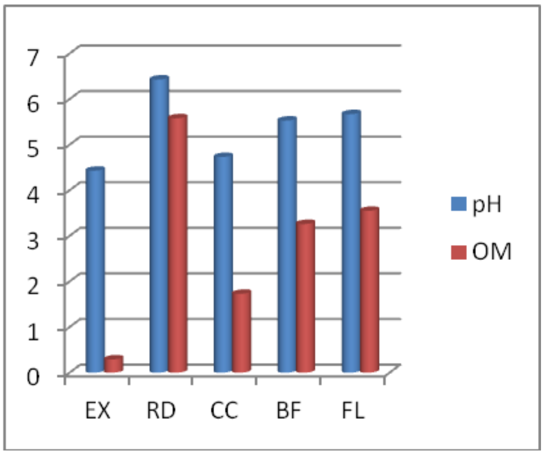

Fig.2. Organic matter and pH values of soils in the various land use systems at 20-40 cm depth in Umudike, Ngeria
Source: Ojimgba and Amajuoyi, 2018.

In the findings of [4], it was observed that soil under forest land had a higher organic matter than soil under continuously cultivated land. They also observed that organic matter decreased with increase in depth. [22] observed a significant high soil organic matter values in the soil from bush fallow land which decreased as the depth increased. [4] recorded high organic matter values from soils found at refuse dump sites, while [4] and [22] observed that the pH of soils under forest land, refuse dump site and bush fallow land ranged from slightly acidic to alkaline and the values decreased with increase in soil depth.

Relationship between Organic Matter and Some Soil Physical Properties

Table 3 shows the relationship between organic matter as well as some soil physical properties under RD, CC, BF and FL. It was observed that organic matter has a positive, strong, significant relationship with total porosity, macro porosity, moisture characteristics, mean weight diameter and bulk density. The table also show that there was no significant relationship between organic matter and soil properties under Excavation site. This could be due to the very low organic matter observed in EX and soil disturbance as well as alteration of soil profile by destroying vegetation, root channels, soil microbes and the soil horizon.

Table 3. Correlation between soil organic matter and some physical properties of soils

Dependent variable	Correlation coefficient (r)
Bulk density (Mg/m^3)	0.96*
Total porosity (%)	0.94*
Percent water (θr) retention at:	
- 0.010 MPa	0.97*
- 1.500 MPa	0.82*
Available water capacity (%)	0.72*
Saturated hydraulic conductivity (cm/hr)	0.75*
Mean weight diameter (MWD)	0.89*

* = Significant at $P < 0.05$
Source: Ojimgba and Amajuoyi, 2018.

CONCLUSIONS

The effectiveness of land use systems on soil physical properties was evaluated in Ikwuano Abia state, Nigeria. However, the physical properties of the soils evaluated were bulk density, total porosity, aggregate stability, hydraulic conductivity and mean weight diameter.

Also, from the results obtained, it was observed that total porosity, aggregate stability as well as organic matter contents were the properties that mostly influenced moisture content in refuse dump, continuously cultivated land, bush fallow (5years) and forest land.

It was deduced from the results that clay, bulk density and porosity influenced the soil aggregate stability under excavation site. The influence of clay on soil aggregate stability may be attributed to its ability to form slurry when it comes in contact with moisture. Bulk density was also high in the excavation site. The highest organic matter was recorded under refuse dump. From the textural class, the aggregate stability was lowest in excavation site followed by continuously cultivated land.

Refuse dump had higher sand and lower clay as well as silt values. Also, bush fallow had high sand than silt and clay contents. Forest land had high sand content. Excavation site had higher clay than silt. The results also show a high organic matter content in forest land and bush fallow sites, which may be attributed to litter falls and vegetative cover. Organic matter was low in excavation site with a slight acid soil reaction (soil pH) Refuse dump had high porosity also.

Based on the data represented in the study, the research shows that the soil physical properties varied within the different land use systems. Also, the soil particle size distribution recorded that sand sized particles dominated other fractions in excavation site. The textural class ranged from sandy clay to sandy loam, while other land use systems were dominated by sandy loam and loamy sand.

The soil porosity varied with bulk density in the various land use systems. However, high total porosity and low bulk density was observed in refuse dump, five year bush fallow land and forest land. The soils under excavation and continuously cultivated land were observed to be highly erodible. The research point to the fact that the pH of soils ranged from very strongly acidic to moderately acidic.

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TECHNICAL EFFICIENCY IN GRAPE PRODUCTION: A CASE STUDY OF DENIZLI, TURKEY

M. Çağla ÖRMECİ KART[1], Mevlüt GÜL[2], Ayşe KARADAĞ GÜRSOY[3]

[1]Ege University, Faculty of Agriculture, Department of Agricultural Economics, İzmir, Turkey, Email: caglaormeci@yahoo.com
[2]Isparta Applied Sciences University, Faculty of Agriculture Sciences and Technology, Department of Agricultural Economics, Isparta, Turkey, Email: mevlutgul@isparta.edu.tr
[3]Iğdır University, Faculty of Agriculture, Department of Agricultural Economics, Iğdır, Turkey. Emails: ayse_karadag@yahoo.com

Corresponding author: caglaormeci@yahoo.com

Abstract

In many parts of the world, viticulture has become primary agricultural importance throughout history. The main reason for this is that it is economically productive with an assessment of grapes as fresh wine, dried fruit, fruit juice and other manufactured products. The aim of this was to determine the resource utilisation success of vineyard in Denizli province, which has an important share in Turkeys grape production. The primary material of the study was the data obtained from the grape producers in selected villages in Çivril, Çal and Buldan Districts of Denizli Province. The sample size was calculated by using proportional sampling method. Sample volume was found 96 farmers in 95% confidence interval and the 10% margin of error. Data envelopment method (DEA) was used in the research to measure technical efficiency in grape production. Data Envelopment Method is used to evaluate the efficiency of a certain number of production units. The technical efficiency, scale efficiency and pure technical efficiency calculated according to input and the results were calculated and compared to irrigated and non-irrigated vineyards. Interviewed producers were 49 years old, educated seven years, and their agricultural experience was 26 years. According to the findings, respondents were asked how much they could reduce their input on the efficiency limit, and some suggestions were made for inefficient vineyards.

Key words: *data envelopment, technical efficiency, economic loss, grape production, viticulture*

INTRODUCTION

Viticulture has been an important agricultural arm throughout history in many countries. The main reason is that it is economically able to evaluate the grapes as fresh food, wine, dried fruit, fruit juice and other processed products. Viticulture in the world is made between in 34^o - 49^o the northern and southern latitudes, which covers Turkey as favourable climate. Grape can be considered the most valuable foods as a raisin or other products. The grapevine leaves collected for use in food and processed in brine are widely considered as a second product. With these considerations, viticulture is considered one of the important economic activities of agriculture. Therefore, vineyards cover the widest field after the grain production in Turkey. Turkey's contribution to agricultural products outside the vineyard production is of vital importance regarding foreign trade and create employment in rural areas. According to data for 2017, Denizli has 9.77 percent of Turkey's vineyard and carries 11.27 percent of the production alone. In 2017; 4.2 million tons of grapes are produced about 417,000 hectares in Turkey [10]. Approximately 65,000 families earn their living from viticulture [2][11]. The grape production is the most shareholders in Turkey [6].

Approximately 50% of the grapes consume fresh, 38% are dried, and 11% is consumed as wine. Turkey, with about 6,000 a year more than 1,400 vine viticulture has a genotype of both culture and wild vine, vine country is considered one of the fatherland. According to data for 2017, Turkey ranks fifth regarding total vineyard area and sixth regarding production in the world [4].

Turkey's almost covers 2.97 percent of the total grape and raisin trade in the world [4]. 7-

10 percent of Turkey's export revenue consisted from the raisins in the 1930s so that, it counts the most important traditional export product. According to data from 2017, Turkey exports about 420 thousand tons of grapes (raisins to 51.53%) and has earned more than 677 million dollars [4]. This value constitutes 4% of the exports of agricultural products. Viticulture Turkey has very important potential regarding creating employment opportunities because almost every month of the year is one of the wine-growing areas that require labour-intensive agricultural activities as well as the economic benefits of foreign trade. Although it is accepted that 15% of the agricultural farms in Turkey operate in the field of viticulture, but not enough information has been reached about the employment rate it has created. When the general structure of farms is evaluated, it is accepted that market-oriented activity is essential in Aegean, Mediterranean and Marmara regions, whereas small family farms in other regions are predominant, but they are also an important source of income [3].

Since the vineyard areas can be established in areas that cannot be cultivated in fields, fruits and vegetables, it is an important source of livelihood for those living in such places. It also protects these areas from erosion. The determination of the efficiency in viticulture provides important information for the investors and establishment of policies that will guide the vineyard regarding the public. Modern vineyards are installed especially in recent years, which are require expensive investments. Therefore, making these investments more conscious is important for the more effective use of resources. The findings of the research provide useful information for these investments. Also, it can be said that the study will shed light on other studies. Briefly, the purpose of this study; was to determine the resource utilisation success of farms in the Denizli province, which has a significant share in Turkey's grape production. Many studies have been done related to grape varieties, and the cost of viticulture but none of them determines the efficiency of farms in Turkey despite the increase the importance of this paper. In the study, the calculated technical efficiency, scale efficiency and pure technical efficiency results for the input were calculated separately for the watery and dry land.

According to the findings, the question of how much can be reduced in proportion to the amount of electricity, labour, depreciation, overheads and other inputs used to obtain the income in question, according to the farms that produce over the efficiency limit, without any change in the production. According to the findings, the question of how much can be reduced in proportion to the amount of electricity, labour, depreciation, overheads and other inputs used to obtain the income in question, according to the enterprises that produce over the efficiency limit, without any change in production. In the end, a number of recommendations were made for ineffective farms.

MATERIALS AND METHODS

The main material of the study was the data obtained from the grape producers in the villages of Çivril, Çal and Buldan in Denizli. The data were obtained from face-to-face interviews using a pre-prepared questionnaire. Also, various statistics, research reports, theses and papers were used as secondary data sources. In 2017; 4.2 million tons of grapes are produced in Turkey, and 11.25% of this quantity are covered by Denizli [10]. Especially in Denizli province, fresh grape and wine grape varieties are at the forefront. Denizli Province produces 205,788 tons of fresh seedless grapes in 2017. Buldan has a share of 32.33 per cent, Çal has a share of 26.53 per cent, and Çivril has a share of 0.084 per cent. However, regarding wine grapes, Çal ranks first with a share of 43.58 percent of Denizli and 8.44 percent of Turkey. In addition regarding raisins, Buldan was shining out with 14,703 tonnes of production quantity and its share of 18.25 percent of Denizli and 1.13 percent of Turkey. Çal (56,257 tons) and Çivril (1,188 tons) districts are other important production places in the production of dried seedless grapes. With the production of 31,711 tonnes in Buldan district came to the fore in 2018 in the production of table seedless grapes. For this reason, Buldan, Çal and Çivril districts, which represent approximately 60% of the total grape production, were selected for representing Denizli district. Buldan district is located in the inner part of the Aegean Region, and neighbour with Güney District from the east; Kuyucak (Aydın Province) from the west, Sarıgöl (Manisa Province) from north and Sarayköy District from the south [7]. Çivril is a district located on the Denizli-Uşak highway in the northern part of Denizli and 90 km northeast of Denizli, in the western part of Denizli province [9]. Çal district is located on the eastern skirts of the Çekelez Mountain in the east of Denizli. On the western skirt of the mountain is the famous Pamukkale.

Table 1. Vineyard area and production quantity of Denizli, Turkey and researched districts

		Fresh with seed	Fresh seedless	Wine grape	Dried with seed	Dried seedless	Total
Çal	Vineyards (ha)	2,000.00	5,833.00	3,955.90	1,996.50	5,880.00	19,665.40
	Share in Denizli province (%)	25.76	47.86	39.44	60.40	79.07	48.29
	Production quantity (tonnes)	16,434.00	54,588.00	41,203.00	19,728.00	56,257.00	188,210.00
	Share in Denizli province (%)	**24.44**	**26.53**	**43.58**	**70.99**	**72.97**	**39.83**
Buldan	Vineyards (ha)	350.00	2,559.60	48.70	256.20	660.00	3,874.50
	Share in Denizli province (%)	4.51	21.00	0.49	7.75	8.88	9.51
	Production quantity (tonnes)	3,515.00	66,539.00	366.00	1,055.00	14,073.00	85,548.00
	Share in Denizli province (%)	5.23	**32.33**	0.39	3.80	**18.25**	**18.11**
Çivril	Vineyards (ha)	207.50	263.90	101.40	113.10	173.20	859.10
	Share in Denizli province (%)	2.67	2.17	1.01	3.42	2.33	2.11
	Production quantity (tonnes)	1,478.00	1,729.00	1,056.00	727.00	1,188.00	6,178.00
	Share in Denizli province (%)	2.20	0.84	1.12	2.62	1.54	1.31
Denizli	Vineyards (ha)	7,762.50	12,187.30	10,030.80	3,305.50	7,436.10	40,722.20
	Share in Turkey (%)	4.06	37.16	15.75	5.92	10.10	9.77
	Production quantity (tonnes)	67,250.00	205,788.00	94,555.00	27,789.00	77,092.00	472,474.00
	Share in Turkey (%)	4.67	**30.81**	**19.38**	7.66	6.22	**11.25**
Turkey	Vineyards (ha)	191,034.10	32,795.60	63,679.50	55,804.70	73,592.90	416,906.80
	Production quantity (tonnes)	1,441,000.00	668,000.00	488,000.00	363,000.00	1,240,000.00	4,200,000.00

Source: TÜİK, 2018 [10].

In the selection of villages, the villages that were thought to represent the research area were selected, and the selection of villages was homogenous. While determining the number of producers interviewed in the study, the following proportional sample volume formula was used.

If the size of the population is unknown;

$n = t^2 pq / d^2$

n: Sample size

p: Probability of occurrence

q: 1-p (or probability of incidence)

d: accepted ± sampling error rate

t (α, sd): The critical value of t table according to the degree of freedom at the level of α significance

Accordingly, 95 percent confidence interval and a 10 percent margin of error sample size were calculated as 96 producers. The villages included in the study and the number of producers interviewed in these villages were given in Table 2.

Table 2. Numbers of interviewed producers in research villages

	Village	Number of producers	Total
Buldan	Yenicekent	29	48
	Oğuzköyü	19	
Çal	Ortaköy	10	35
	Selcen	8	
	Bahadınlar	6	
	İsabey	6	
	Kabalar	5	
Çivril	İmralı	6	13
	Koçak	7	

Source: own calculation

In the research, data envelopment method (DEA) was used to measure the technical efficiency of grape production. Efficiency score was determined by considering the following variables. Data Envelopment Method is used to evaluate the effectiveness of a certain number of production units. It can determine production technology in the case of multiple outputs and inputs based on distance functions [8]. Efficiency score was calculated by considering the following variables.

Y: Grape production quantity (1,000 tons)

X1: Vineyard size (ha)

X2: Labour hours (Adult male equivalent-AME)
X3: Machinery power (hours)
X4: Fertiliser (TRY)
X5: Pesticides (TRY)

The amount of grapes produced was the amount of grapes produced in each farm and was included as a dependent variable in the analysis. The size of the vineyard, was the width of the land, indicates the size of the grape produced area regarding hectares (ha).

The labour force was included in the analysis as the expression of the workforce spent during the grape production regarding adult male equivalent (AME). Labour force includes both family power and foreign labour. It was thought that it would be more appropriate to include the labour force in quantity, not in monetary terms.

Machinery costs were obtained separately from the hours spent for each process, from the first to the harvest, which the farms spent on producing grapes. Since different fertilisers used in grape production contain different amounts of nutrients (N, P, K) or they have different properties, it was decided to treat them as fertiliser costs in TRY. Similarly, it was decided that it should be included in the model in monetary terms because it was considered a large number of chemicals in grape production.

When determining the efficiency score, the observed and optimal values of the inputs and outputs used were compared. This comparison can be considered as the ratio of the observed output to the maximum output available from the current input, or the ratio of the minimum potential input required producing a certain amount of output to the observed input, or a combination of the two.

Efficiency component has not been taken into consideration in efficiency studies for many years. The activity is, in fact, one of the components that provide efficiency change [8].

If agricultural production is not done effectively, agricultural production can be increased by better utilisation of resources. When we look at the subject, in theory, it will be shifted from a point below the production possibilities curve to the production possibilities curve where maximum potential production is realised [5] [8].

RESULTS AND DISCUSSIONS

Table 3 presents the general characteristics of the producers interviewed. The average age of the interviewed producers was 49 years, the training period was seven, and the agricultural experience was 26 years. When compared to producers according to the land structure, it was determined that the producers who produce in the irrigated land be younger and more educated, but their experience period was shorter than the non-irrigated vineyards. When farms were evaluated regarding households, it was seen that the farms were composed of four persons.

Table 3. Farmers' characteristics according to the land structure in interviewed farms

General characteristics	Irrigated (N=56)		Dry (N=40)		Total (N=96)	
	Mean	Std. Dev.	Mean	Mean	Std. Dev.	Mean
Age (year)	44.30	9.71	56.45	9.13	49.36	11.18
Education (year)	7.70	3.13	6.00	2.28	6.99	2.91
Household population (person)	4.09	1.16	3.90	2.38	4.01	1.77
Experience (year)	21.26	8.56	32.80	13.42	26.17	12.26

Source: own calculation

Table 4 shows the distribution of the vineyards according to their owned status and land structure. According to the results of the research, it was determined that the farms have 4.52 hectares of vineyard. It was determined that 4.1 hectares be owned by the property, 0.25 hectares were rented, 0.26 hectares was mutual property. The vineyards were found to have an average of 4.8 plots. When the ownership status of the vineyards according to the land structure was evaluated, it was determined that the irrigated vineyards were larger, less fragmented and the property rate was higher.

Table 4. The land presence and tenure in interviewed farms according to the land structure

	Irrigated (N=56)		Dry (N=40)		Total (N=96)	
	Mean	Std. Dev.	Mean	Mean	Std. Dev.	Mean
Vineyard size (ha)	5.09	42.39	3.72	30.38	4.52	38.28
Personal vineyard (ha)	4.55	42.27	3.26	24.05	4.10	36.24
Rented vineyard (ha)	0.15	5.70	0.39	15.38	0.25	10.83
Mutual vineyard (ha)	0.39	13.04	0.08	4.74	0.26	10.49
Mean plot (number)	3.91	2.09	6.03	4.99	4.79	3.72

Source: own calculation

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The average yield of grapes was 13,343 kg per hectare, and the average vineyard was 4.52 hectares (Table 5). In grape production, producers use an average of 692 hours of labour (AME), 534 hours of machinery power, 891 TRY of fertiliser and 360 TRY of pesticides. In irrigated vineyards, the average grape yield was 17,858 kg per hectare, and the average vineyard size was 5.09 hectares. In irrigated conditions, it was determined that the producers use 794 hours of labour (AME), 517 hours of machinery power, 955 TRY of fertiliser and 359 TRY or pesticides. In dry conditions, it was noteworthy that the vineyards produce much lower efficiency than the aqueous conditions. The average yield of vineyard in dry conditions was 4,695 kg per hectare. Producers producing grapes in dry conditions need 495 (EİG) 692 hours of labour (AME), 567 hours of machinery power, and 767 TRY fertiliser and 363 TRY agricultural pesticides.

Table 5. Grape production and input use quantities in interviewed farms according to the land structure

General features	Irrigated (N=56)		Dry (N=40)		Total (N=96)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Yield (kg ha^{-1})	17,858	1,125.34	4,695	322.71	13,343	1,136.55
Vineyards (ha)	5.09	42.39	3.72	30.38	4.52	38.28
Labour (man power ha^{-1})	794	42.91	495	34.99	692	43.59
Machinery (hour ha^{-1})	517	25.18	567	25.87	534	25.47
Fertilisers (TRY ha^{-1})	955	50.56	767	48.94	891	50.07
Pesticides (TRY ha^{-1})	359	43.51	363	41.24	360	42.37

Source: own calculation

The gross production value of the grape production in the interviewed vineyards was determined to be TRY 11,209.5; the total variable cost per hectare was 5,666 TRY (Table 6). It was seen that labour costs were the most significant share among variable expenses. The gross margin of the vineyard was determined to TRY 5,543. When comparing according to the land structure, it was seen that the gross production value was higher in the irrigated vineyards. According to Table 6, the total variable costs, fertiliser, labour force, machinery power and other costs were higher in the irrigated vineyards than non-irrigated vineyards.

Within the scope of the research, data envelopment method was applied all the vineyards interviewed to evaluate the results of the input efficiency. Moreover, according to the land structure, the vineyards were separated as irrigated and non-irrigated vineyards and evaluated independently. The study examined the question of how much input quantities can be reduced proportionally without changing the amount of grapes produced in the vineyard. Table seven presents the results of input efficiency score in general and according to the land structure of the examined vineyards.

Table 6. Gross production value, variable costs and gross margins in interviewed farms according to the land structure

	irrigated (N=56)		Dry (N=40)		Total (N=96)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Gross production value (TRY ha^{-1})	12,605.0	836.01	8,538.0	647.89	11,209.5	815.26
Variable costs (TRY ha $^{-1}$)						
Fertilizers (TRY ha $^{-1}$)	955	50.56	767	48.94	891	50.07
Pesticides (TRY ha^{-1})	359	43.51	363	41.24	360	42.37
Labour (TRY ha^{-1})	3,988	222.53	2,330	186.57	3,419	229.33
Machinery power (TRY ha-^{1})	425	11.00	380	17.97	409	14.40
Irrigation (TRY ha^{-1})	309	12.28	-	-	203	18.81
Other costs (TRY ha^{-1})	421	22.03	311	15.14	384	20.15
Total (TRY ha^{-1})	6,457	245.54	4,151	205.30	5,666	262.88
Gross margin (TRY ha^{-1})	6,147	788.44	4,386	521.35	5,543	706.45

Source: own calculation

The lowest value of the total technical efficiency for the input was 0.020, and the average score was 0.374. When an evaluation made according to the average efficiency, it was possible to realise the same production even if the examined vineyards can reduce the amount of input they use by 62.6%. When looking at the source of inefficiency in input usage, it seen that this was a problem due to not being able to realise the current production using minimum input and deviation from the optimum scale. The number of reference vineyards with a total technical efficiency value of one or which constitutes the effective limit was determined as three and these vineyards constitute only 5.36% of all vineyards.

When the vineyards evaluated according to the land structure, the technical efficiency score in the irrigated conditions was determined as 0.050, and the average value was 0.533. These coefficients were determined as 0.112 and 0.470 in the non-irrigated vineyards. While the number of active vineyards in water conditions was 11 and 19.64% of total vineyards, the number of active vineyards in dry conditions was six, and it has a share of 10.71% in total. The high number of vineyards that provided pure technical efficiency in both land structures shows that there were losses due to scale inefficiency in vineyards. According to the results of the analysis, although it was not an active agricultural activity in both land structures, it was seen that resource utilisation was more successful in irrigated conditions.

Table 7. The results of the input efficiency according to the land structure in the interviewed farms

		Irrigated vineyards (N=56)	
Efficiency	Technical effi.	Pure effi.	Scale effi.
Max.	1.000	1.000	1.000
Min.	0.050	0.124	0.050
Mean	0.533	0.749	0.742
Std. Dev.	0.304	0.287	0.288
Var. Coefficient.	0.173	0.110	0.112
%100 efficient farms	11	26	11
Share in total (%)	19.64	46.43	19.64
		Dry vineyards (N=40)	
Efficiency	Technical effi.	Pure effi.	Scale effi.
Max.	1.000	1.000	1.000
Min.	0.112	0.163	0.112
Mean	0.470	0.826	0.612
Std. Dev.	0.310	0.297	0.316
Var. Coefficient.	0.205	0.107	0.163
%100 efficient farms	6	27	6
Share in total (%)	10.71	48.21	10.71
		Total (N=96)	
Efficiency	Technical effi.	Pure effi.	Technical effi.
Max.	1.000	1.000	1.000
Min.	0.020	0.020	0.020
Mean	0.374	0.374	0.374
Std. Dev.	0.316	0.316	0.316
Var. Coefficient.	0.266	0.266	0.266
%100 efficient farms	3	3	3
Share in total (%)	5.36	5.36	5.36

Source: own calculation

The loss of inputs resulting from inefficiency in the vineyards has calculated by subtracting the targeted input usage amounts from the current use of the vineyards that have not been able to ensure their efficiency in production. In other words, in each group, inefficient vineyards were determined how much they need to save more labour force, machinery power, pesticides and fertiliser costs compared to reference vineyards that produce over activity limit. In grape production, producers overuse 111 hours of the workforce, 94.3 hours of machinery power, 193 TRY of fertilisers and 46.5 TRY of pesticides due to inefficiency in production. If the loss of inputs due to inefficiency in the interviewed vineyards was expressed in monetary terms, 15.19 percent of the variable costs were wasted. Considering that the area where the vineyards in Denizli was more than 40 thousand hectares, the total loss of input will be 35 million TRY. These input losses were very important regarding increasing the producer's income and decreasing the product costs and increasing consumer welfare. It was determined that although irrigated vineyards were more effective, the input losses were more. It was possible to say that the amount of loss was less because non-irrigated vineyard was more extensible.

Table 8. Input losses according to the land structure in interviewed farms

	Irrigated vineyards (N=56)	Dry vineyards (N=40)	Total (N=96)
Labour (TRY ha^{-1})*	807.2	120.3	548.3
Machinery power (TRY ha^{-1})**	77.2	42.5	72.6
Fertilisers (TRY ha^{-1})	233.6	85.1	193.2
Pesticides (TRY ha^{-1})	61.1	22.7	46.5
TOTAL	1179.1	270.6	860.6
Share in the variable cost (%)	18.26	6.52	15.19

* 1 unit of men power hourly rate was calculated as 5.02 TRY in irrigated farms, 4.70 TRY in dry farms and 4.94 TRY in general. ** The hourly rate of the machinery power was calculated as 0.82 TRY in irrigated farms, 0.67 TRY in dry farms, and 0.77 TRY in general.
Source: own calculation

CONCLUSIONS

The results of this study, which shows the technical efficiency of grape production in Denizli province, can be summarised as follows:
Total technical efficiency value was determined as 0.374. This indicates that the production of grapes in Denizli was not effective and generally shows that 62.6% of the producers use excess input. It was determined that ineffectiveness be mostly due to the inability of the farms to operate on an appropriate scale. The primary reason for this was the fact that farms, which were the main problems of the Turkish agricultural structure, were mostly fragmented. The number of active farms was determined as only three, and it was determined that it constitutes only 5.36% of the total farms. According to the land structure, it was determined that the irrigated farms be more effective regarding the amount of input, but because of the intense production, they have a higher monetary value than the ones producing in dry conditions. Because of the research, it was necessary to increase the mechanisation of viticulture, in other words, in order to make the production of grapes more efficient.

Grape was a very important traditional product regarding Turkish agriculture, and grape production was made in many regions of Turkey. In this regard, more efficient work of the research institutions and ensuring that innovations were delivered to the farmers will contribute to the increase of efficiency in both Denizli and other regions.

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THE EVOLUTION OF MILK PURCHASE PRICE IN ROMANIA (2012-2016)

Radu Lucian PÂNZARU, Dragoș Mihai MEDELETE

University of Craiova, Faculty of Agronomy, 19 Liberty, 200421, Craiova, Romania, Phone: +40 741 180 976, Fax: + 40 251 418 475, Emails: rlp1967craiova@yahoo.com, medelete@yahoo.com

Corresponding author: medelete@yahoo.com

Abstract

The paper seeks to create an overall picture of the evolution of the milk purchase price at national and regional level for the period 2012-2016. In this respect, using a credible database (www.insse.ro), it presents the price evolution and the positioning in the context of importance for the respective product to the Romanian agricultural economy. The milk sales price recorded a national multiannual average of 1.17 lei / l, with extreme values of 0.65 lei / l in 2014 for the South West Oltenia Region and 1.68 lei / l for the year 2015 for South Muntenia Region (total amplitude variation of 1.03 lei / l). As a result, there is a need at national level to implement adequate sequential policies in the territory to support milk-producing establishments to obtain favorable marketing prices through the involvement of competent decision-makers.

Key words**:** *amplitude of variation, evolution, milk, price, absolute variation*

INTRODUCTION

Taking into consideration the fact, that milk is a strategic product for a country economy, appear the tendency to provide with sufficient quantities the population by the development of primary milk production [2]. The production of milk in value terms is situated on the second place, after meat in animal production [6].

The milk supply is conditioned by: technical factors (number and breed of cows, their yield, breeding and feeding system, disease prevention, etc.); economic factors (referring to the ratio between the milk and fodder price, the conditions for the remuneration of staff working in the dairy sector and beyond, the changes and the production structure of the dairy farm, etc.). There is still a low quality of milk supply, which is mainly determined by the quality of feed and the lack of a focus on quality and hygiene on farms. Milk quality is also negatively affected by the lack of cooling facilities at farms and collection points.

The price of a product must be regarded as a good equivalent for paid money. That does not mean it has to be the cheapest the on the market. The costumers are willing for paying more money, when something that really suits them appear [3].

Price types for agricultural / agri-food products can be structured according to several criteria. In the literature there is the following form of classification: after the stages of the chain, the prices of agricultural / agri-food products; the price system used in Romania during previous periods; the price system used in the Common Market over the years. The EU Council fixes agricultural product prices at the beginning of each year: the indicative price being considered the price at which the transaction could be made; the initial price, which is the minimum level at which import products can be sold (higher than the intervention price, thus encouraging the purchase of Community products); the intervention price, which is the guaranteed price level at which the Authority can buy and store certain quantities produced [4].

Pricing can be a complex action if the closest competing firms are hard to identify. But one must not forget that no product is absolutely free of competition; there is almost always a way to satisfy the customer's need for the product. Also, different consumers have different needs; therefore, they will have different needs as to what constitutes value in exchange for money. Therefore, markets need to be segmented carefully to ensure a fair price for each segment. As with any marketing issue, it's wise to start from the customer [3].

In the context of the competitive market economy, especially in transition periods - characterized by the emergence of inflationary factors, agricultural and agri-food prices have a number of characteristics such as: they show a fluctuation over time due to the perishability of the products, the degree of preference to storage and the size of specific storage capacities, the degree of scarcity (in certain situations), their qualities and the degree of consumer demand; may tend to stabilize or reduce; may lead to an increase or decrease in farmers' incomes, depending on the intensity of consumption; their fluctuation may amplify, reduce or stabilize the price of other goods for consumption [1].

The price of agricultural / agri-food products, at any stage of the market knows changes in the direction of its growth or decrease, depending on market orientation [5].

The influence of milk prices on profitability is crucial. The evaluation of profitability in dairy farms requires to consider both cost input and milk output as well as milk market price [8].

Marketed milk and milk price have a positive impact on profit, while production cost has a negative impact [9].

MATERIAL AND METHODS

The elaboration of this study called for the comparison of time and space [7]. Regarding the temporal sequences that are included in the analysis, the media was also operated.

For the present paper, the purchase price was used as an indicator (lei/l).

Running the analysis refers to the time period between 2012 and 2016, to which was added the average of the period, thus forming a dynamic series consisting of 6 terms.

The analysis was carried out at both national and regional level (seven development regions), showing the position of each region relative to the national average price level, the absolute variations of the indicator (lei / l) and the dynamics of the indicator. Please note that the database used does not show values for the Ilfov and West Regions of Bucharest respectively.

RESULTS AND DISCUSSIONS

Table 1 shows the milk price data at national and regional level as well as the position of the latter relative to the national situation [10].

The year 2012 is characterized by price variations of 0.85 lei / l for the South West Oltenia region (-0.26 lei / l and -23.42% compared to the national situation) and 1.24 lei / l for the Centru region (+0.13 lei / l and + 11.71% compared to the national situation), while at national level the indicator reached 1.11 lei / l. As a result, we are talking about regions that recorded higher levels than the reporting base (national level of the indicator), such as: 1.16 lei / l North West Region (+0.05 lei / l and + 4.50%). At the same time, lower values are recorded: 0.98 lei / l in the South Muntenia Region (-0.13 lei / l and -11.71%) 1.01 lei / l South East Region (-0.10 lei / l and -9.01%), 1.08 lei / l North East Region (-0.03 lei / l and -2.70%).

At the level of 2013, the national average price was 1.20 lei / l, compared to which there were at the regional level both supra-unitary values and sub-unitary levels. Thus, the South West Oltenia, South Muntenia, South East and North East regions are characterized by sub-unitary levels: 0.66 lei / l, 1.03 lei / l and 1.09 lei / l the last two regions. Consequently, we discuss absolute declines of 0.54, 0.17 and 0.11 lei / l, decreases in relative sizes of 45.0, 14.17 and 9.17%. Surplus levels reached 1.27 lei / l for the North West Region (+0.07 lei / l and + 5.83%), 1.43 lei / l at the Center Region level (+ 0.23 lei / l and + 19.17%).

In the case of 2014, the price ranged from 0.65 lei/l in the South West Oltenia Region (-48.0% and -0.60 lei/l compared to the comparison term) to 1.48 lei/l, in the case of the Center and South Muntenia (+ 18.40% +0.23 lei/l) and the national level of the indicator was 1.25 lei/l. The regions of South East, North East and North West are characterized by registering sub-unit values, compared to the reporting base. The decrease

was: -0.18 lei/l South East Region (1.07 lei/l, -14.40% in relative values), -0.10 lei/l North East Region (effective 1.15 lei / l, decrease by 8.0% the base of reporting), -0.06 lei/l North West region (1.19 lei / l, decrease by 4.80% - relative to the national level).

Table 1. Situation of sales prices (lei / l) at national and regional level

Specification	Year										Average**	
	2012		2013		2014		2015		2016			
	Eff. *	% compared to the national level **	Eff. *	% compared to the national level **	Eff. *	% compared to the national level **	Eff. *	% compared to the national level **	Eff. *	% compared to the national level **	Eff.	% compared to the national level **
National level	1.11	100	1.20	100	1.25	100	1.16	100	1.15	100	1.17	100
North West Region	1.16	104.50	1.27	105.83	1.19	95.20	1.12	96.55	1.10	95.65	1.17	100.0
Center Region	1.24	111.71	1.43	119.17	1.48	118.40	1.31	112.93	1.27	110.43	1.35	115.38
North East Region	1.08	97.30	1.09	90.83	1.15	92.00	1.00	86.21	1.03	89.57	1.07	91.45
South East Region	1.01	90.99	1.09	90.83	1.07	85.60	1.14	98.28	1.18	102.61	1.10	94.02
South Muntenia Region	0.98	88.29	1.03	85.83	1.48	118.40	1.68	144.83	1.57	136.52	1.35	115.38
South West Oltenia Region	0.85	76.58	0.66	55.00	0.65	52.00	0.75	64.66	0.78	67.83	0.74	63.25

Source: *http://statistici.insse.ro/shop/index.jsp?page=tempo3&lang=ro&ind=PPA102C (28.11.2017)
**own calculation

In the case of 2014, the price ranged from 0.65 lei/l in the South West Oltenia Region (-48.0% and -0.60 lei/l compared to the comparison term) to 1.48 lei/l, in the case of the Center and South Muntenia (+ 18.40% +0.23 lei/l) and the national level of the indicator was 1.25 lei/l. The regions of South East, North East and North West are characterized by registering sub-unit values, compared to the reporting base. The decrease was: -0.18 lei/l South East Region (1.07 lei/l, -14.40% in relative values), -0.10 lei/l North East Region (effective 1.15 lei / l, decrease by 8.0% the base of reporting), -0.06 lei/l North West region (1.19 lei / l, decrease by 4.80% - relative to the national level).

If we refer to the specific situation of 2015, there is a national price of 1.16 lei/l, against which the development regions were positioned as follows: -35.34% South West Oltenia Region (effective 0.75 lei/l, real decrease (-0.17 lei/l), -3.45% North West Region (1.12 lei/l, absolute decrease of 0.04 lei/l), -13.79%/-1.72% South East Region (1.14 lei/l, absolute decrease of 0.02 lei/l), + 12.93% for Center Region (1.31 lei/l, absolute excess of 0.15 lei/l), + 44.83% South Muntenia Region (actual level of 1.68 lei/l, 0.52 lei/l absolute overrun).

For the year 2016, there was a national level of 1.15 lei/l of the selling price, with limits of 0.78 lei/l in the South West Oltenia Region (-42.17% and -0.37 lei/l compared to the national situation) and 1.57lei/l in South Muntenia Region (+ 36.52% and +0.42 lei/l). Below the reference level are the North East Region - 1.03 lei/l (-0.12 lei/l and -10.43%) and North West Region - 1.10 lei/l (-0.05 lei/l and -4.35%). The other regions exceeded the base of comparison as follows: + 2.61% South East (effective 1.18 lei/l, absolute 0.03 lei/l), + 10.43% Center (1.27 lei / l, absolute growth of 0.12 lei / it).

Based on the above-mentioned annual situations, the average of the period characterized by a national level of the indicator of 1.17 lei/l was determined (Figure 1): -36.75% South West Oltenia Region (effective 0.74 lei/l, absolute decrease of 0.43 lei/l); -8.55% North East Region (effective 1.07 lei/l, absolute decrease of 0.10 lei/l); -5.98% South East Region (effective 1.10 lei/l, absolute decrease of 0.07 lei/l); level for the North West Region; + 15.38% of Centru and

South Muntenia (1.35 lei/l level, 0.18 lei/l absolute increase).

The evolution of the price for milk are shown in Table 2, in absolute terms (lei/l), at national and regional level.

There is an increase of the milk price at national level, in the years 2013 and 2014 (+0.09 and +0.05 lei/l respectively) and decreases in the years 2015 and 2016 (-0.09 and -0.01 lei/l respectively). Under these conditions, the average of the period exceeded the level of 2016 by 0.02 lei/l.

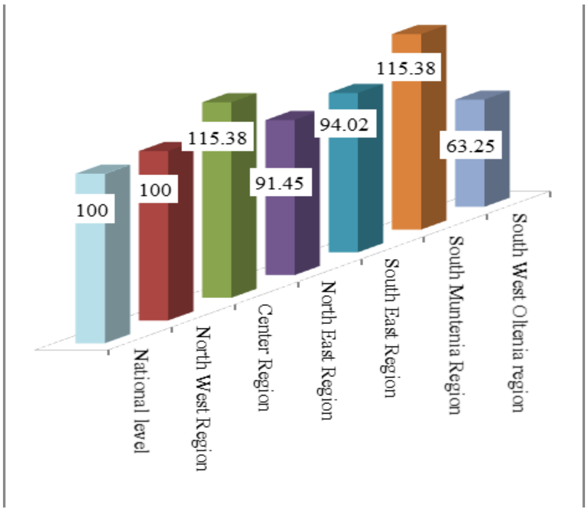

Fig. 1. Positioning of development regions against the national price level (% of the period)
Source: Own calculation and design.

For the North West Region, there are increases in the years 2013 and 2014 (+0.11 and +0.08 lei/l respectively), as well as decreases compared to the bases in the years 2015 and 2016 (-0.17 and -0.02 lei/l respectively). For the average of the period, there are increases compared to the reference period (+0.07 lei/l).

In case of the Center Region, it is noted that the indicator showed 3 growth trends (+0.19, +0.05 and +0.08 lei/l in 2013, 2014 and the for the period average) and 2 downward trends for 2015 and 2016 years (- 0.17 and - 0.04 lei/l).

The North East region is characterized by the existence of four situations when the indicator increases compared to the reference terms, respectively, the years 2013, 2014, 2016 and the average of the period (+0.01, +0.06, +0.03 and +0.04 lei/l respectively) - a situation of decrease of the indicator level - 2015 (-0.15 lei/l).

The South East Region shows an evolution characterized by increases in indicator levels in the years 2013, 2015 and 2016 (+0.08, +0.07 and +0.04 lei/l compared with reporting terms), but also downward trends in 2014 and for the average of the period (-0.02 and -0.08 lei/l).

Table 2. The absolute variation in selling prices (lei / l) in Romania, at national and regional level *

Specification	±Δ 2013 vs. 2012	±Δ 2014 vs. 2013	±Δ 2015 vs. 2014	±Δ 2016 vs. 2015	±Δ Average vs. 2016
National level	+0.09	+0.05	-0.09	-0.01	+0.02
North West Region	+0.11	-0.08	-0.07	-0.02	+0.07
Center Region	+0.19	+0.05	-0.17	-0.04	+0.08
North East Region	+0.01	+0.06	-0.15	+0.03	+0.04
South East Region	+0.08	-0.02	+0.07	+0.04	-0.08
South Muntenia Region	+0.05	+0.45	+0.20	-0.11	-0.22
South West Oltenia Region	-0.19	-0.01	+0.10	+0.03	-0.04

Source:* own calculation.

In the South Muntenia Region case, there are decreasing tendencies for the level of the indicator (0.11 lei/l in 2016, 0.22 lei/l in the average of the period), but also growth tendencies (0.05 lei/l in 2013, 0.20 lei / 2015 and 0.45 lei/l in 2014).

The South West Oltenia Region shows the absolute decrease of the indicator of 0.01, 0.04 and 0.19 lei/l in 2014, for the period average and for the year 2013. Trends in price growth are shown in the years 2016 and 2015 - 0.03 and 0.10 lei/liter.

As for the annual variation amplitudes of the indicator, they were 0.39 lei/l in 2012 (45.88%), 0.77 lei/l in 2013 (116.67%), 0.83 lei/l in 2014 (127.69%), 0.93 lei/l in 2015 (124.0%), 0.79 lei/l in 2016 (101.28%) and 0.61 lei/l for the average of the period (82.43% - Figure 2). It can be seen that the highest price uniformity occurred in 2012 (relative differences of 45.88% between extreme values), and the largest variation is specific to 2014 (relative differences of 127.69% between extreme values).

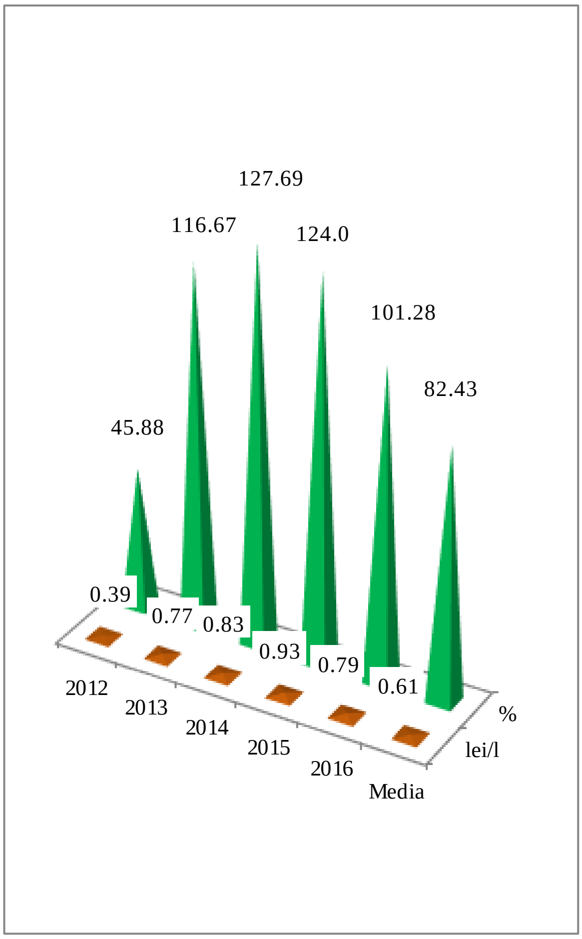

Fig. 2. The sequential amplitude of price variation (lei/l)
Source: Own calculation and design.

If we analyze the indicator according to the variation amplitude for each reference level (national and regional), the following is shown (Figure 3): total amplitude is equal to the annual amplitude (without the average of the period) of 0.18 lei/l at national level; variations of 0.19 lei/l for the North West Region, total or annual amplitude; amplitudes of 0.36 lei/l (total and yearly) for the Center Region; changes of 0.21 lei/l (total and annual amplitude respectively) in the North-East Region; amplitudes of variation of 0.16 lei/l (including average of the period - total) and 0.10 lei/l (excluding the average - annual) respectively for the South East Region; total amplitude of 0.67 lei/l and annual amplitude of 0.56 lei/l for the South Muntenia Region; changes of 0.29 lei/l in the South West Oltenia Region (total and annual amplitude, respectively).

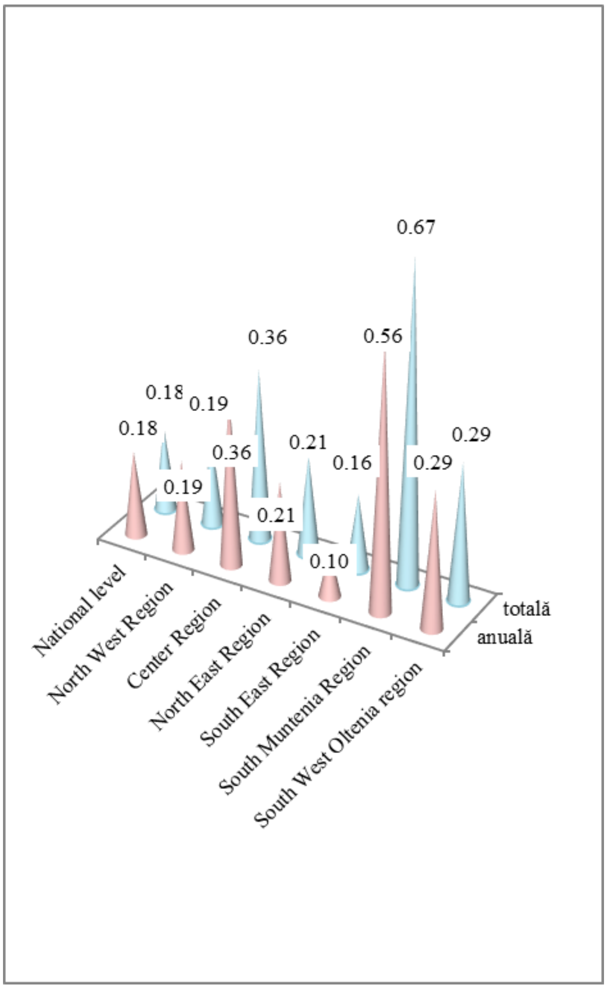

Fig. 3. Annual and total amplitude of price variation (lei/l)
Source: Own calculation and design.

Based on these observations, it can be seen that, in terms of total amplitude, the variation was 0.51 lei/l (difference between 0.67 and 0.16 lei/l for the South Muntenia and South East regions), while at the level of the annual amplitude the variation was 0.46 lei/l (0.56 and 0.10 lei/l for the same development regions as for the total amplitude).

CONCLUSIONS

The milk sales price recorded a national multiannual average of 1.17 lei/l, with extreme values of 0.65 lei/l in 2014 for the South West Oltenia Region and 1.68 lei/l for the year 2015 for South Muntenia Region (amplitude total variation of 1.03 lei/l).

The evolution at national level for the indicator is uneven, increasing for the years 2013 and 2014, decreasing for 2015 and 2016, and with a recovery trend at the average of the period. This state of affairs also appears for the Center Region. If we analyze the situation specific for the remaining regions, there are fluctuating developments with annual disparities as follows: growth in 2013, followed by declines to 2016 and a recovery to the period average in North West; increases in years 2013 and 2014, declines for 2015, increases in year 2016 and for period average in North East; growth in 2013, declining in 2014 year, increases in 2015 and 2016 followed by a decrease for average in South East; increases in 2013, 2014, 2015, declines in 2016 and in average for the South Muntenia region; decreases in 2013 and 2014, increases in 2015 and 2016 followed by decreases in the average for South West Oltenia. This state of affairs shows quite pronounced particularities from one region to another.

At national level, there is a need to implement adequate sequential policies in the territory to support milk-producing establishments to obtain favorable marketing prices through the involvement of competent decision-makers.

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DEVELOPMENT AND UTILITY OF GEOREFERENCED ANALYTICAL TOOLS IN RURAL AREAS

Andreas PAPANDREOU

Alexander Technological Institute of Thessaloniki, Faculty of Agricultural Technology, Department of Rural Development and Management of Agricultural Enterprises, P.O. BOX. GR 55132, Kalamaria, Greece, Phone: +302310487035, Mobile Phone: +306940327602, Email: andreaspapandreou94@hotmail.gr

Corresponding author: andreaspapandreou94@hotmail.gr

Abstract

The purpose of this paper, is to investigate the planning and development a mapping, georeferenced and analytical tool and the utility of this, in agricultural sector. The methodological approach followed is based on the research of scientific approaches and scientific bibliography, also using technological innovations and aims at the overall assessment of the usefulness of such a technological development in agricultural sector. As a result of this research, it is considered that proper planning and optimal use of all the data held in their hands by farmers, is necessary so that they have sustainability in agricultural sector.

Key words: *agricultural analytic tools, agriculture topography, agriculture planning, agriculture development*

INTRODUCTION

Today, technology and agriculture have joined forces to provide a new way of cultivation, which enables producers to maximize their profits.
This is Agriculture Precision, which allows the modern farmer to manage his field at points smaller than that of the parcel.
Precision agriculture is based on technologies and instruments that initially record the existing state of the parcel, then manage the data and eventually apply the inputs covering spatially and temporally the needs of each plot item according to its variation.
But what problem can precision agriculture cure?
The problem that has arisen today is the first strand of precision agriculture, i.e. the initial recording of the existing situation, which is needed because it has been proven that there have been a bunch of breaches by farmers - landowners who have been building a boundary from owning their neighbor. [7]
The problem has come to light in recent years in Greece, as you are now implementing the cadastral registration of the country. [5]
Cross-cutting science, such as Topography, Information Technology, Agriculture, Legal and Analytical, combined with state-of-the-art technologies such as Decision Support Systems and Positioning and Positioning Systems, can bring development and solutions to many problems in the modern rural area. [4]

MATERIALS AND METHODS

The material used for this research is the sources of knowledge of the location of country Greece as well as the scientific literature. The methodological approach followed is based on the research of scientific approaches as well as on scientific bibliography and using of special purpose pc programs.

RESULTS AND DISCUSSIONS

This sector presents the design and development of a cartographic, georeferenced and analytical tool as well as it uses in the agricultural sector based on the superior methodological approach.

Clarification of Concepts

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In order to fully understand the operation of the system, some concepts should first be clarified.

First of all, Topography is the study of the shape and characteristics of the Earth's surface or other observable nearby celestial bodies (planets, natural satellites or asteroids). More specifically, it is the scientific field of description and methods for the depiction and depiction of any such surface, natural or man-made on a topographic map. In another sense, the topography of an area refers to the shapes and characteristics of the earth's surface itself.

This branch of geosciences and planetary sciences has been expanded recently to include local geography, even local history and culture. [10]

Secondly, a georeferenced is defined as the process by which real mapping coordinates of a desired coordinate system are assigned to a digital image that has been derived by scanning an analytical map or an aerial shot on a scanner device.

Another one, is Business Intelligence Systems.

Business Intelligence refers to computer-based techniques that are used to find, surface and analyze business data, such as revenue from product or segment sales, or various costs and incomes. [9]

BI technologies provide historical, current and predictive views of the Function Management. The usual functions of BI are: Reporting, Online Analytical Processing, Analytics, Data Mining, Business Performance Management, Benchmarking, Text Mining and Predictive Analysis. [6]

There are also existing The Decision Support Systems in Agriculture, which are: Information technology designed to help farmers deal with complex crop problems by using the best available data and knowledge with best scientific practices. [1]

These technology systems support the smart agricultural approach, which can:

-Reduce labor and agricultural inputs,

-Minimize negative environmental impacts and also

-Increase crop yields. [3]

As for Agriculture Precision, the term was mentioned above.

Use of the program

The program, which we will use, is Microsoft's Power BI. [8]

The reason this program is used is due to its compatibility with other Microsoft Office tools. However, there are many programs that can perform this task.

The first part, is the introduction of data. We'll have to move three columns (Longitude, Latitude and Location) to one sheet and pass the data.

After we save it, we open the Power BI program. We go from Home tab to Edit Queries and load Excel with our records.

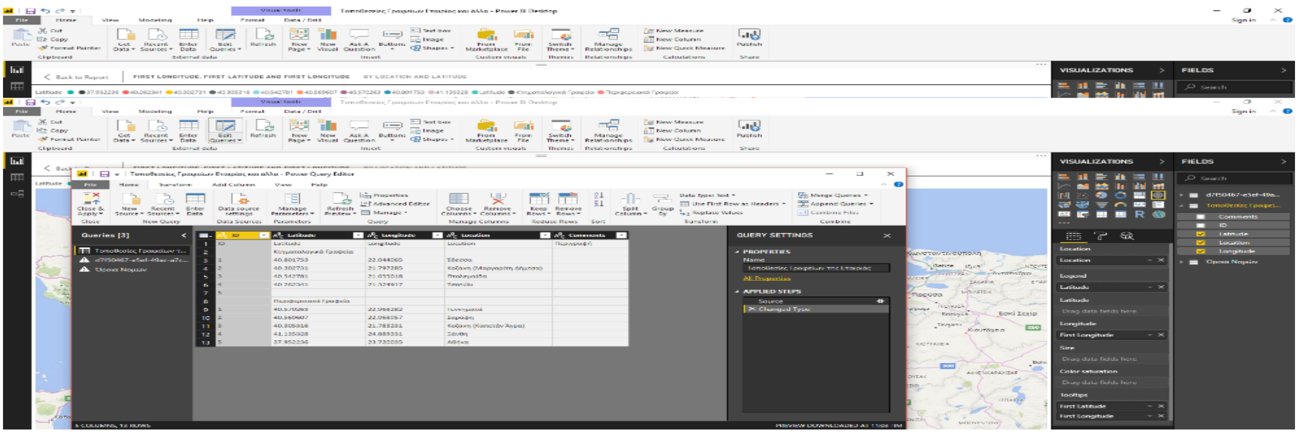

Photo 1. The insert of information.
Source: Screenshot of personal using and design.

Once we have completed our subscriptions, we will see dots appear in the map at the points we chose to, geo-map.

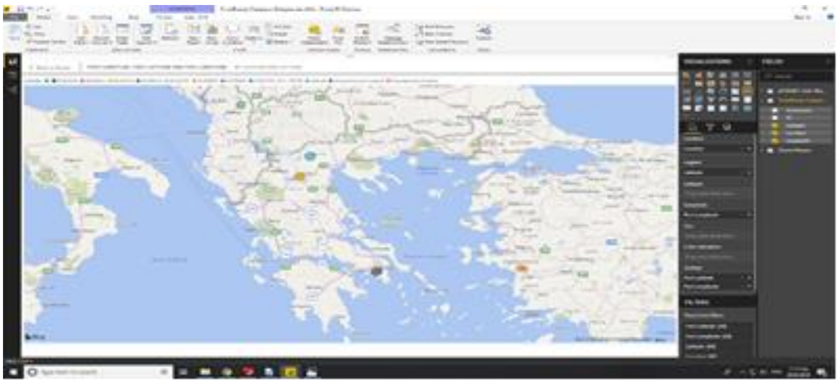

Photo 2. The first phase of results appearing

At each dot there will be the information we load and therefore the more columns in the original excel, and we will have more information if we want it.

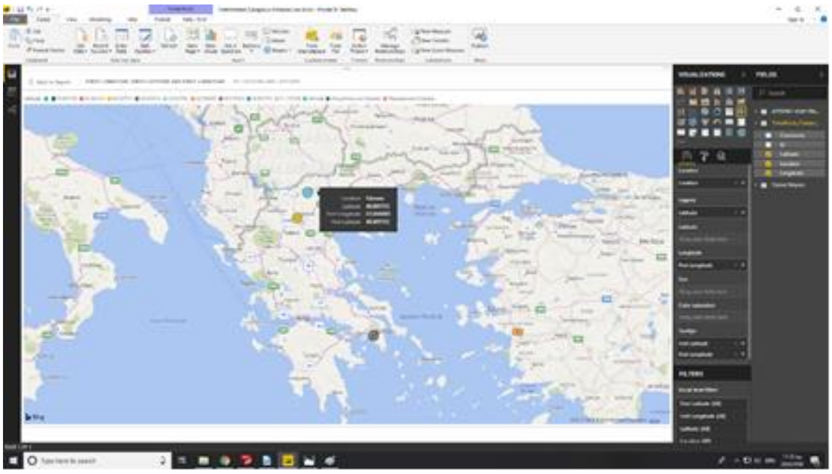

Photo 3. The first phase of results appearing
Source: Screenshot of personal using and design

Significance of the program in Agriculture

The importance of using business intelligence technologies in rural areas and more, of such a program, is related to the development through the information that this technology can provide to the user.

Information such as: what cultivation exists in the particular parcel, its geographical limits, crop history, etc.

They enable us to make decisions, such as: whether or not to set aside whether or not to use fertilizer, because we will already have the history of the information.

Future Development of the Program

All of the above can be an important pillar of development in the program, as linking the information base of the BI program, based on a decision-making program: Lindo, which is also linked to its modern form with Excel, can be innovations that will reduce the labor costs of farmers and reduce the margin of error.

Still a design development move that could be done is linking the above programs to projects such as Floorplaner, available in electronic form, free of charge, for the design and modeling of building facilities on the parcel, and linking it to a based-on indices of depreciation of building facilities from the agricultural appraisal tables of the Ministry of Rural Development. [2]

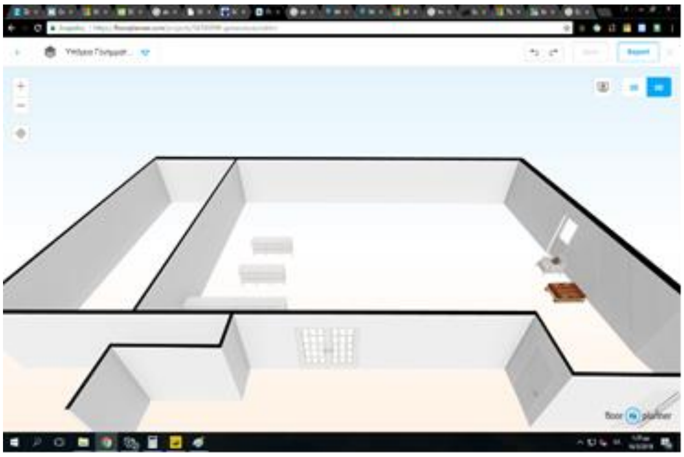

Photo 4. Planning and development design
Source: Screenshot of personal using and design

Program Cost

The Power BI program is completely free of charge from Microsoft. So, a farmer can start to integrate Business Intelligent into his business without any cost to his business.

For the use of the program as well as for their full potential, it may take a few days of short-term education and a small fee for this education will be spent.

CONCLUSIONS

Nowadays, more emphasis is placed on accessibility related to business intelligence that focuses on information gathering, something that has not happened in the past decades. The availability of a strong business model leads to a deeper knowledge of technology with regard to business executives.

From the analysis of the above, as a conclusion, we could deduce the fact that there is now the possibility for fast education and low cost, in order to have a development policy for the agricultural producer to become a rural entrepreneur.

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HONEY PRODUCTION AND TRADE BEFORE AND AFTER ROMANIA'S ACCESSION INTO THE EUROPEAN UNION

Agatha POPESCU

University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest Romania, Phone: +40213182564, Fax: +40213182888, Email: agatha_popescu@yahoo.com

Corresponding author: agatha_popescu@yahoo.com

Abstract

The paper analyzed the impact of Romania's accession into the EU on honey production and trade, using the empirical provided by FAOSTAT and National Institute of Statistics. The methodology was adapted to the purpose of comparison between the pre and post accession period using fixed basis index, growth rate, absolute and relative differences, structural indices, specific trade ratios, and graphical representation. Romania is an important honey producer with a potential over 30,000 tonnes per year. The accession into the EU in 2007 has stimulated the development of apiculture. In 2017, Romania produced 30,177 tonnes honey of which, about 46 % was exported mainly in the EU. Romania has over 1,600 thousand bee colonies and 46,000 apiculturists, meaning 24 bee families per apiary. Honey yield per bee family is 18.8 kg, but the potential is over 22 kg, less than in other EU countries. Weather conditions have deeply influenced apiculture performance during the last decade. Both acquisition and producer's price increased in the domestic market, and also the export/import price index was favorable to Romania due to the high quality of honey which is much required on the EU market. In 2016, the export value reached USD 41.4 Million, being 5.37 times higher than in 2000, and the import value achieved USD 8.9 Million, being 52.5 times higher than in the 1st year of the study. Trade balance accounted for USD 32.5 Million, being 4.3 times higher than in 2000. As a conclusion, the accession of Romania into the EU favored honey production, export and import and helped the EU to meet much better its internal market needs and intensify export. For this reason, beekeeping will continue to be an important sector of Romania's and EU agriculture in order to support pollination of agricultural crops, food security and safety and preserve biodiversity. Due to the strong competition, Romania should fight to maintain its position as a top honey producer and exporter of the EU. For this reason, beekeepers should increase apiary size, include organic honey as a market niche, assure honey certification brands and join in more associative forms for increasing efficiency along the honey market chain.

Key words**:** *honey, production, export, import, Romania, pre-accession, post-accession*

INTRODUCTION

Beekeeping is an important activity from an economic, social and environment point of view.

From an economic point of view, bees are a production factor, assuring a large range of products: honey, pollen, beewax, propolis, venom and other products, which are used for human food consumption and health, medicine and industry (pharmaceutical, cosmetics etc.). Also, bees provide services for agriculture, helping the pollination of the agricultural crops and wild flora, contributing to the growth of agricultural production and not only. More than 70 % of agricultural crops are pollinated by insects, among which *Apis mellifica* plays the most important role in the world [3, 10].

Beekeeping contributes to the diversification of the activity in the rural areas, providing jobs and income for rural population, and giving its support to the economic and social development of the communities [32]. It is also a profitable business for apiculturists, but also it could have an important economic impact on the localities and areas, processors and marketers (wholesalers and retailers) along the bee products chain.

Beekeeping is an opportunity to support the sustainable development by the valorization of the natural resources and the production of useful and healthy products for the actual and future generations [7].

The economic efficiency of beekeeping depends on many factors, among which the most important are: the number of bee families and hives and apiary size. The more the number of bee families and the higher, the apiary size, the higher honey production and apiculturists' income and profit [24, 28].

The practice proved that a minimum number of 150 bee families per apiary could assure the economic efficiency, but the higher the number of bee families per apiary could reduce production costs, increase income and profit of the beekeepers [25, 29, 30, 36].

Another factor of economic efficiency in apiculture is the quality of the biological material which is assured by the use of selected bee queens and breeding programmes. The diversity of food resources, the structure of the agricultural cultivated crops and the composition of the wild flora producing nectar could influence pickings, honey production and its quality. Among other factors could be mentioned: the technical endowment of the apiary (hives and their modernization status, specific apiculture tools, transportation means in pastoral, equipment for honey extraction etc), the maintenance of the bee families in all seasons, the measures of prevention and treatment for bees diseases, the lack of aggressive factors which could disturb the normal activity of the bee families such as: the change of crops varieties and hybrids which do not allow the bees to collect nectar and the plant protection measures based on the intensive use of pesticides, insecticides and other chemicals which remain in the nectar, plants, soil, water and could diminish the production performance of the bee families, affect their health and even kill them [17, 30, 35].

Also, beekeeping efficiency depends on the apiculturist training level and experience in the field. In practice, not all the apiculturists are "professionals", because this activity also attracts people who would like to use it as an additional source of money or like a part time job and even as a hobby [5, 30, 31].

Bee products, mainly honey are subject of international trade, contributing to the exchange of goods among various countries to cover better the demand of the internal market [27, 33].

From a social point of view, beekeeping could be practiced by any person (young, mature or old), it needs a few knowledge and skills, but also experience for professional apiculturists. It does not involve large financial capital to assure apiary inputs, and products do not require a high storage capacity. That is why apiculture is also practiced in the developing countries in order to diminish poverty and increase living standard.

Beekeeping offers a chance for people to work, to get income and be healthy making this activity outdoor and using the bee products. Apiculture is also important for food security [22, 36].

Bees have an important impact on the environment, contributing to the preservation of biodiversity supporting the development of the useful insects species and agricultural crops, the maintenance of the wild plants by pollinating the entomophily flora and balancing the ecosystems [14].

Climate change is an unpredictible factor, but it should be known and evaluated and measures are imposed to diminish its negative impact on bee families and honey production.

The development of beekeeping at the world level, in Europe and in the EU is justified by the increased honey demand and the non sufficient offer.

EU is the 2nd producer and exporter of honey in the world, in 2016, having 17 million beehives and producing 237,549 tonnes. The main producers of honey are Spain, Hungary, Germany and Romania, whose annual performance is over 20,000 tonnes. About 20,000 tonnes of honey are exported yearly by the EU to the main beneficiaries: Switzerland, Saudi Arabia, Japan, USA and Canada. About 200,000 tonnes of honey were imported especially from China, Ukraine, Argentina, Mexico to cover the EU market demand [9].

Romania has a favorable geographical position, a temperate climate, a large variety of entomophily plants both cultivated and wild, a long experience in apiculture, a considerable number of bee families and beekeepers and it is an important honey producer and exporter.

Due to the low consumption, no more than 0.55 g/inhabitant, most of the extracted honey is sold in other counties, mainly in the EU, where the demand and consumption are high [34].

Romanian honey has a high quality and purity and a large range of types (monofloral such as: acacia and lime honey etc), polyfloral and forest honey [11, 14].

Honey is a sweet food with a nice smell, pleasant taste and flavor. It has a special chemical composition which consists of: sugars, proteins, amino acids, enzymes, organic acids, vitamins, enzymes, minerals, phenolic and volatile compounds, which provides key nutrients for human diet and also energy [1].

These compounds play an important role on honey quality and also serve for its identification. The prolonged storage and various processing procedures like heating etc could affect honey quality, change its composition and favour its degradation [9, 16, 37].

Romania is among the countries which have the largest number of bee families, being among the top producers and exporters of honey in the EU besides Spain, France and Greece.

In order to satisfy better the needs of honey on the common market, the European Parliament issued Regulation (EU)No.1308/2013 which financially supports the development of beekeeping in the period 2017-2019 providing Euro 72 Million. The money could be used by beekeepers for the modernization of apiaries by purchasing bee hives, bee families, high breeding value bee queens, specific equipment mainly for pickings in pastoral. In this purpose, funding is assured 50 % from the national budget and 50 % from the EU funds [12].

In this context, the paper aimed to analyze the dynamics of beekeeping in Romania in the period 2000-2017, making a comparison between the status of apiculture in the post accession, 2007-2017, versus the pre-accession period, 2000-2006, in order to identify the main trends and changes in honey production, number of bee families, apiary size, export, import and trade balance.

MATERIALS AND METHODS

The indicators used in this study have been the following ones: honey production and its dispersion in the territory, contribution of the regions of development to honey production, honey production per km^2 and per bee family, number of bee families, number of bee families per apiary, number of apiculturists, exported and imported honey quantities, the share of exported quantities in honey production, the ratio between exported and imported quantities of honey, export and import values and honey trade balance, the ratio between export value and import value, honey price in the domestic market in terms of producer's price and wholesaler's price, honey price for export and import, the ration between export price and import price.

The data have been collected for the period 2000-2017 from FAOSTAT Data base and National Institute of Statistics Tempo online Data Base, and from EU Commission and Parliament Reports [6, 8, 10, 19, 20].

In order to comparatively analyze the trends and changes in apiculture, the period of reference was divides into two sub periods: 2007-2017, the post- accession period and 2000-2006, the pre-accession period.

The methodological procedures used in this research have been:

Fixed basis Index, in order to evaluate the changes in the evolution of an indicator in the last year of the chronological series (y_t) compared to the first item of the series (y_0),

$I_{FB}= (y_t/y_0)100$,

Average growth rate was determined according to the formula:

$$\bar{R}_a = \left(\sqrt[n-1]{\frac{y_n}{y_0}} - 1\right)100.$$

The total value of an indicator in each analyzed period was calculated with the formula:

$Y_t = \sum_{t=1}^{n} y_t$.

The average value of an indicator in each period of analysis was determined based on the formula:

$$\bar{y}= \frac{\sum_{t=1}^{n} yt}{n}$$

Absolute differences, $\Delta = y_n - y_{n-1}$

Mean, $\bar{X} = \frac{\sum_1^n x_i}{n}$

Standard deviation, S = $\sqrt{\frac{\sum_1^n (X_i - \bar{X})}{n-1}}$

Variation coefficient, $V(\%) = (S/\bar{X})100$

Graphical Method in order to display the trend and variations of each indicator during the analyzed period.

The results were tabled and graphically illustrated, the interpreted and commented and also compared and finally the corresponding conclusions were drawn.

RESULTS AND DISCUSSIONS

Honey Production.

Honey production - general trend. Romania has a high potential for producing honey and other bee products. This is due to its climate conditions which offer a large variety of plants with nectar and its long tradition in beekeeping [26].

Honey production has known a general trend in general, with a few inflexions in the unfavourable years for pickings due to rainfalls and drought. In the year 2017, Romania achieved 30,177 tonnes honey, by 156.9 % more than in the year 2000 (Fig.1.)

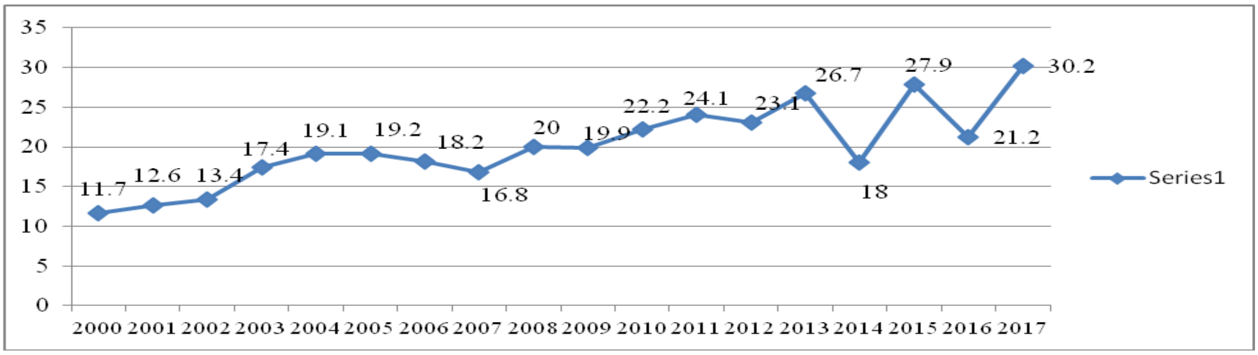

Fig.1. Honey production in the period 2000-2017, Romania (tonnes)
Source: Own design based on the data provided by [20] and [6].

In the pre-accession period, 2000-2006, Romania produced 111,732 tonnes honey, meaning 15,961.7 tonnes in average per year. In the post-accession period, the country registered 250,147 tonnes, by 123.8 % more than in the pre-accession interval. The average honey production per year in the period 2007-2017 was 22.740.6 tonnes, by 42.46 % higher than in the period 2000-2006.

In the territory, there are differences among various regions regarding the level of production.

In 2014, Romania came on the 5th position for honey production in the EU after Spain, Hungary, Greece and Poland, while in 2015, it came on the 1st place with 35 thousand tonnes, representing 13.05 % of the EU honey production (268 thousand tonnes). Romania is followed by Spain and Hungary which occupied the 2nd and 3rd positions in the EU [4, 8, 21].

Honey production in the territory. In the pre-accession period, the highest production was noticed in the NE area (17,253 tonnes), followed by Center (17,030 tonnes) and S. Muntenia (16,794 tonnes). A similar result on the territorial distribution of honey production was found by [15].

In the post-accession interval, the highest production, in the decreasing order, was carried out by SW Oltenia (41,082 tonnes), N East (36,623 tonnes) and Centre region (36,238 tonnes).

In Bucharest-Ilfov area, it was recorded the lowest honey production both in the pre-accession and in the post-accession period.

Regarding the average production per year in the pre-accession period, the same regions registered the highest level as follows: NE (2,465 tonnes), followed by Center (2,433 tonnes) and S Muntenia (2,399 tonnes).

In the post-accession interval, the highest average annual production was achieved as follows: 3,735 tonnes in SW Oltenia, 3,329 tonnes in NE and 3,294 in the Centre area.

By region of development, honey production followed an ascending trend in general from the year 2000 to the year 2017 as shown in

Fig.2. However, honey production declined in the years 2007, 2014 and 2016 when the rains and droughts affected the nectar resources.

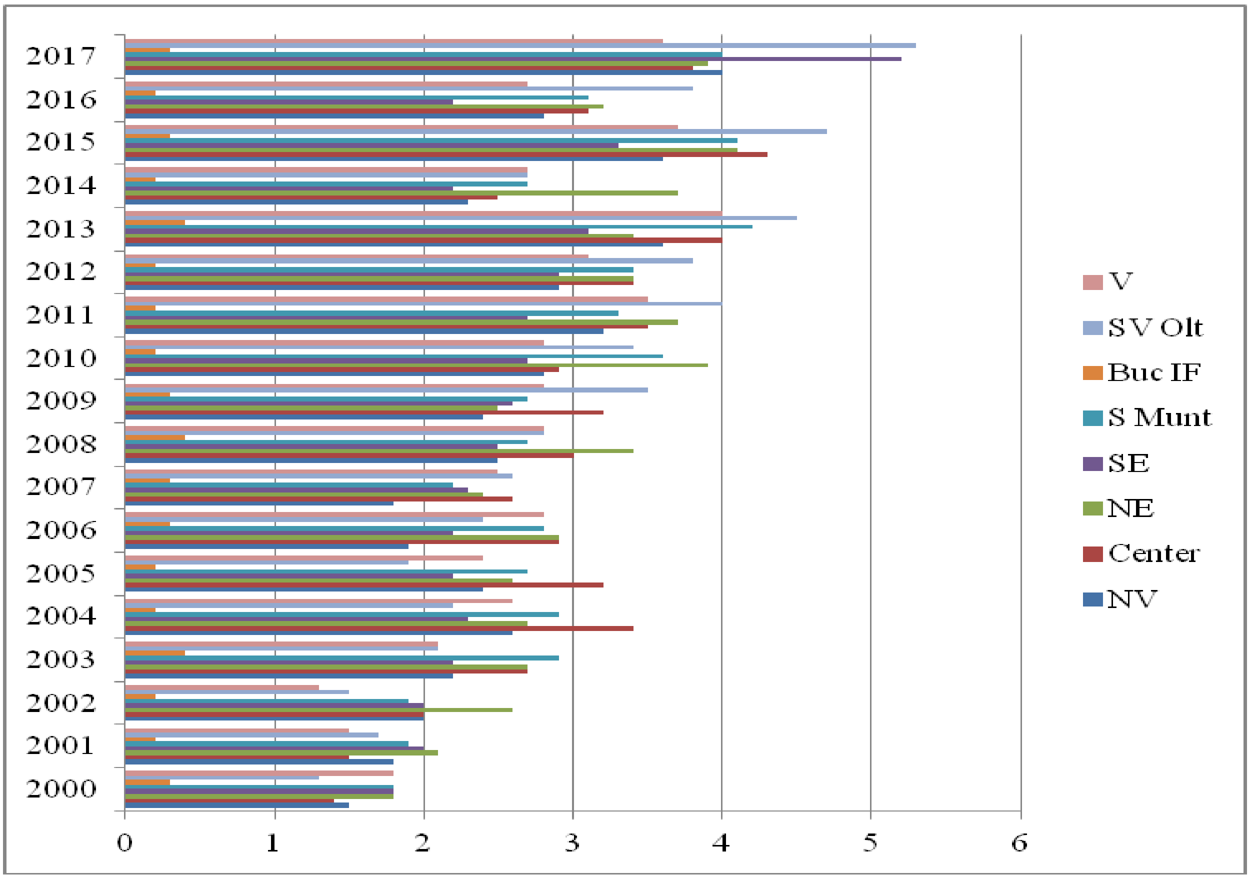

Fig.2.Honey production by region of development, Romania, 2000-2017 (Million tonnes)
Source: Own design based on the data provided by [20] and [6].

Honey production growth by region. The highest increase of honey production, in percentage points, in the period of accession was registered by the following regions: SW Oltenia (310.5%), West (234.5%) and NW (214.7%). The lowest increase was found in Bucharest Ilfov (156.2 %).

Regarding the average honey production in the period of post-accession compared to the level recorded in the period of pre-accession, the highest growth was achieved by the same regions: SW Oltenia (197.6 %), West (149.3 %) and NW (136.6%). Bucharest Ilfov area registered a slight decline of mean production of honey (-0.8%) (Table 1).

Table 1.Honey production and average honey production in the pre and post accession period by region (tonnes)

	Romania	NW	C	NE	SE	S Munt	Buc IF	SW Olt	W
Honey production									
(a)2000-2006	111,732	14,620	17,030	17,253	14,871	16,794	1,903	13,227	14,534
(b)2007-2017	250,147	31,394	36,238	36,623	31,731	36,019	2,974	41,082	34,087
Difference (b)-(a)	148,415	16,774	19,208	19,370	16,860	19,225	1,071	27,855	19,553
(b)/(a)100 (%)	223.8	214.7	212.7	212.2	213.3	214.4	156.2	310.5	234.5
Average honey production									
(a)2000-2006	15,952	2,089	2,433	2,465	2,124	2,399	272	1,890	2,076
(b)2007-2017	22,741	2,854	3,294	3,329	2,885	3,274	270	3,735	3,099
Difference (b)-(a)	142.4	136.6	135.3	135.0	135.7	136.5	99.4	197.6	149.2
(b)/(a)100 (%)	142.5	136.6	135.3	135.0	135.8	136.4	99.2	197.6	149.3

Source: Own calculation.

The contribution of the regions to honey production. Along the years, there were noticed changes concerning the contribution of the regions to honey production. This was caused by the picking conditions in close connection with the climate variations.

In the year 2000, the highest contribution to honey production was given by West area (15.6%), N E (15.4%) and S E (15.2 %). In the year 2006, on the 1st rank there were situated two regions: N E (15.8%) and Centre (15.8%), followed by S Muntenia (15.3%) and West (15.3%), and finally on the 3rd position was situated SW Oltenia (13.2%).

In 2007, the top position belonged to the Centre area (15.7%), followed by SW Oltenia (15.4 %0 and West (14.7%). In 2017, on the top rank came SW Oltenia (17.6%), then on the 2nd position was SE (17.2 %) and on the 3rd position two areas: S Muntenia (13.4%) and NW (13.4%) (Table 2).

Table 2. The contribution of the regions to honey production (%)

	NW	C	NE	SE	S Munt	Buc IF	SW Olt	W
2000	13.2	11.7	15.4	15.2	15.0	2.8	11.1	15.6
2006	10.8	15.8	15.8	12.2	15.3	1.6	13.2	15.3
2007	10.6	15.7	14.5	13.9	13.2	2.0	15.4	14.7
2017	13.4	12.7	13.0	17.2	13.4	0.9	17.6	11.8

Source: Own calculation based on the data provided by [20]

The main counties producing honey. If we consider the distribution of honey production by county, it is important to mention that the highest levels are recorded in the following counties: Valcea (11.9%), Dambovita (10.2 %), Mures (8%), Brasov (5.7%), Caras Severin (3%), which all together totalize 38.8 % of Romania's honey production [13].

The performance in honey production was influenced by many factors, among the most important being: the number of bee families, the power of the colonies, the average honey production per colony, nectar resources, diseases incidence etc.

Number of bee families.

General trend in the number of bee families. The number of bee families increased year by year in the analyzed period. If in the year 2000, Romania had 648,808 bee families, in 2006, their number reached 891,043, being by 37.33 % higher than in the first year of the pre-accession period. For the year 2007, the statistics mentioned 982,368 bee families and for the year 2017 it was found 1,602,453, by 63.12 more than in 2007 and by 146.9 % more than in the year 2000.

The growth rate of the bee families was 5.5 % in the pre-accession period and 6.16 % in the post-accession interval (Fig.3).

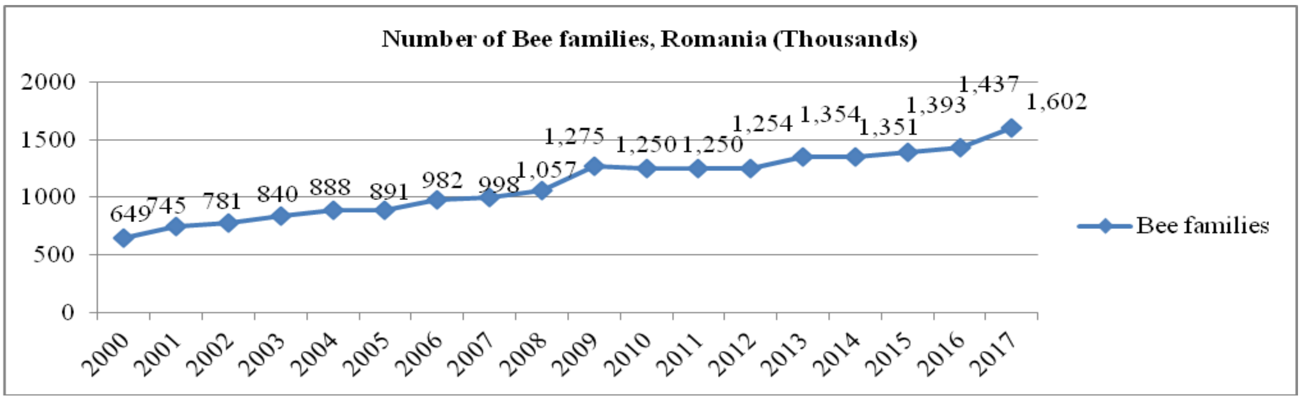

Fig.3. Number of bee families, Romania, 2000-2017 (Thousands)
Source: Own design based on the data provided by [20]

The development of the bee families by region. The highest increase for the average number of bee families in the period of accession in comparison with the mean in the period of pre-accession was carried out in by SW Oltenia (218.7%), West (165.3%) and Centre (160.8). The lowest growth was noticed in Bucharest Ilfov area (105.1 %)(Table 3).

Table 3. The average number of bee colonies in the pre and post accession period by region

	Romania	NW	C	NE	SE	S Munt	Buc IF	SW Olt	W
(a)2000-2006	825,143	113,326	113,069	133,627	100,191	130,959	16,521	105,462	98,446
(b)2007-2017	1,292,818	162,775	181,843	176,694	149,935	186,574	17,365	230,661	162,736
Differ. (b)-(a)	467,675	49,449	68,774	43,067	49,744	55,615	844	125,199	64,290
(b)/(a)100 %	156.6	143.6	160.8	133.2	149.6	142.5	105.1	218.7	165.3

Source: Own calculation.

The dispersion of bee families in the territory in not so equal among regions, as shown in Table 3. In the year 2000, the regions with the highest share in the total number of bee families were: North East (16.3%), S Muntenia (16%) and N W (14.5%). In 2017, the situation was the following one: S W Oltenia (19.5 %), S E (15.6%) and S Muntenia (14.2 %).

There are regions such as: N W, Centre, N E, S Muntenia and W, where their weight in the total number of bee families recorded a decreasing trend in the period 2000-2017, also regions whose share registered an ascending trend like SW Oltenia and S E, and Bucharest Ilfov region which achieved different shares, either increasing or decreasing from a period to another (Table 4).

Table 4.The share of the number of bee families raised in the regions of development in Romania's number of bee families (%)

	NW	C	NE	SE	S Munt	Buc IF	SW Olt	W
2000	14.5	12.2	16.3	13.0	16.0	2.8	12.2	13.0
2006	13.3	16.0	16.2	11.0	15.8	1.9	11.6	14.2
2007	13.1	14.7	14.1	12.9	14.8	2.3	14.4	13.7
2017	13.1	12.8	13.5	15.8	14.2	0.9	19.5	10.2

Source: Own calculation based on the data provided by [20].

The number of bee families per km² was determined in order to better compare the potential of beekeeping by region. In 2017, in Romania, there were 6.72 bee families per km^2 by 63.1 % more than in 2007 and 2.4 times more than in the year 2000. If we look at the figures along the analyzed years, we may notice the development of beekeeping in terms of the number of bee families in each region, and this is obviously seen mainly in the period of post-accession, therefore after 2007.

In the period 2007-2017, the highest increase of the number of bee families was achieved in SW Oltenia (+121.2%), S E (+99%) and N W (+62.8%).

In 2017, the highest number of bee families per km^2 was 10.71 in S W Oltenia, 7.78 in Bucharest Ilfov and 7.07 in S E region. Despite that in Bucharest Ilfov area it is an important number of bee colonies per km^2, here, it was noticed a decrease by 31.26 % from 12.4 bee families in 2007 to 7.78 bee colonies in 2017 (Table 5).

Table 5. The number of bee families per km^2 in the regions of Romania

	Romania	NW	C	NE	SE	S Munt	Buc IF	SW Olt	W
2000	2.72	2.76	2.30	2.88	2.35	3.00	10.40	2.72	2.61
2006	3.73	3.46	4.17	3.92	2.74	4.11	9.33	3.55	3.90
2007	4.12	3.77	4.25	3.76	3.55	4.11	12.40	4.84	4.15
2017	6.72	6.14	6.00	5.84	7.07	6.58	7.78	10.71	5.17
2017/2000%	163.10	162.8	141.1	155.3	199.0	160.0	62.74	221.20	124.5

Source: Own calculation.

The number of bee families per km^2 is used to make comparisons among countries regarding the density and intensity of apiculture. The number of bee colonies per surface unit varies from a country to another in Europe. In 2010, the average number of bee colonies per km^2 of Europe was 4.2, while in Greece it was 11.4, in Hungary 10.7, in Czech Republic 6.6, in Spain 4.9, in Romania 4, in Italy 3.7, in Poland 3.6, in France 2.4 and in Germany 1.9 [5].

The number of bee families per beekeepers (apiary) also varies from a country to another. In 2010, at Europe level, the average number of bee colonies per apiary accounted for 22.4. The highest average number of bee families per apiculturist is in Spain (103), Greece (75), Hungary (56.7), Poland (25), Romania (23.1), France (19.5), Italy (16), Czech Republic (11.1), Germany (7.6) [5].

In Europe there is a large range of persons dealing with beekeeping and not all of them could be named "real or professional beekeepers". It was affirmed that in the EU just 4% apiculturists could be considered "professionals" because they have over 150 bee family in their apiary. The rest of 96 % keep less than 150 bee families/apiary and should be not considered experienced apiculturists. But, this opinion is still a controversial one, a figure more appropriate being 40 bee families/apiary as considered by beekeepers associations [4].

However, there is another opinion based on a detailed survey in many European countries, that in Europe there is the following distribution of beekeepers based on the apiary size: 78 % of beekeepers are growing less than 50 bee colonies, 16 % have between 51-150, 4 % have between 151-300 bee colonies and 2 % keep over 300 bee families. According to this analysis, in Romania, it was found 23.1 bee families per apiary, by 3.1 % more than the European mean. Also, it was affirmed that in Romania 56.6 % apiculturists have less than 50 bee families, 23.9 % are raising between 51-150, 10.4 % have between 151-300 bee families and 9.1 % are keeping more than 300 bee families.

The persons dealing with beekeeping are: professionals, non professionals, part time and hobby beekeepers. According to the EU Commission, only the apiculturists with over 150 bee families could be considered professionals [2, 5].

However, in Romania, the apiary size varies between 20 bee families up to over 600 bee families.

The situation of the number of bee families by county pointed out that the counties where the highest number of bee colonies is grown are: Mehedinti (6.11%), Valcea (5.12%), Iasi (3.85), Caras Severin (3.58%), Bacau (3.47%), Brasov (3.3%), all these counties together accounting for 25.43 % of the total number of bee colonies in Romania [13].

Regarding the number of bee hives. In 2015, Romania had 1,550 thousand bee hives, of which: 6.14 % in Mehedinti, 5.51 % in Valcea, 5.36 % in Mures, 3.80 % in Iasi, 3.70 % in Caras Severin county as affirmed by MARD [13].

According to the EU Commission, in Romania there were 975 thousand bee hives in the period 2008-2010, 1,280 thousand bee hives in the period 2011-2013, and 1,550 thousand hives in 2014-2016 and in 2,472 thousand bee hives in the year 2016. Based on the number of bee hives, Romania is classified in the 2nd position in the EU after Spain [8].

Number of beekeepers. The development of apiculture depends on the number of beekeepers which in general reflects the number of apiaries, but also on the number of bee families and apiary size, in terms of bee families/apiary. We may also add the technologies applied in apiculture regarding the assurance of high value bee queens, breeding programmes, bee keeping technologies, opportunities for pastoral pickings, variety of flora supplying nectar, bee feeding, disease prevention and treatments, beekeepers training level and experience in the field and other factors.

Romania has an important number of beekeepers.

The number of beekeepers in Romania has continuously increased. In the year 2000, Romania had 23,409 beekeepers representing 5 % of the EU number of beekeepers. In 2016, Romania had 43,200 apiculturists, meaning

6.8 % of the beekeepers operating in the EU. For the number of beekeepers, Romania is situated on "the 7th position in the EU, after Germany, France, Poland, Italy, Czech Republic and United Kingdom". (Table 6) [8].

Table 6. The number of beekeepers in Romania and their share in the EU beekeepers number

	2000* EU-15	2004-2006* EU 25	2008-2010** EU 27	2011-2013** EU 28	2014-2016** EU 28
EU	470,797	593,168	624,872	635,638	631,236
Romania	23,409	34,971	36,800	40,000	43,200
Share of Romania's beekeepers in the EU (%)	5	5.9	5.9	6.3	6.8

Source: [8, 19].

About 60 % of the number of apiculturists belong to various associative forms and are members of Beekeepers Association in Romania. About 20 % of the 2,472 thousand bee hives in the year 2016 were owned by the beekeepers with more than 150 bee families [13].

Honey production/Bee family.

Besides the number of bee families, honey production is influenced by the production potential of each bee colony to produce honey. This depends on its power in terms of the number of family members, the use of selected bee queens, opportunities for pickings in stationary and pastoral related to the variety of flora producing nectar, favourable or non favourable weather conditions, works in the apiary made by beekeeper and its experience in supporting the bee family during the winter season and in the period of weak or lacked of pickings [30].

In the whole analyzed period, honey yield varied between 17.7 kg in the year 2000 and 18.8 kg in the year 2007. In the last year of the analysis it was by 6.21 % higher than in the first one.

However, there were favourable years when the average production achieved a good performance such as: 2003 (20.7 kg), 2003 and 2005 (21.6 kg), 2006 (20.4 kg), and also in 2008, 2013 and 2015 (20 kg). The lowest yield level was recorded in the year 2014, which was the worst year for beekeeping due to the unfavourable weather conditions which affected pickings (Fig.4).

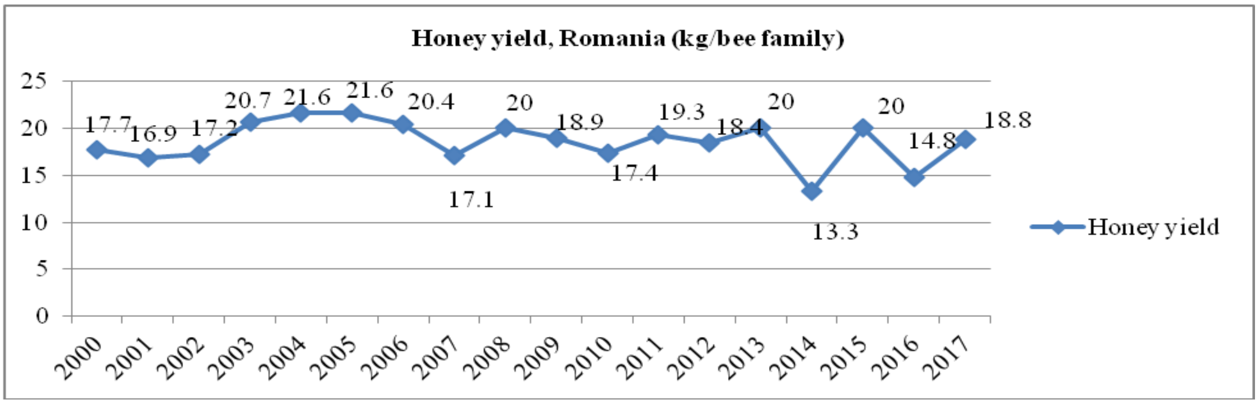

Fig.4. Honey yield, Romania, 2000-2017 (kg/bee family)
Source: Own design based on the data provided by [20]

Honey yield dispersion in the territory by region. The highest performance in honey yield was achieved in the W region, which has been in the top almost every year, except 2006. The highest level recorded by this region was 22.4 kg/bee family in the year 2006. On the 2nd position came the S E region which registered the highest honey yield, 22.6 kg/bee family in the year 2006. On the 3rd position is situated the Central region with the highest honey yield 20.2 kg achieved

in 2006. Also, S W Oltenia had a good yield in 2006 (23.1 kg) and in 2007 (18.1 kg).
The highest growth rate for honey yield in the analyzed period was registered by N W region (+17.1 %), N East (7%), Bucharest Ilfov (6.9%), Central region (6.2 %), A slight decline of 0.9 % was noticed in the W area (Table 7).

Table 7. Honey yield by region of Romania

	Romania	NW	C	NE	SE	S Munt	Buc IF	SW Olt	W
2000	18.1	16.4	17.6	17.0	21.2	17.0	17.3	16.3	21.9
2006	20.4	16.6	20.2	20.0	22.6	19.6	16.9	23.1	22.4
2007	17.1	13.8	18.1	17.6	18.4	15.2	15.1	18.1	18.5
2017	18.2	19.2	18.7	18.2	20.6	17.8	18.5	16.9	21.7
2017/2000 %	100.5	117.1	106.2	107.0	97.2	104.7	106.9	103.7	99.1

Source: Own calculation.

Honey price in the internal market. Honey price depends on the honey type (polyfloral, acacia, lime etc), honey quality, demand/offer ratio, form of delivery (in bulk or bottled), organic honey or usual honey, selling place (beekeeper's price or wholesaler's price) and conjunctural factors.
The share of various honey types in honey production are: multi-floral honey 50%, acacia honey 25 % and lime honey 25 %. Acacia and lime honey have a higher price than polyfloral honey [23].
The average acquisition price registered a general increasing trend in the period 2004-2017. Thus, from Lei 6.17/kg honey in the year 2004, it achieved Lei 16.13/kg in the year 2017, being 2.61 times higher than in the 1st year of the study period. Also, the producer's price increased by 76 % from Lei 13.17 in the year 2004 to Lei 23.18 in the year 2017 (Fig.5).

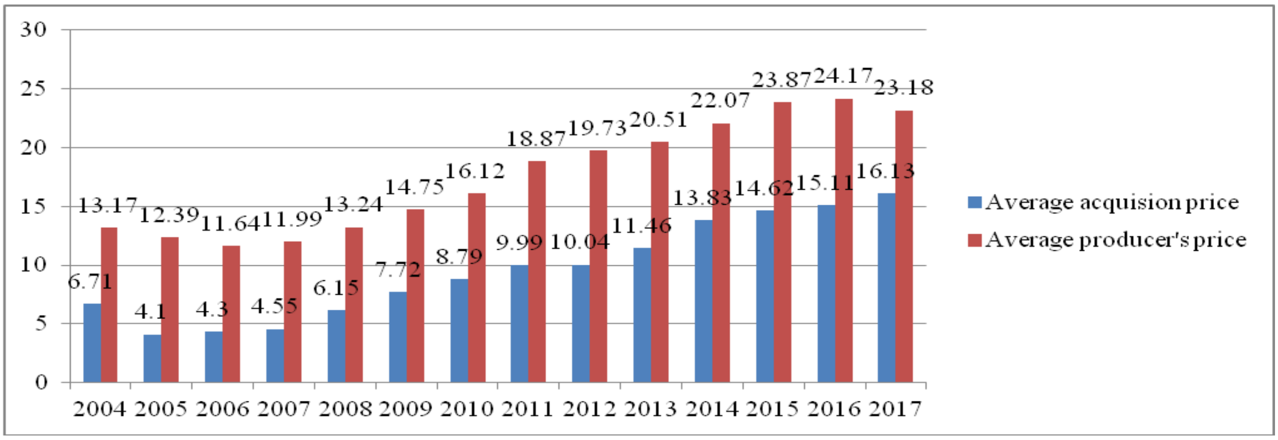

Fig.5.Honey average acquisition price (wholesaler's price) and producer's price
Source: Own design based on the date from [20].

Quantitative honey export and import.
Exported amounts of honey. Romania has a good potential for honey export as production performance is enough high and domestic consumption is low, about 0.45-0.55 kg/inhabitant and 0.078 tonnes in 2016 [18].
Along the analyzed period, honey export varied from a year to another depending on production and export opportunities in the external market. However, in general, it could be affirmed that the export increased. In 2016, Romania exported 10,371 tonnes honey, by 38 % more than in 2007, when its registered 7,512 tonnes. The peak of exported amount of honey was 12,649 tonnes registered in the year 2013, and the low export level was 5,793 tonnes registered in the year 2002. After the country accession into the EU market, the export was mainly oriented to the common market where the demand for honey is high and Romanian honey is appreciated for its high quality. The statistical data confirm that in the period 2007-2017, Romania exported between 10-12 thousand tonnes by year (Fig.6).

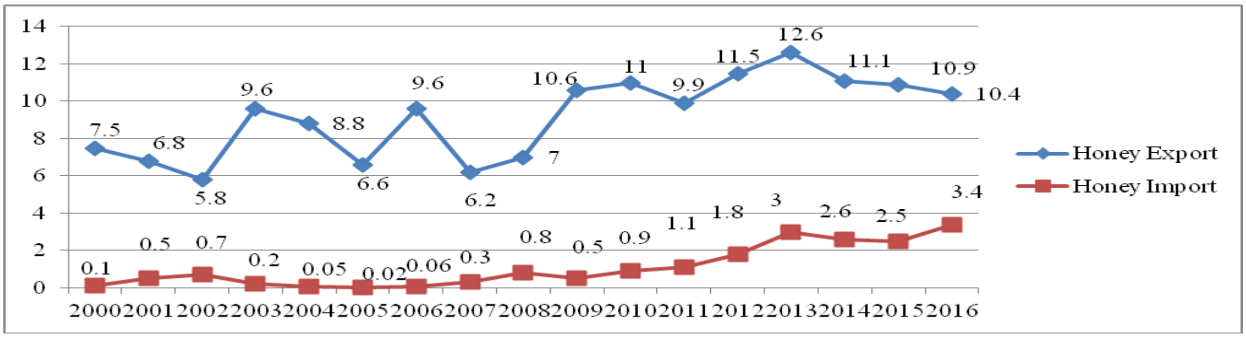

Fig.6. Exported and imported amounts of honey, Romania, 2000-2017 (Thousand tonnes))
Source: Own design based on the data provided by [6].

Imported amounts of honey. Despite that Romania is a producer and exporter of honey, and export is also determined by the weak consumption on the internal market, honey is also a subject of import. In the period, 2000-2006, the imported amounts were very small, practically non significant. But, after 2007, the imports of honey have been intensified. In 2016, Romania imported 3,388 tonnes honey, 25 times more than in the year 2000 and 10.7 times more than in the year 2007 (135 tonnes).

Export/Import ratio. This indicator of efficiency registered higher values in the period of pre-accession, as Romania imported smaller amounts of honey, and lower and lower values in the post-accession interval, when honey imports grew up. The average export/import ratio was 110.1 in the period 2000-2006, and 9.37 in the period 2007-2016. (Fig.7).

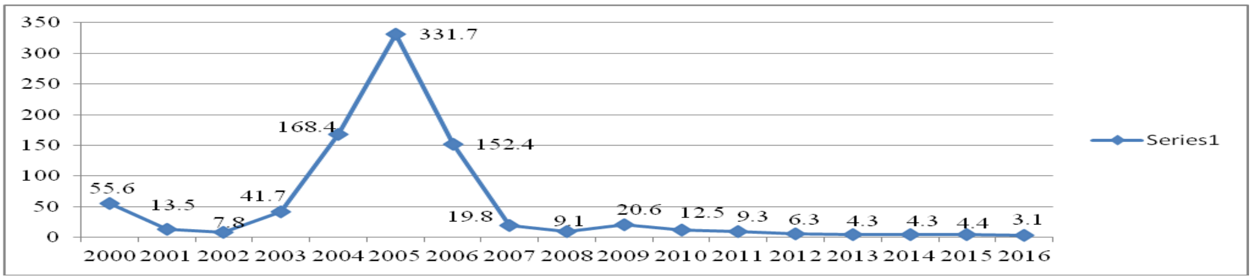

Fig.7. Export/Import ratio for honey amount, Romania, 2000-2016
Source: Own calculation and design.

Export/Production ratio varied between 0.63 in the year 2000 and 0.48 in the year 2016. The average of this ratio accounted for 0.50 in the period 2000-2006, reflecting that 50 % of honey production was exported and for 0.46, showing that 46 % of production was sold on the external market (Fig.8).

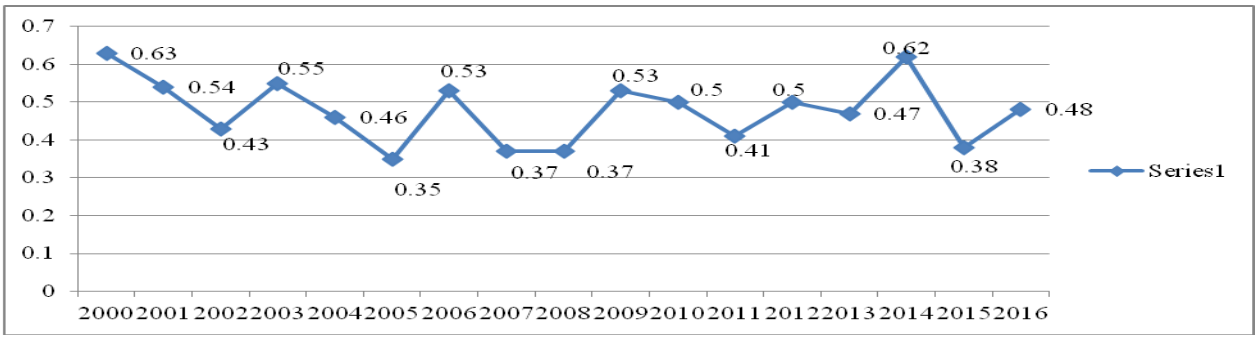

Fig.8. Export/Production ratio for Honey, Romania, 2000-2016
Source: Own calculation and design.

Export and Import Values and Trade Balance.

Honey export value registered a general ascending trend in the researched interval. In 2016, honey export value was USD 41.4 Million, 5.37 times higher than in the year 2000 (USD 7.7 Million).(Fig.9.)

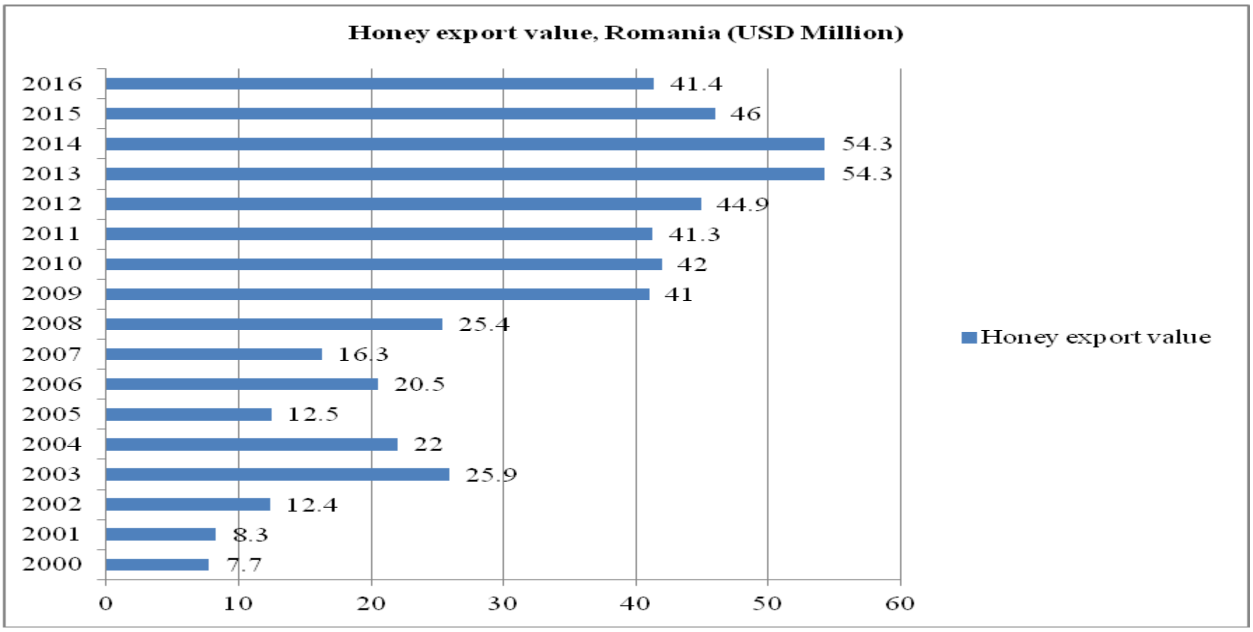

Fig.9. Honey export value, Romania (USD Million)
Source: Own calculation and design, based on the data from [6].

Honey import value has also increased, in the year 2016 accounting for USD 8.9 Million, being 52.5 times higher than at the beginning of the analyzed period. However, the small amounts of honey imported between the year 2000 and 2006 led to a lower import value in this interval, except the year 2002. After 2007, the import value has known a higher dynamics determined by the higher and higher quantities of honey purchased from the external market. Thus, in 2016, the import value was 11.64 times higher than in 2007. (Fig.10).

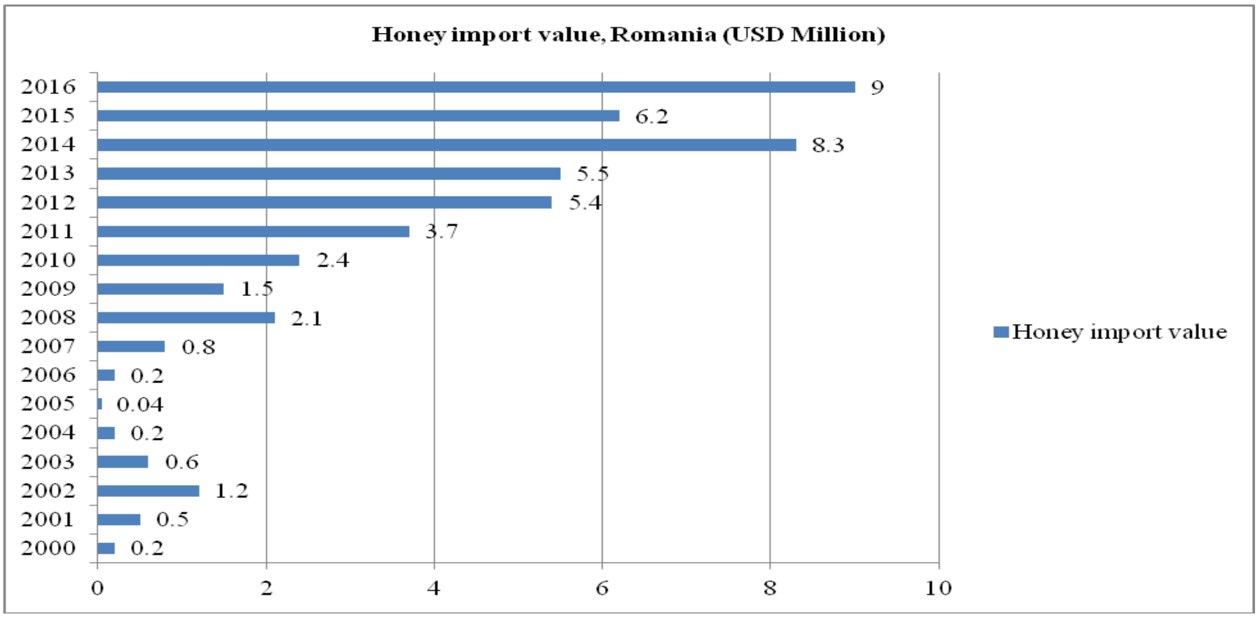

Fig.10. Honey import value, Romania (USD Million)
Source: Own calculation and design, based on the data from [6].

Honey trade balance had a positive value as export value exceeded import value in each of the analyzed years. In 2016, it was recorded USD 32.5 Million compared to USD 7.5 Million in honey trade balance in the year 2000, which means a value 4.3 times higher. Compared to the 2007 level, in 2016 trade balance was 2.09 times higher.(Fig.11).

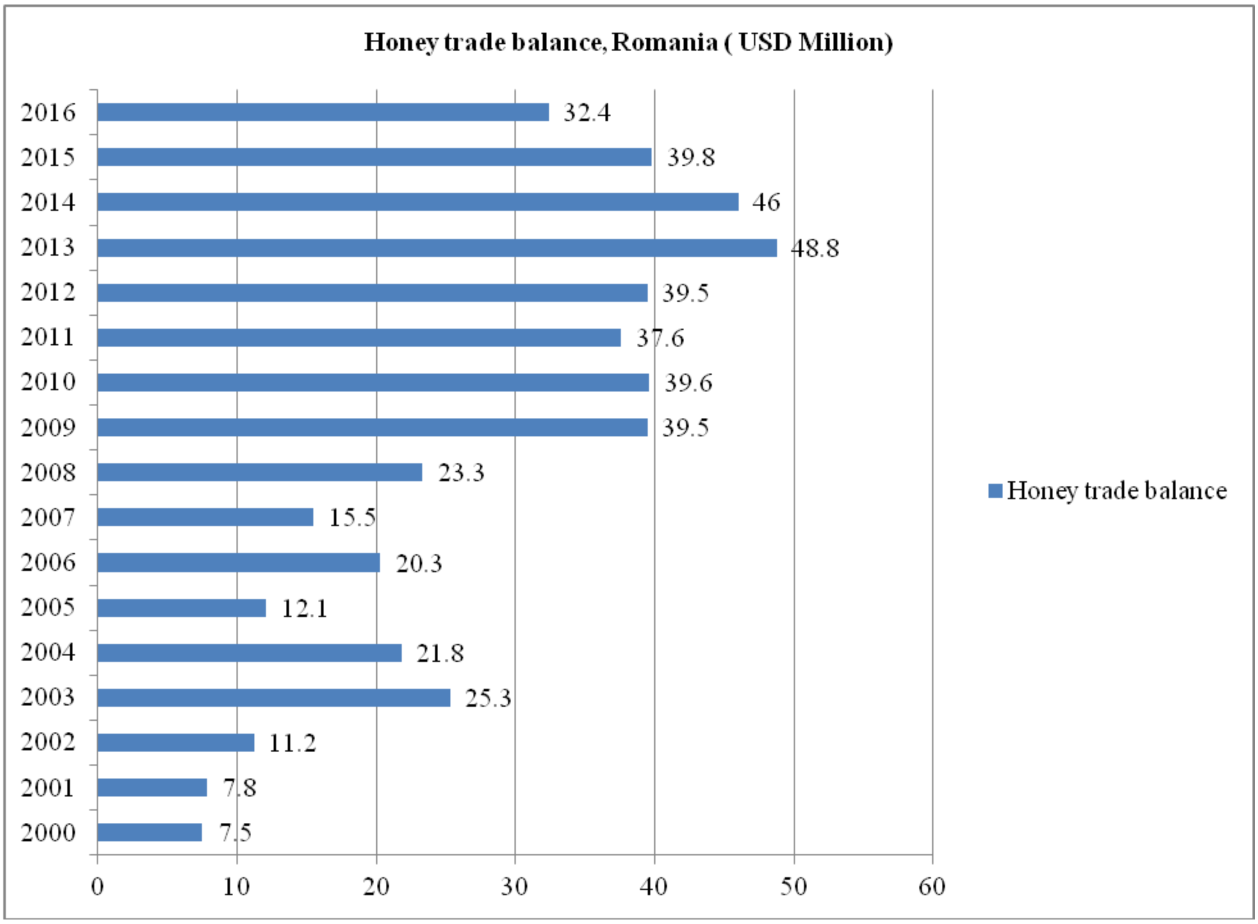

Fig.11. Honey trade balance, Romania (USD Million)
Source: Own calculation and design.

The main partners for export and import of honey.

*Export partners***.** The honey produced in Romania is of high quality which determines to be required on various external markets, but mainly in the EU countries. Among the most important beneficiaries there are: Germany, Italy, France, Poland, Austria, Spain, United Kingdom, Israel, Belgium and China.

Import partners. Honey is imported from various suppliers such: Poland, China, Rep. of Moldova, Ukraine, Germany, Bulgaria, France, Spain, Italy [13].

Honey export and import price.

Honey export price has slowly but continuously went up and the import price as well. The export price ranged between USD 1.02 per kg honey in the year 2000, the lowest price level and USD 4.88 registered in the year 2014. However, honey is exported at a low price, because it is exported in bulk and the external processors offer a low price which does not cover production costs in beekeeping.

The average import price varied between USD 1.07 per kg in 2001, the lowest level and USD 3.42 achieved in the year 2011. In 2016, the honey export price accounted for USD 4/kg and the import price USD 2.65 per kg (Fig.12).

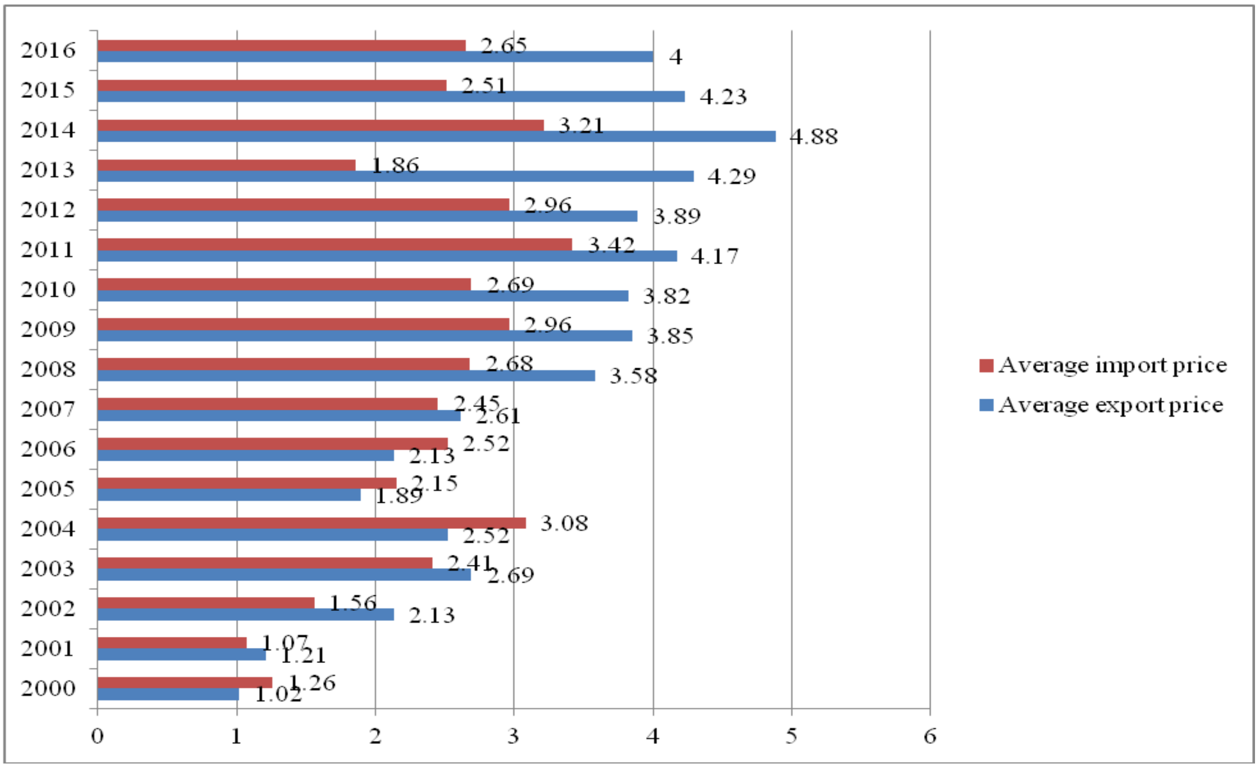

Fig.12. Honey export and import price. (USD/kg)
Source: Own calculation and design based on the data from [6].

Comparison between average export and import price. Making a comparison between the average export and the average import price, one may easily notice that in general, export price was higher than import price.
In the period 2000-2006, the difference between the export and import price of honey had a positive value only in the years 2001, 2002 and 2003, but in the other years it had a negative value. And this reflects that the positive value of honey was determined much more by the quantity of honey exported than the export price. Romania was disadvantaged in export by the lower honey price compared to the higher import price.
In the period 2007-2016, the average export price was higher than the average import price in each year of the analyzed period.
As a result the ratio between the average export price and the average import price was less than 1 in four year and over 1 in the years 2001, 2002 and 2003. in the period 2000-2006 and also in all the years from the period 2007-2016 (Fig.13).

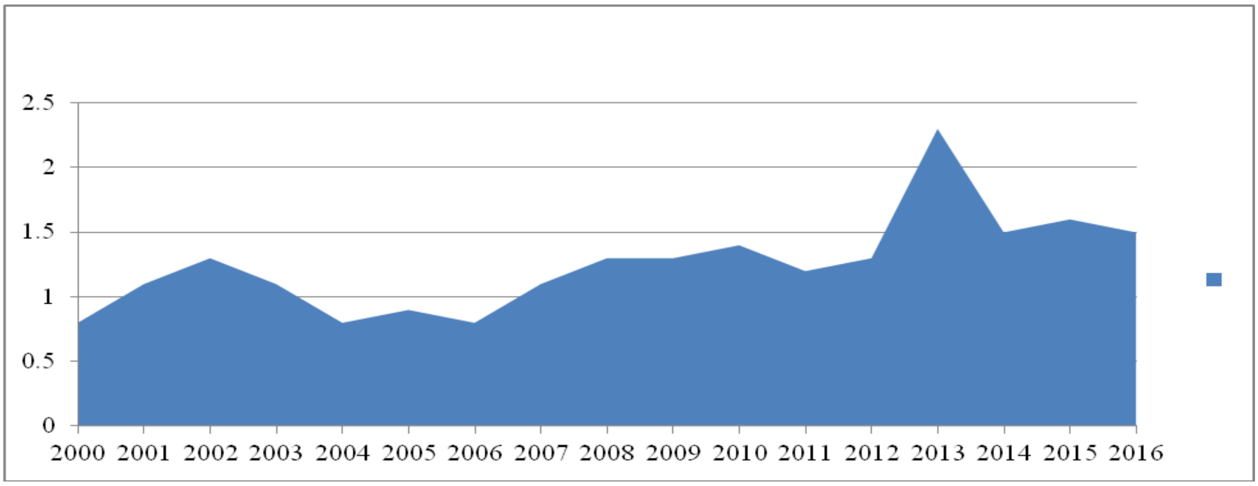

Fig.13. Ratio between the average export and import price of honey
Source: Own calculation and design.

The main statistical parameters in terms of average, standard deviation and variation coefficient for all the analyzed indicators are shown Table 8.

Table 8. The average, standard deviation and variation coefficient for all the indicators used in this study

	Mean	Std. Deviation	Coefficient of variation (%)
Honey production (Million tonnes)			
(a) 2000-2006	15.94	3.25	20.38
(b)2007-2017	22.73	4.19	18.43
Difference (b)-(a)	+ 6.79	-	-
Number of bee families (Thousands)			
(a) 2000-2006	825.14	109.93	13.32
(b)2007-2017	1,292.81	167.79	12.97
Difference (b)-(a)	+467.67	-	-
Honey yield (kg/bee family)			
(a) 2000-2006	19.4	2.09	10.77
(b)2007-2017	18.0	2.21	12.27
Difference (b)-(a)	-1.4	-	
Exported amount of honey (Thousand tonnes)			
(a) 2000-2006	7.81	1.52	19.46
(b)2007-2016	10.12	1.99	19.66
Difference (b)-(a)	2.31	-	-
Imported amount of honey (Thousand tonnes)			
(a) 2000-2006	0.26	0.23	88.46
(b)2007-2016	1.69	1.11	65.68
Difference (b)-(a)	1.43	-	-
Honey export value (USD Million)			
(a) 2000-2006	15.6	7.14	45.76
(b)2007-2016	40.69	11.77	28.93
Difference (b)-(a)	25.09	-	-
(b)/(a)100 %	260.8	-	-
Honey import value (USD Million)			
(a) 2000-2006	0.42	0.39	92.85
(b)2007-2016	4.49	2.84	63.25
Difference (b)-(a)	4.07	-	-
(b)/(a)100 %	1,069.04	-	-
Honey trade balance (USD Million)			
(a) 2000-2006	15.14	7.20	47.55
(b)2007-2016	36.20	10.06	27.79
Difference (b)-(a)	21.06	-	-
(b)/(a)100 %	239.1	-	-
Export price (USD/kg)			
(a) 2000-2006	1.94	0.62	31.95
(b)2007-2016	3.93	0.58	14.75
Difference (b)-(a)	1.99	-	-
(b)/(a)100 %	202.57	-	-
Import price (USD/kg)			
(a) 2000-2006	2.00	0.73	36.50
(b)2007-2016	2.73	0.43	15.75
Difference (b)-(a)	0.73	-	-
(b)/(a)100 %	136.5		

Source: Own calculation based on the data provided by [20]

In case of honey production, the variation coefficient had values below 20 % reflecting that this indicator was relatively homogeneous in the analyzed periods.

For the number of bee colonies as well as for honey yield, the variation coefficient ranged between 10 % and 20 % meaning that the values of the indicators were relatively homogeneous and that the average is representative in the both periods of analysis.

The average exported amount of honey in the post-accession period was 10.12 thousand tonnes by 29.57 % higher than in the pre-accession period. The imported quantity of honey accounted for 1.69 thousand tonnes in the post-accession interval, being 6.5 times higher than in the previous period.

The variation coefficient ranged between 10 and 20 %, being closer to the maximum threshold, reflecting that the data are relatively homogenous in case of the exported amount of honey. But, in case of the imported honey, the variation coefficient had very high values reflecting heterogeneous data. The high standard deviation reflects a high dispersion from the mean of the values in the both studied periods in case of the imported quantity of honey.

Regarding the export value, in the pre accession interval, the export value was enough small, but the variation coefficient reflect a high variability among the variables in this period of time. In the post-accession period, the average export value of honey is 2.6 times higher than before, and the variation coefficient is much smaller but still expressing a heterogeneous series of data.

Concerning the import value, the mean was very small in the pre-accession period, but the variation coefficient reflected a high variability of the data from the mean. In the post accession period, the average import value was 10.6 times higher than in the previous period and the variation coefficient diminished a little but it is still very high reflecting large discrepancies between the data of the time series and the mean.

The trade balance accounted, in average, for 15.14 USD billion in the pre accession period and for 36.2 USD Billion in the post accession period, meaning 2.39 times more. The values of the variation coefficients reflected a heterogeneous series of data in the first analyzed period, and a moderate heterogeneous sample of data in the second period.

The average export price in the post accession period was USD 3.93 per kg honey, 2 times higher than in the average price in the pre accession period. The average import price achieved in the period 2007-2016 was USD 2.73 per kg, by 36.5 % higher than the average price in the period 2000-2006.

The coefficients of variation were higher in the first studied period reflecting a large dissimilarity among the variables, and in the second period their values being lower reflected more homogeneity among the data.

CONCLUSIONS

In the period 2000-2017, honey production in increased by 56.9 %, reaching 30,177 tonnes at the end of the last year of the analysis.

After its accession into the EU, more exactly in the period, 2007-2017, Romania produced in average 22.740.6 tonnes of honey per year by 42.46 % more than in the pre-accession period. This was due to the continuous increase of production in all the regions of development, but mainly in SW Oltenia, N E and Centre regions which are the top producers, whose market share is 17.6 %, 17.1 % and, respectively, 13.4 %.

In Romania, in 2017, there were more than 1,600 bee families, 2.46 times more than in the year 2000. This was stimulated by the interest of apiculturists to develop apiary size as reflected by the a higher growth rate (6.16%) in the period 2007-2017 compared to 5.5 % in the previous period. The regions with the highest number of bee families are SW Oltenia, SE and E and S Muntenia with a market share: 19.5 %, 15.6% and 14.2 %. The highest number of bee families per km^2 is 10.71 recorded in SW Oltenia, followed by 7.78 in Bucharest Ilfov and 7.07 in SE region.

The average apiary size in Romania is 24 bee families, higher than 22.4 the European average, but lower than the one recorded in Spain, Greece, Hungary and Poland. Therefore, Romania is on the 5th position in the EU for apiary size.

In 2017, Romania had over 46,000 apiculturists, meaning about 7 % of the total number in the EU, placing the country on the 7th rank after Germany, France, Poland, Italy, Czech Republic and United Kingdom.

In 2017, honey yield/apiary was 18.8 kg, by 6.2 % higher than in the year 2000, and by 9.9

% higher than in 2007. Its level depended on total production and number of bee families, but also of the weather conditions. In the good years for pickings, average honey production per apiary reached 21.6 kg. However, honey yield in Romania is lower than in other EU countries.

The average acquisition price of honey was 2.6 times higher in 2017, accounting for Lei 16.13/kg, while the average producer's price increased by 76 %, reaching Lei 23/18 in 2017.

The amounts of exported honey increased by 38.6 %, recording 10.4 thousand tonnes in 2017 compared to the level in the year 2000. The imported honey amounts are much smaller than export but they increased from 0.1 to 3.4 thousand tonnes in period 2000-2017, but mainly in the post accession period. For this reason, export/import ratio declined from 55.6 in the year 2000 to 3.1 in 2017.

If in the pre accession period, Romania exported about 50 % of honey production, in the post-accession interval, it delivered on the external market a little less, 46 %.

The honey export value reached USD 41.4 Million in 2016, being 5.37 times higher than in 2000, while the import value accounted for USD 8.9 Million, being 52.5 times higher than in the 1st year of the study. As a result, honey trade balance was positive, in 2016, accounting for USD 32.5 Million, being 4.3 times higher than in 2000.

In the post accession period compared to the pre accession period, the average yearly export value increased 2.6 times and the average annual import value increased 10.69 times. The trade balance went up 2.3 times.

The beneficiaries of Romanian honey are mainly from the EU: Germany, Italy, France, Poland, Austria, Spain, United Kingdom, Belgium and the main suppliers are Poland, China, Rep. of Moldova, Ukraine, Germany and Bulgaria.

Romania sold honey for USD 4/kg and purchased for USD 2.65 per kg in the year 2016. In the post accession period the export price increased 2 times while the import price went up 1.3 times. The export/import ratio of honey price has continuously increased, mainly in the post accession interval.

Therefore, the accession into the EU was in the benefit of the both sides, as Romania intensified its honey production, export and import, while the EU covered much better the internal market. This was due to the measures taken by the EU Commission and the Romanian Government to encourage the development of beekeeping in order to assure consumers' needs, pollination of agricultural crops, biodiversity preservation and food security and safety.

Apiculture should continue to be an important agricultural sector in Romania as the country to maintain its position as a top honey producer and exporter of the EU. The beekeepers should be focused on the increase of the number of bee families, apiary size, production diversification, paying attention to organic honey as a market niche, honey quality, certification and brands and associative forms which could assure a higher efficiency along the honey market chain.

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MAIN ASPECTS REGARDING THE CONTRIBUTION OF DOMESTIC TRADE TO THE DEVELOPMENT OF ROMANIA'S ECONOMY IN THE PERIOD 2008-2017

Agatha POPESCU

University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest Romania, Phone: +40213182564, Fax: +40213182888, Email: agatha_popescu@yahoo.com

Corresponding author: agatha_popescu@yahoo.com

Abstract

The paper analyzed the contribution of the domestic trade to the economic development of Romania in the period 2008-2017 in terms of contribution to GDP, investments, jobs, labor productivity, number of companies in operation and turnover. The data taken from the National Institute of Statistics were processed using fixed basis indices, growth rates, structural changes, comparisons to emphasize the main aspects which characterize the evolution of home trade and of its subsectors. The results proved the important role that home trade has in the economy. In 2016, it contributed by Lei 160 Billion 918.7%) to GDP, by Lei 20.06 Billion (20 %) to the investments in the economy, by 1,884 thousand persons (22.5 %) to the occupied population, but in a lower measure to the increase of labour productivity. Home trade is attractive for small business investors as proved by the increased number of new companies in 2016. At present, 45.4 % of the enterprises operating in the economy are profiled on trade transactions. Also, home trade has contributed by Lei 565.1 Billion to the turnover in the economy. The increased sales are justified by the consumption high growth rate for goods and services. The wholesale and retail trade contributes by about 81 % to the national turnover. Therefore, trade is a very important sector of activity which supports Romania's economic development.

Key words: *domestic trade, wholesale trade, retail trade, economic development, Romania*

INTRODUCTION

"Trade has become a modern and efficient branch of the national economy, contributing to the harmonious and sustainable development, as well as to the promotion of international relationships with major implications on foreign exchange and payment balance"[13].

The modern trade is an integrated system including wholesale trade, retail trade, the commercial network of export and import operating on various markets. The trade companies play a key role in puting in practice the selling-purchasing activities and the development of the economic flows. For this reason, trade is required to regulate the market mechanism, the demand/supply ratio, production/consumption ratio and to contribute to the strategic orientation of the modern economy and to the assurance of the economic development [14].

The economic growth is benefic for a country as it is closely related to the increase of wealth, wellness and living standard. The economic growth is a complex concept and for this reason a system of specific indicators is required to be used for a profound analysis. Usually, GDP is the main indicator used in statistical analysis. It reflects the combination between the production factors, the level of production, labor productivity, profitability of investments and is linked to employment and unemployment, price evolution and inflation level [3].

The turnover analysis is also an important indicator as it is connected with consumption and also with economic growth in terms of GDP [2].

Trade has the task to study the real and potential consumer's needs, to influence producers to produce what is required in the market, to carry out the goods distribution from suppliers to consumers on the shortest and the most effective channels, to achieved the selling-purchasing activties, to satisfy consumer's requirements and to inform consumers on the goods launched in the market on their content, quality, performance, availability, guarantee period, and to educate consumers to develop new needs and modelate their consumption behavior, to advertise the goods and services, to protect consumers, and to assure a civilized trade enviroment.

The wholesale trade has the duty to procure a large-scale of goods in an industrial assortment from producers in order to resale them in small amounts to retailers or other categories of recipients who purchase products for their subsequent processing.

The retail trade has the duty to assure the re-selling goods in small amounts in commercial asortment to consumers or other beneficiries in the amount, quality, price, place, and moment suitable to clients' desires.

An important subsector of trade is transport without which the goods could not be transferred from producer to consumer. The transport activity supports the movement of goods in space without affecting the properties and the use of goods before being transported.

Storage is another important activity to protect goods in the period when they are not consumed and has the duty to assure the corresponding capacity, good conditions of quality and integrity preservation of the goods till the moment of delivery to the clients.

Hotels and restaurants are another important component of trade, being named hospitality industry, which assures the material basis for travel and tourism offering a large variety of accommodation units, number of places, board services, but also programmes of leisure and entertainment to their clients. Hotels and restaurants develop a close contact with transportation companies, tour-operators and travel agencies in order to satisfy in the best manner the tourists' needs.

All these sectors are very important in the economy as they contribute to the GDP, economic growth, create jobs and improve people's life [14, 15].

In this context, the paper's goal was to study the dynamics of home trade as a factor of economic growth in Romania in the period 2008-2017. The emphasis was put on the contribution of this sector to GDP, investments, occupied population, number of companies and turnover in the economy of Romania. The main trends and changes within this sector as well as in the economy have been identified and studied.

MATERIALS AND METHODS

The study was focused on the following indicators characterizing the domestic trade:

(i)GDP produced by home trade and its share in Romania's GDP,

(ii)investments in home trade and their share in the investments at the level of the national economy,

(iii)investments in the domestic trade by subsectors: wholesale trade, retail trade, transportation and storage, and hotels and restaurants;

(iv) occupied civil population in the domestic trade and its share in the occupied population in the national economy;

(v)labor productivity in the home trade and its comparison in the various activities in the economy,

(vi) number of enterprises operating in the home trade and its share in the number of enterprises existing in the economy;

(vii) the structure of enterprises in the home trade based on the number of employees;

(viii)the turnover achieved in the domestic trade and by its subsectors, and

(ix) the contribution of each trade subsector to the home trade turnover.

For setting up this analysis in the period 2008-2017, the data were taken from Tempo Online Data base put at the disposal by the National Institute of Statistics [11].

The methodology was specific to such a study including:

Fixed basis Index, $I_{FB} = (y_t/y_1)100$,

Average growth rate, $\bar{R}_a = (\sqrt[n-1]{\frac{y_n}{y_1}} - 1)100$.

The indicator total value, $Y_t = \sum_{t=1}^{n} y_t$.

The results were suggestively illustrated, and then commented and compared where it was the case. Conclusions pointed out the importance of home trade in the development of Romania's economy.

RESULTS AND DISCUSSIONS

The contribution of Home Trade to Romania's GDP.

Romania's economy has continuously developed during the last decade especially after the country accession into the EU. In the analyzed period, the GDP has doubled its value increasing from Lei 538 Billion in 2008 to Lei 858.7 Billion (Euro 187.5 Billion) in 2017.

However, Romania has still a low contribution of only 1.1 % to the EU-28 GDP, despite that it is ranked the 9th based on the area and comes on the 7thposition based on the population. From this point of view, Romania comes on the 17th position in the EU.

Romania can't be compared to the contribution of 50 % of Germany, United Kingdom and France to the EU GDP [6, 7].

The GDP growth in Romania was determined by the high development of services and industry, which are the driving forces of Romania's economy at present. Among services, domestic trade is on the top position playing the most important role in the national economy.

In 2008, the industry contributed by 24.57 % to GDP and domestic trade, including wholesale and retail trade, repairs of vehicles and motorcycles, transportation and storage, and hotels and restaurants by 18.84 %.

In 2017, GDP registered the highest value due to the high growth rate, 7 %, which situated Romania on the 16th position in the EU-28. This was due to the contribution of all the activities in the national economy to GDP, but especially due to services, whose share was 55.8 %. Among services, domestic trade was on the 1st position with 18.7 %, followed by services of public administration with 11.4 % and information and communications with 5.1 %. The other sectors contributed by: 24.2 % industry, 5.9 % constructions and 4.4 % agriculture [30].

The second position of the domestic trade in the economy is explained by the ascending consumption for goods and services, as a consequence of the salary growth and reduction of a few taxes. However, consumption is higher than production, which has determined the increase of imports to cover the market requirements [11, 29].

For example, only regarding the basic goods like agro-food products, the increased consumption is based on high import compared to export, the effect being reflected by the negative agro-food trade balance. [16, 17, 18, 19, 20, 21, 22].

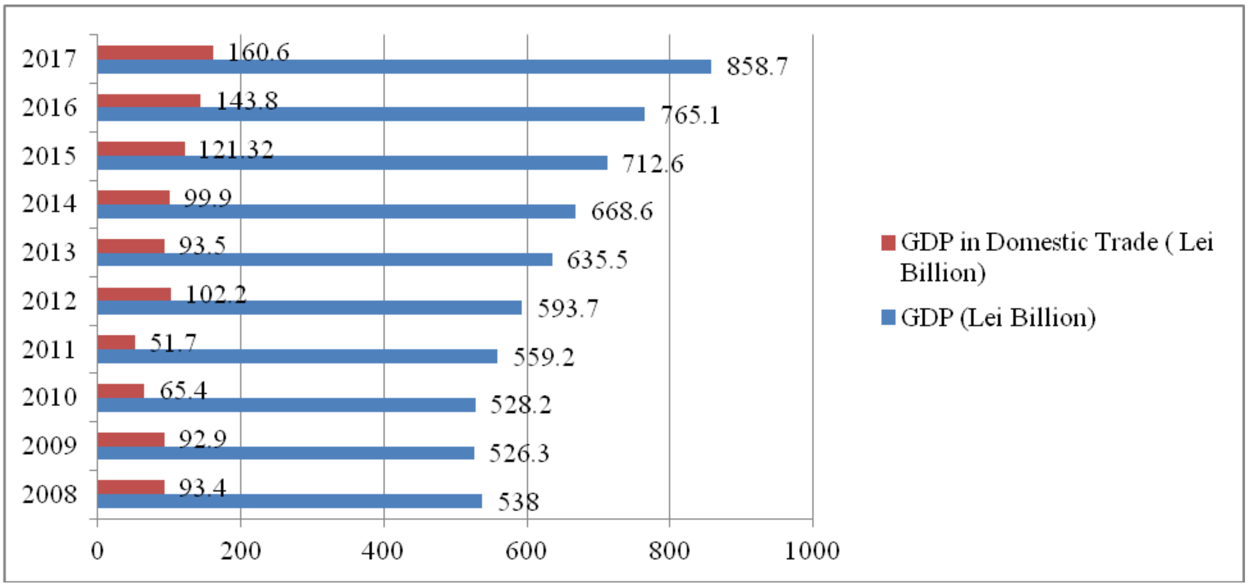

Fig.1. The comparative dynamics of GDP and GDP created in Home Trade, Romania, 2008-2017 (Lei Billion)
Source: own design based on NIS Tempo Online, 2018, [11].

The low production of agro-food products is due to the non corresponding farm structures, low endowment and productivity in agriculture and even in food industry. As a consequence the contribution of agriculture, forestry and fishing to GDP declined from 5.13 % in 2008 to 4.4 % in 2017 [23, 24,25,26,27,28].

The evolution of GDP created by domestic trade reflected a relatively ascending trend from Lei 93.38 Billion in 2008 to Lei 160.6 Billion in 2017, meaning by 71.98 % more than in the first year of the study (Fig.1.)

The inflexions of GDP at the national level and of GDP created by domestic trade were caused by the economic crisis which started in 2008 and its effects were seen in 2009, 2010 and even in 2011.

The crisis affected employment, increasing unemployment, also labour productivity declined and production growth as well, exchange rates have floated many times, and inflation went up. This was the feed-back of the economy not only in Romania, but many other countries during the economic crisis and even after to the external shocks which produced the drift of the economy and domestic trade and bankruptcy of some companies.

After 2011, the trade and the economy started to recover adapting to the new market conditions regarding demand/supply ratio.

Investments in domestic trade.

Investments are very important in the economy to support the modernization of the economic sectors and create jobs, assuring the economic growth. They contributes to the increase of the fixed assets, the use of material resources and labour productivity in the economy.

The investments in Romania's economy registered a varied evolution. In 2008, they accounted for Lei 99.5 Billion and in 2016, they registered a slight decline being Lei 96.2 Billion, by 3.4 % less than at the beginning of the analyzed period.

The lowest investments were recorded in 2009 and 2010 when the economic crisis affected the economy. Since 2011, they have recovered but did not reach the 2008 level.

In 2017, the net investments accountde for Lei 77.96 Billion, representing by 6.4 % more than in 2016. The investments were mainly oriented to industry (33.4%), commerce (25.8 %), constructions (10.6%) transportation (8.6%), and also to processing industry (6.8%), hotels and restaurants (6.2 %) and IT and C (5.2 %) [8,10].

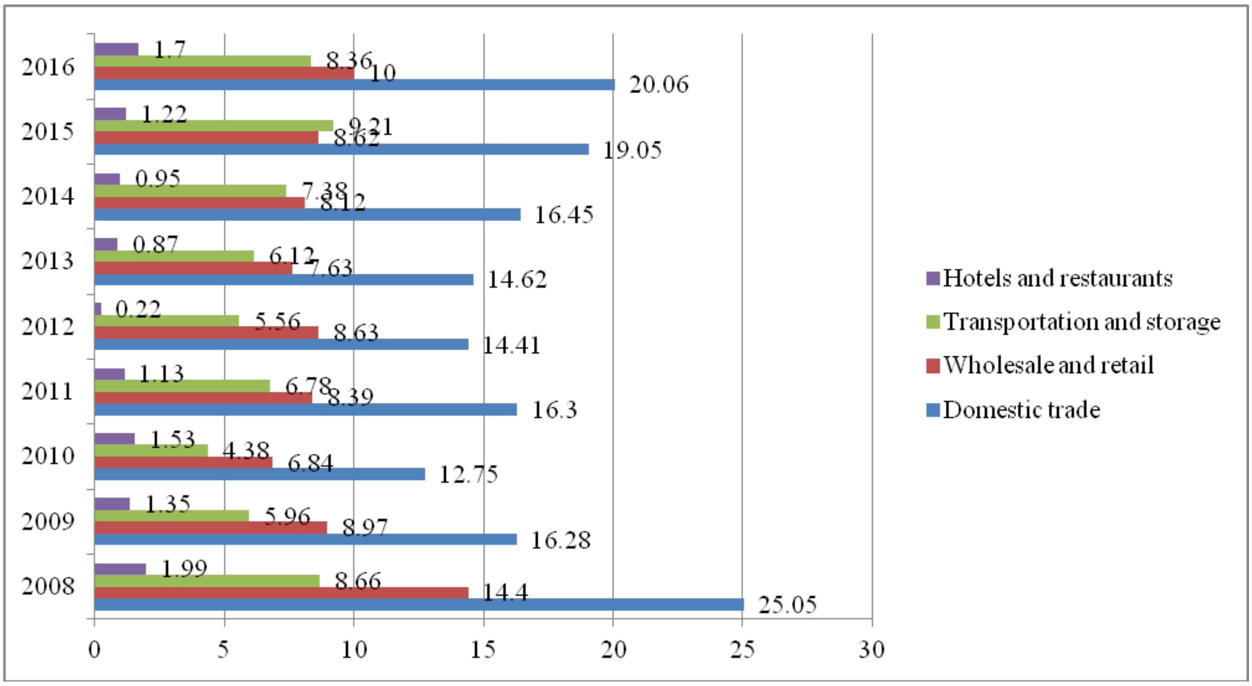

Fig.2. The dynamics of investments in domestic trade, Romania, 2008-2016 (Lei Billion)
Source: own design based on the data from [11].

However, analyzing the evolution of investments only in the field of the domestic trade, taking into account wholesale and retail trade, repairs of vehicles and motorcycles, transportation and storage and hotels and restaurants, it was noticed that in 2016, the investments accounted for Lei 20.06 Billion, representing about 20 % of the level in 2007. After a period of decline due to the economic crisis, since 2011, investments in trade have recovered, and started to increase more intensively since 2014 till present. It is also expected to continue to grow as long as consumption is high.(Fig.2.).

Analyzing the situation by component subsectors of domestic trade, there were found the following aspects:

- the investments in the field of wholesale and retail trade, repairs of vehicles and motorcycles declined by 30.56 % from Lei 14.4 Billion in 2008 to Lei 10 Billion in 2016;
- in transportation and storage, they registered a reduction from Lei 8.66 Billion in the 1st year to Lei 8.36 Billion in the last year of the analysis;
-in hotels and restaurants they declined by 14.58 % from Lei 1.99 Billion in 2008 to Lei 1.7 Billion in 2016.

In 2016, the distribution of investments by subsectors of trade have been: 49.85 % in wholesale and retail, 41.67 % in transportation and storage and 8.48% in hotels and restaurants.

After processing industry, financial and insurance intermediation, real estate, constructions and transportation, foreign investments in the field of wholesale and retail occupied the 4th position in the investments in Romania [12].

The evolution of investments in the national economy and in home trade is illustrated in Fig.3.

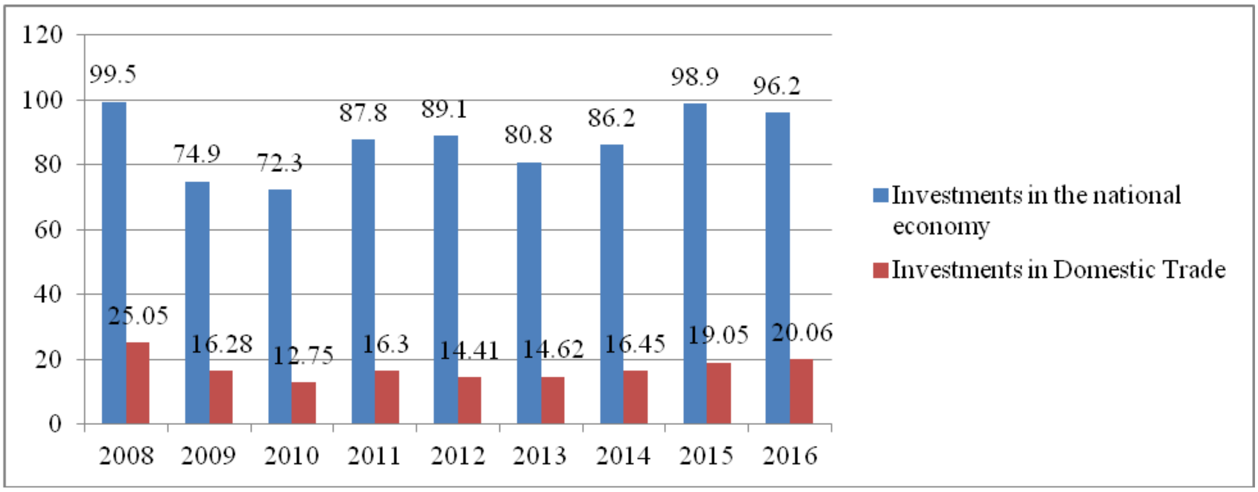

Fig.3. The comparative evolution of investments in the national economy and in the domestic trade, Romania, 2008-2016 (Lei Billion)

Source: own design based on the data from [11].

The occupied population in the field of domestic trade.

In the national economy, the occupied civil population recorded a decreasing trend because of the aging of the population and emigration. In 2017, the occupied civil population accounted for 8,366.8 thousand persons, by 4.35 % less than in 2008. But, it could be noticed the differences from a field of activity to another.

While, the occupied civil population declined by 31.3 % in real estate, by 27.7 % in agriculture, forestry and fishing, by 13.5 % in financial transactions and insurance, by 13.1 % in education, by 5.7 % in public administration, by 0.7 % in industry, by 0.1 % in constructions, in other fields of activity, it increased in other economical sectors: by 56.3 % in IT & Communications, by 51.6 % in administrative activity, by 25.5 % in cultural services, by 26.2 % in hotels and restaurants, by 16.7 % in professional, scientific and technical activities, and by 7.5 % in domestic trade.

The situation by subsector of domestic trade was the following one:
-in wholesale and retail trade, the occupied civil population increased by 4.7 % from 1,168.4 thousand persons in 2008 to 1,224.2 thousand persons in 2016;
-in transportation and storage, it increased by 8 % from 422 thousand persons to 455.8 thousand persons in the analyzed interval;
-in hotels and restaurants it was registered the highest increase, 24.2 % from 161.8 thousand persons to 204.2 thousand persons in the analyzed period.

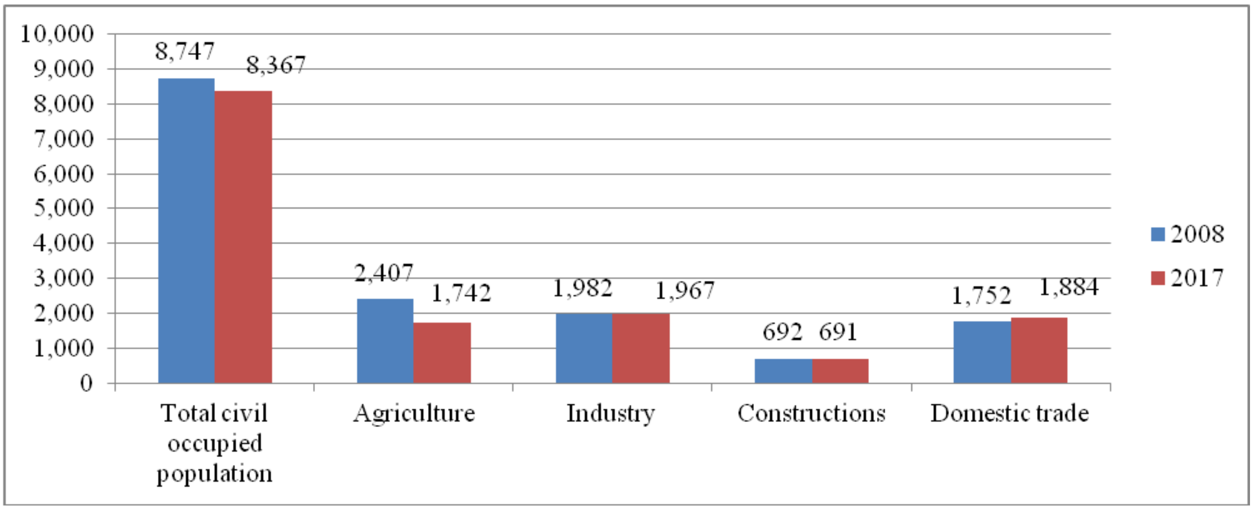

Fig.4. The comparative occupied civil population in the main economic sectors, Romania, 2008 and 2017 (Thousand persons)
Source: own design based on the data from [11].

In 2017, the share of various sectors in the occupied civil population in the national economy was: 23.5 % in industry, 22.5 % in domestic trade, 20.8 % in agriculture, forestry and fishing, 8.2 % in constructions, all these sectors representing 75 % of the total occupied population.
By subsectors of home trade, the highest share, 65 %, belongs to wholesale and retail trade, followed by 24.1 % in transportation and storage and 10.9 % in hotels and restaurants.

Labour productivity.

In the national economy, labour productivity registered a continuous growth. In 2015, its level was Lei 73.5 thousand per person, by 80.5 % higher than in 2008.
The decreasing order of the economic activities based on the level of labor productivity is the following one: real estate transactions, financial and insurance intermediation, IT &C, professional, scientific and technical activities, cultural services, domestic trade, industry, constructions, agriculture, forestry and fishing and public administration services (Table 1).

Table 1. Labour productivity by economic sectors in Romania, 2015 (Lei thousand per person)

	2008	2015	2015/2008%
Average labour productivity in the economy	51.4	73.5	142.9
Agriculture, forestry and fishing	12.2	13.2	108.2
Industry	61.7	96.2	155.9
Constructions	83.4	66.1	79.2
Domestic trade	53.1	67.6	127.3
IT & C	189.5	210.2	110.9
Financial and insurance intermediation	114.9	223	194.1
Real estate transactions	597.9	1,905.9	318.7
Professional scientific and technical activities	71.2	137.4	192.9
Public administration	50.5	60.1	119.0
Cultural activities	47.7	96.2	201.6

Source: own determination based on the data from [11].

Number of enterprises in operation.

The number of enterprises operating in the national economy recorded a negative trend, declining by 4.9 % in the period 2008-2016.

In 2016, there were 527,792 enterprises at the national level, of which 239,828 were functioning in domestic trade (45.4 %). But looking at the whole interval, one could easily notice that the number of enterprises with profile of home trade declined by 12 % from 272,279 in 2008 to 239,828 enterprises in 2016. In consequence, the share of home trade decreased from 49.6% to 45.4% in the total number of companies at national level.

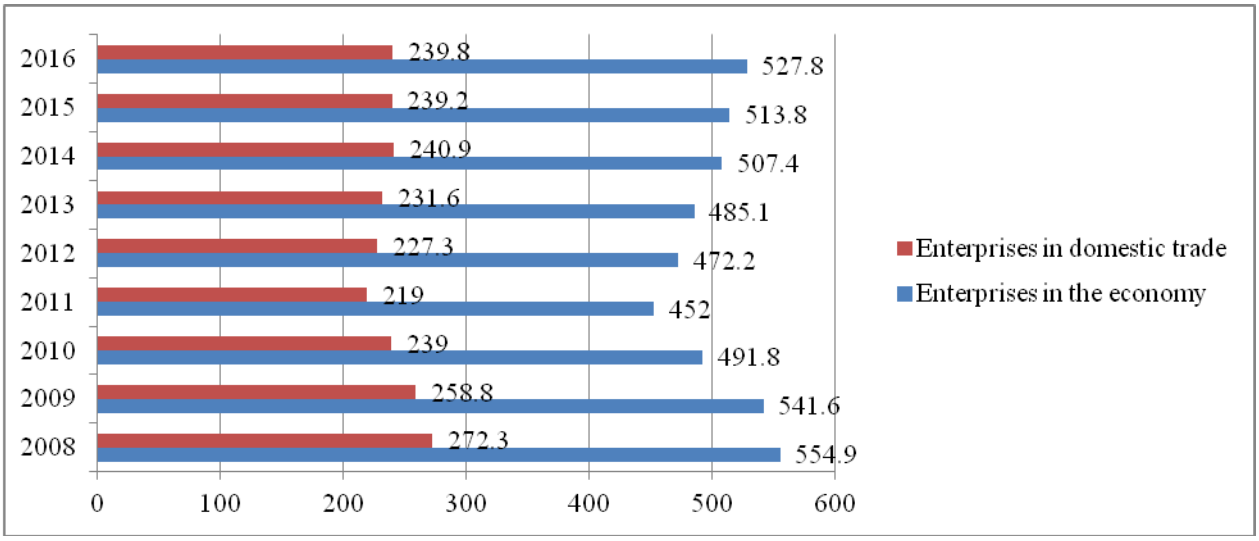

Fig.5. The number of enterprises operating in the national economy and in domestic trade, Romania, 2008-2016 (Thousand)

Source: own design based on the data from [11].

The situation by activities belonging to domestic trade was the following one:

-the number of companies operating in wholesale and retail decreased by 20.7 % from 214,137 in 2008 to 169,712 in 2016;

-in transportation and storage, the number of companies increased by 29 % from 34,489 in 2008 to 44,504 in 2016;

-in hotels and restaurants, the number of enterprises also increased but by only 8.2 %, from 23,653 in 2008 to 25,612 in the last year of the analysis.

Therefore, the enterprise structure in home trade consists of 70.7 % wholesale and retail companies, 18.5 % transportation and storage companies and 10.8 % hotels and restaurants companies.

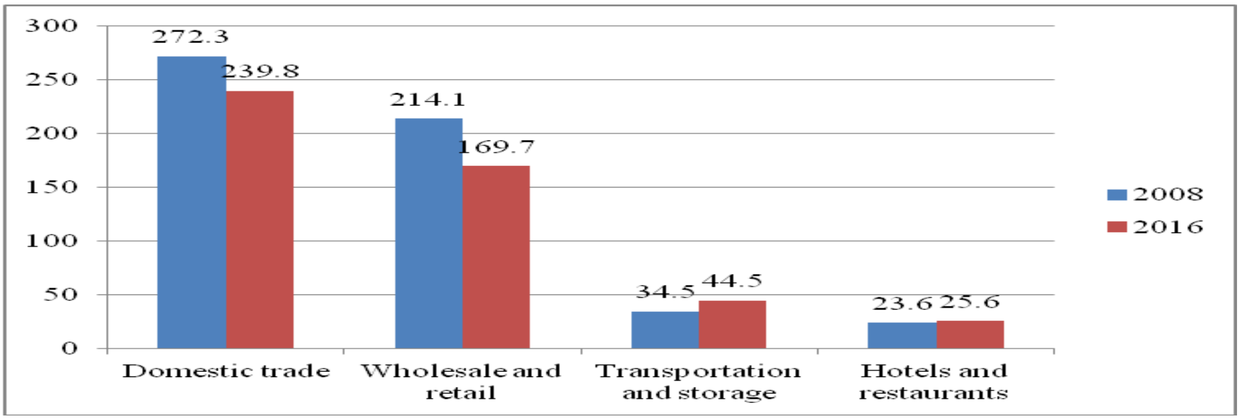

Fig.6. The number of enterprises operating in Domestic trade by subsector, 2008 and 2016 (Thousand)

Source: own design based on the data from [11].

In 2016, a number of 67,719 new companies were established in the economy, of which 17,525 enterprises, meaning 25.8 %, in the field of wholesale and retail trade and 5,873 (8.6 %) in transportation and storage and 4,243 (6.26%) in hotels and restaurants. This reflects that whole sale and retail trade are fields of high attraction for developing a profitable business [10].

Taking into account the number of employees, in 2016, about 89 % of enterprises in the national economy had between 0 and 9 employees, and just 0.4 % had over 250 employed persons.

In the field of domestic trade, the share of the smallest enterprises with 0-9 employees is the highest one, 91.4 %, and higher than in the national economy.

In the category with 10-49 employees, in the economy there are operating 8.9 % enterprises and in the field of home trade 7.4 %.

The enterprises with over 50 employees have the lowest weight both at the national level and in the domestic trade.

We may affirm that in the field of trade as well as in the national economy of Romania, small and medium sized enterprises are the main type of companies. the small business is a feature in the Romanian economy.

Turnover in Domestic trade.

Taking into account the increased consumption of goods and services, justified by a higher income and time for leisure, the business in wholesale and retail, in transportation and storage and in hotels and restaurants has continuously developed leading to a higher and higher turnover.

In 2016, the turnover achieved in domestic trade accounted for Lei 565.05 Billion, being by 39.4 % higher than in 2008 (Fig.7).

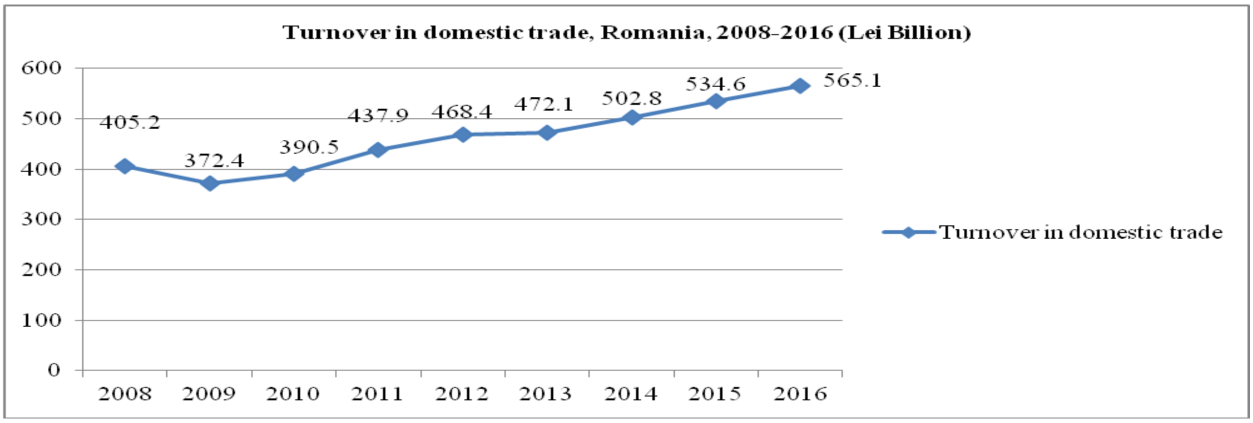

Fig.7. The dynamics of turnover in the domestic trade of Romania, 2008-2016 (Lei Billion)
Source: own design based on the data from [11].

In the field of wholesale and retail trade, the turnover increased by 34.8 % from Lei 338.8 Billion in 2008 to Lei 457 Billion in 2016. This was due to the increased sales by 57.2 % in the retail trade and by 22.9 % in the wholesale trade.

In the sector of services, the turnover raised by 62.6 % from Lei 66.42 Billion in 2008 to Lei 108.01 Billion in 2016. The growth rate of turnover in the analyzed period went up by 67.2 % in the field of transportation and storage and by 48.9 % in the field of hotels and restaurants (Fig.8).

The contribution of various subsectors to the turnover of the domestic trade was the following one in 2016: 48 % wholesale trade, 32.8 % retail trade, 14.6 % transportation and storage and 4.6 % hotels and restaurants. In 2008, the hierarchy of the subsectors was the same, just the figures were a little different as follows: 54.4 % wholesale trade, 29.1 % retail trade, 12.2 % transportation and storage and 4.3 % hotels and restaurants. Therefore, it was noticed a decline in the share of wholesale trade, and an increased weight of the retail trade, transportation and storage, and hotels and restaurants.

In the month of August 2017 compared to August 2016, it was noticed the highest increase of retail sales in Romania due to the increased consumption by 15.9 %, due to the high sales of non food products by +18.5 %, due to the raise in the retail trade of fuels by +18.4% and also in food, beverages and tobacco. This situation was created by the low capacity of production in the economy which could not cover the demand of goods. As a result, the increased imports on the Romanian market are a stimulus for production, jobs and exports in other countries [4, 9].

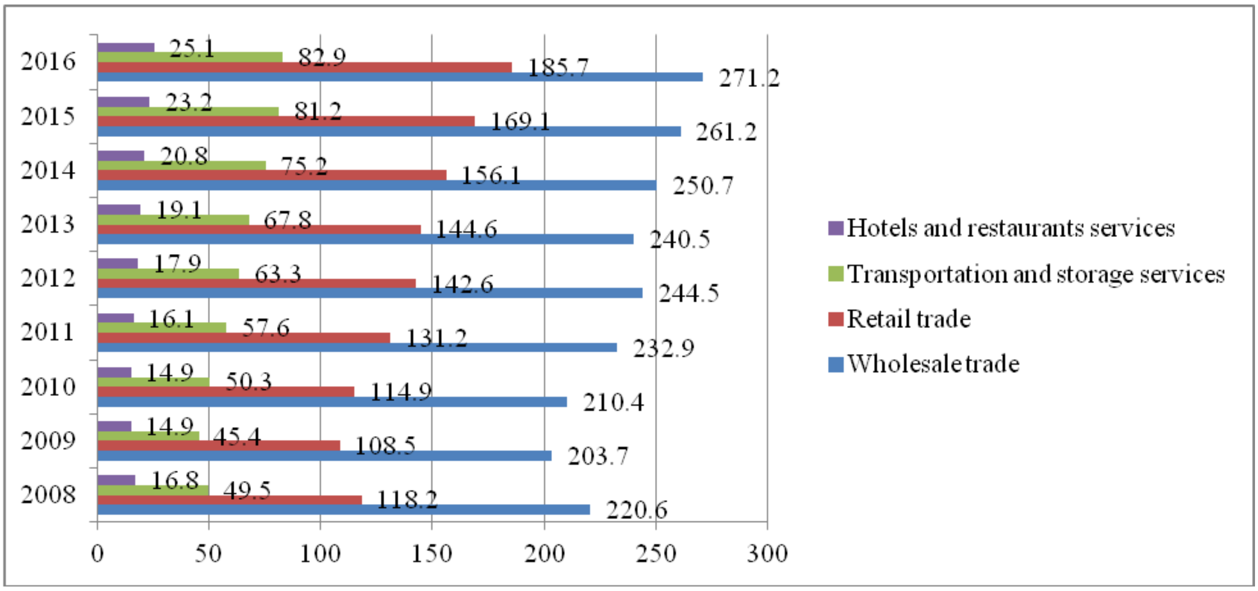

Fig.8. The evolution of turnover by subsectors of the domestic trade, Romania, 2008-2016 (Lei Billion)
Source: own design based on the data from [11].

Also, in December 2017, Romania registered another "boom" of retail trade, placing the country on the 2nd position in the EU.
The highest annual growth was recorded by Malta (12.4%), Romania (10.1%) and Poland (9.2%). The highest monthly growth was noticed in Malta (3.1%), Estonia (1.8%) and Romania (1.3%) [5].
Compared to the evolution of wholesale sector in the first eleven months of the year 2016, in 2017, the wholesale trade turnover increased by 7.6 %.
This was determined by "the increased non specialized wholesale by 16.5%, of the specialized wholesale of other goods by 14.2%, of the wholesale with consumer goods, others than food by 6,6%, of the wholesale trade with food, beverages and tobacco by 6%, of the whole sale of gross agricultural products and live animals by 5.9% and of the wholesale trade of other machinery, equipments and furniture by 4.2%" as mentioned by [31].

CONCLUSIONS

The domestic trade is one of the main sectors of the national economy taking into account its contribution to GDP, investments, jobs, labour productivity, number of companies in operation and turnover.
Of Romania's GDP recorded in the year 2017, accounting for Lei 858.7 Billion, domestic trade came on the 2nd position with a share of 18.7 % after industry which had 24.2 %.
The dynamism of home trade has been stimulated by the consumption growth which, in its turn, was determined by the measures taken by Government to increase salaries and reduce some taxes.
Consumption is the most important determinant responsible of the economic growth, and not investments and external trade.
This aspect reflects that the economic growth is in danger not to be sustained in the future, as long as production has a slow increase compared to consumption, which impose as higher imports to cover the market needs, with a negative impact on the trade balance.

Investments in the economy, as well as in the domestic trade have followed a descending trend.

Only during the last years, it was noticed a refreshing in this field. The increased number of companies in 2016 is a hope that investments are more and more attractive in Romanian economy and mainly in domestic trade which has a high growth rate.

While at the national level, it was registered a decline of the occupied civil population due to the aging process and emigration, and in agriculture as well, a stagnation was noticed in the field of industry and constructions.

But, the domestic trade was the most generous sector in offering more jobs and increasing employment.

Labour productivity has increased in all the economic activities, and in the field of domestic trade it is still by Lei 5.9 thousand per person less than the average labour productivity in the economy. From this point of view, home trade comes on the 8th position in the economy.

Home trade is an attractive sector of the economy for developing business, and that's why 45.4 % of the enterprises functioning in the economy have a trade profile.

However, after 2008, the number of enterprises went down being affected by the economic crisis, and only after 2011, it was noticed a refreshment.

Taking into account that over 90 % of the commercial companies have less than 9 employees and only 7.4 % have 10-49 employees, it is obvious that small business in commerce is characteristic to the Romanian economy.

The turnover in home trade has recorded an ascending trend and reached Lei 565.05 Billion in 2016. The growth rate of about 39 % is the result of the increased consumption for services and goods and of the price growth.

Therefore, home trade has an important contribution to the increase of turnover in the national economy.

The highest contribution to home trade turnover is given by wholesale trade, 48%, followed by retail trade with 32.8 %, meaning about 81 % only from these two sectors.

As a final conclusion, domestic trade is a very important sector of the national economy and which will continue to support the economic growth in Romania.

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ROMANIA'S SUNFLOWER SEEDS PRODUCTION, EXPORT AND IMPORT- ANALYSIS OF THE 2007-2017 PERIOD AND FORECAST FOR 2018-2022 HORIZON

Agatha POPESCU

University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest Romania, Phone: +40213182564, Fax: +40213182888, Email: agatha_popescu@yahoo.com

Corresponding author: agatha_popescu@yahoo.com

Abstract

The paper analyzed sunflower seeds sector in Romania in terms of production, exported and imported quantities, export and import value, trade balance and export and import prices in the period 2007-2017 and set up the forecast for the horizon 2018-2022 using the extrapolation method. Romania has a good performance in production and export of sunflower seeds, being ranked on the top position in the EU-28. The volume and quality of sunflower seeds has continuously grown, and the exported amount as well. The imported amount is 6 times lower than import, which favours the trade balance. The export was higher and higher and covered the import value resulting a positive trade balance. But, import price is higher than export price having a negative impact on the trade efficiency. For this reason, imported quantities should be kept at a low level. In the year 2022, it is expected as the seeds production. export and import to increase, as well as the trade balance to preserve its positive value. Farmers should pay attention to use high value cultivars and hybrids, to apply modern technologies, and improve the product market chain. The high demand for sunflower seeds for producing oil and biodiesel mainly in the EU and in other external markets is a chance for Romania to intensify its export.

Key words: *analysis, forecast, sunflower seeds, production, export, import, Romania*

INTRODUCTION

Oil seeds crops are of a large variety of species including soybeans, groundnuts, castor bean, linseed, mustard, rapeseed, sesame, sunflower, coconuts, olives and oil palms [5].

They are important in human diet, but also in industry due to their rich content in oil, protein, vitamins, fiber etc. Oils seeds are also used as fertilizers for land rejuvenation, the fiber is utilized in industry of textiles and plastics, also the cakes which remain from seeds procession are important in animal feeding. Oil seeds are efficiently used for producing renewable energy in terms of biodiesel.

The world oil seeds production reached 573 Million tonnes in 2017, of which sunflower seeds accounted for 50 Million tonnes (8.7 %). The main producers are Ukraine, Russia, EU-28, Argentina and China.

Oilseeds are object of international trade being a good deal for exporters. The export and import price depends on demand/supply ratio [11,13,19].

Sunflower (*Helianthus annuus L.)* is cultivated in many countries of the world due to its high capacity of adaptation, high degree of high mechanization, and low labor needs. However, its production could be deeply affected by droughts and in summer season it needs important rainfalls. In addition, it could be damaged by diseases and birds.

Sunflower is one of the most important oilseeds crops in the world as the content of its kernel in oil is about 50 %, of which 30% is the essential linoleic acid. Sunflower oil is rich in non saturated fatty acids compared to other oil types. At present, sunflower supplies 11% of the crude vegetable oil production [9].

Its oil is good for human consumption as it has a pleasant taste and flavor and it is rich in A, D, E. The hull is about 20-30% and contains mainly crude fibers. Also, it has 20 % protein. [1, 12, 20].

Argentina, Ukraine and Russia are the world leaders in producing and trading sunflower seeds. They are responsible of about 52 % of the world sunflower production and 40 % of the world export. In 2050, it is expected as the world sunflower seeds production to reach 60 Million tonnes.

The EU-28 is the main beneficiary of the sunflower seeds sold by Ukraine and Argentina. Other importing countries are Turkey, Egypt and China who need to cover the demand of the domestic market.

In the Eastern Europe, Romania, Bulgaria, Turkey, Moldova and Serbia are the principal producers of sunflower. The world trade with sunflower oil accounts for 30 % of total consumption. [8].

In Romania, the main oilseeds crops are sunflower, rape and soybean which are successfully used in human diet and in animal feeding. Sunflower oil together with soybean fat are successfully utilized mainly in pig and poultry fattening assuring a high daily gain [14, 15].

Also, it is a good raw material for industry. The industrial processing is based on their high content in vegetal fat: sunflower 50%, rape 34 % and soybean 20% which is extracted and utilized as oil, bio fuel. It is also a very good plant in crop rotation with maize and wheat. Romania exports not only sunflower seeds, but also crude oil and meal [7, 16].

Sunflower oil is an important source of energy being well appreciated in producing biofuel, especially bio diesel [17].

In the EU, Romania is on the 1st position both for the cultivated area and the production of sunflower seeds. In 2016, the cultivated area with sunflower reached over 1.01 million ha and production recorded 1.95 Million tonnes. In the future, it is expected an increase of the cultivated area, production and export [18].

In this context, the paper aimed to study the situation of sunflower seeds production, export, import and trade balance during the period 2007-2017 and to forecast the expected performance in the sunflower sector of Romania for the 2018-2022 horizon.

MATERIALS AND METHODS

The analysis of sunflower sector is based on the following indicators: production of sunflower seeds and its share in oilseeds production, exported and imported amounts of sunflower seeds, the share of exported amounts in sunflower production, exported and imported quantities ratio, sunflower seeds export value, import value and trade balance, sunflower export price (FOB) and import price (CIF).

These indicators were studied using the data for the period 2000-2017 taken from N.I.S. Tempo online Data Base, and from FAOSTAT Data base [6, 10].

The analysis of the indicators characterizing sunflower sector was supported by the use of the following methods:

Index Method, of which it was utilized *Fixed basis Index*, having the formula $I_{FB}=(y_n/y_0)100$.

Average growth rate, $\bar{R}$, was determined according to the formula:

$\bar{R}_a = (\sqrt[n-1]{\frac{y_n}{y_0}} - 1)100$, where y_n is the n value and y_0 is the first value of the chronological series.

Absolute differences, $\Delta = y_n - y_{n-1}$

Mean, $\bar{X} = \frac{\sum_1^n x_i}{n}$

Graphical Method in order to display the trend and variations of each indicators during the analyzed period.

Linear regression function, $Y= bx + a$ was used to analyze the relationship between sunflower seeds production, X, the independent variable, and oil seeds production, Y, the dependent variable. Also, it was used to analyze the connection between the exported quantity, the dependent variable and the sunflower seeds production, the independent factor.

Correlation coefficient and coefficient of determination were also determined to offer a more comprehensive image of the existing relationships between the indicators mentioned above.

Linear Extrapolation Method. The forecast for 2018-2022 horizon of production, exported and imported quantities, export and import price, export and import values and trade balance were determined taking into account the level of each indicator achieved in 2017 and the average growth rate, $\bar{R}$, in the analyzed period and the average annual growth in absolute value $\overline{\Delta y}$ in the period 2007-2017.

The formula used to forecast these indicators belongs to Extrapolation Method based on the chronological series of data and was the following one:

$y_t = y_o + n_0 \times \overline{\Delta y}$

where:

y_t is the extrapolated indicator for the time horizon t;

y_o is the value of the indicator in the first year of the analysis, considered the base value;

n_0 is the number of years between the base value and the value at the t horizon;

$\overline{\Delta y}$ is the average annual growth in absolute value [2].

The most of results were graphically presented, and also tabled, being interpreted and commented. Finally, the conclusions were drawn reflecting the main ideas resulted from this research.

RESULTS AND DISCUSSIONS

Sunflower Production.

Oil seeds production is an important vegetal sector in Romania assuring both the internal market needs and also a substantial amount for export.

Oil seeds production has continuously increased from 1.04 Million tonnes in 2007 to 4.98 Million in 2017, being 4.76 times higher than in the 1st year of the study.

Sunflower is the main oil seeds crop, which is proved by the dynamics of its performance in production. In 2007, Romania achieved 0.54 Million tonnes sunflower seeds and in 2017, it produced 5.32 times more, i.e. 2.91 Million tonnes. However, the production was diminished in 2015 due to the unfavorable weather conditions. The average production of sunflower seeds in the interval 2007-2017 was 1,666.12 thousand tonnes. (Fig.1.).

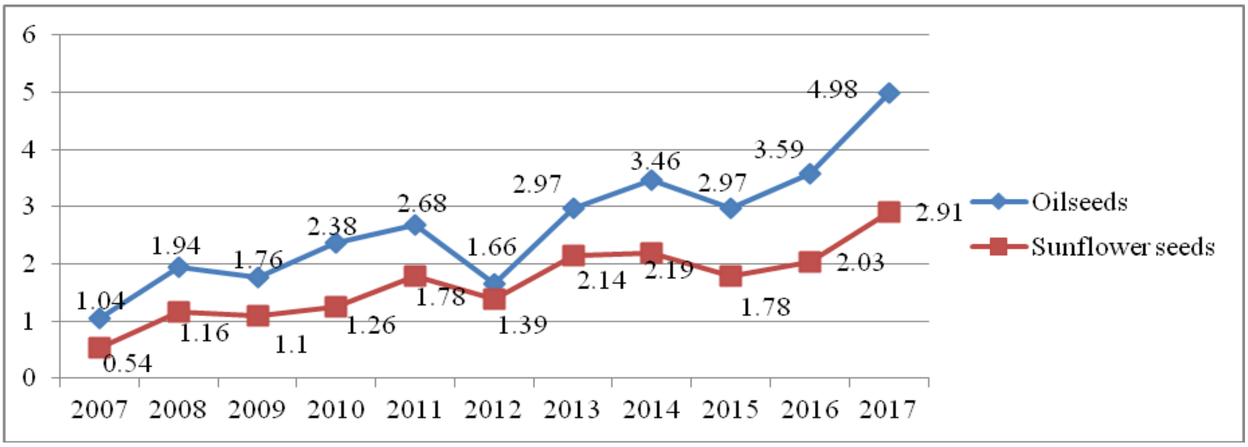

Fig.1. Sunflower seeds production in the period 2007-2017, Romania (Million tonnes)
Source: Own design based on the data from [6, 10].

The data shown in Fig.1. reflect that sunflower seeds production has been more dynamic compared to the oil seeds production.

Sunflower plays an important role among the oil seeds crops, so that its production represents 62.5 % in average of the oilseeds output. This share varied from 52.2 %, the minimum value registered in the year 2007 to 83.8 % in the year 2012. In 2017, the share has diminished to 58.4%, but it is higher than in 2007.

In the year 2017, Romania came on the 1st position in the EU for 1.95 Million tonnes sunflower seeds, meaning 23.04 % market share in the EU-28 production which accounted for 8.46 Million tonnes.

Romania is followed by other important sunflower seeds producers such as: Hungary (22.3 %), Bulgaria (21.27%), France (12.76%) and Spain (8.39 %) [11]

At the world level, Romania occupies the 5th rank contributing by 4.29 % to the world production which reached 47.34 Million tonnes in 2016. The top producers worldwide are: Ukraine (28.7 %), Russia (23.25%), Argentina (6.33%0, China (5.46 %) and Romania (4.29%) [4].

Regression of oil seeds production depending on sunflower seeds production is presented in Fig.2. The regression function y = 1.6121x - 0.0036 reflects the relationship between the two variables. Also, the coefficient of correlation is r = 0.959, a very strong and positive value and the coefficient of determination, R^2, shows that 92.09 % of oil seeds production variation is determined by sunflower seeds production. The significant F = 0.2495 is higher than the tabled values and confirms the strong relationship between the two indicators for P=0.05 % (Fig.2.).

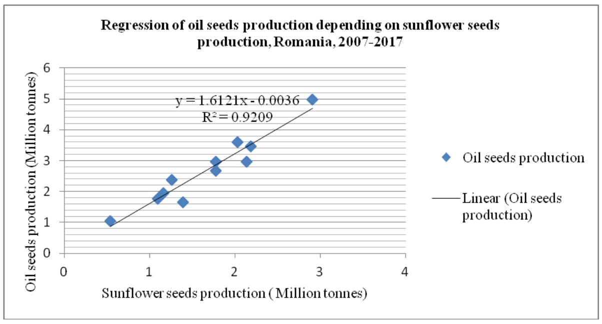

Fig.2. Regression of Sunflower seeds production oil seeds production depending on sunflower seeds production, Romania, 2007-2017
Source: Own design based on the data from [6, 10].

Exported and imported quantities of sunflower seeds.

The exported amount of sunflower seeds increased from 0.38 Million tonnes in 2007 to 1.18 Million tonnes in 2016, being 3.09 times higher than in the first year of the interval (Fig.3.)

Romania is the largest exporting country of sunflower seeds in Europe, with a contribution of 38 % to the 3 Million tonnes exported by Europe in 2016.

Since 2012, Romania occupies the top position in Europe's export. The growth rate of the export volume was +16 % and 9.3 % growth rate was recorded for export value.

Of the production of sunflower seeds, Romania exports about 60 % and the remained 40 % is destined to cover the needs of the domestic processors such as Bunge, Expur, Prutul and others. [3].

About 76 % of the imported sunflower seeds in Europe is assured by the intra-EU trade. In 2016, Europe imported 3.2 Million tonnes of sunflowers seeds. Romania is the main supplier having 27 % market share, being followed by Bulgaria (13%), Hungary (11%) and France (8.5 %).[3].

The main importing countries of sunflower seeds from Romania and other suppliers are the Netherlands, France, Germany, Spain and Italy.

The imported amount of sunflower seeds is about 6 times smaller than the exported quantity. In the analyzed period, the imports increased from 0.07 Million tonnes in 2007 to 0.20 Million tonnes in 2016, meaning +185.7 % compared to the 1st year of the study (Fig.3.)

The main suppliers of sunflower seeds for Romania are Republic of Moldova, France, Bulgaria, Hungary and Turkey.

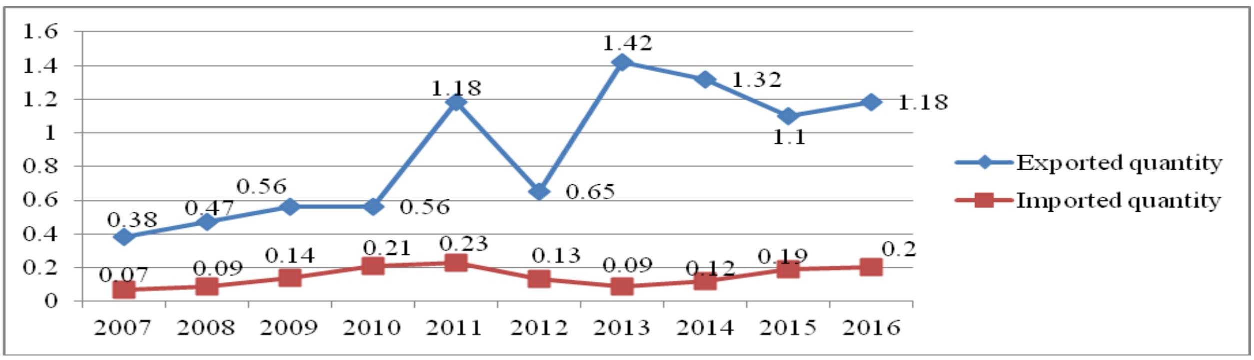

Fig.3. Sunflower seeds exported and imported amounts in the period 2007-2017, Romania (Million tonnes)
Source: Own design based on the data from [6]

Regression of exported quantity depending on sunflower seeds production is presented in Fig.4.

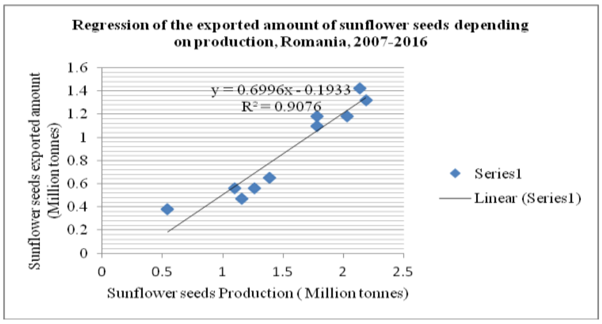

Fig.4. Regression of Sunflower seeds exported quantity depending on production, Romania, 2007-2017
Source: Own design based on the data from [6]

The regression function y = 0.6996x - 0.1933 shows that the relationship between the two variables is linear and strong. This aspect is attested by the correlation coefficient r = 0.952, a positive value and the determination coefficient, R^2, which reflects that 90.76 % of oil seeds export is determined by production. The significant F = 0.2067 is higher than the tabled values and confirms the strong link between the two variables for P=0.05 %.

The share of export in production. Taking into account the high production of seeds, the contribution of sunflower to the exported quantity is very high. The export/production ratio had values ranging between 0.69, the maximum level recorded in 2007 and 0.58 in the year 2016. The average level of this ratio was 0.56 in the analyzed interval (Fig.5.)

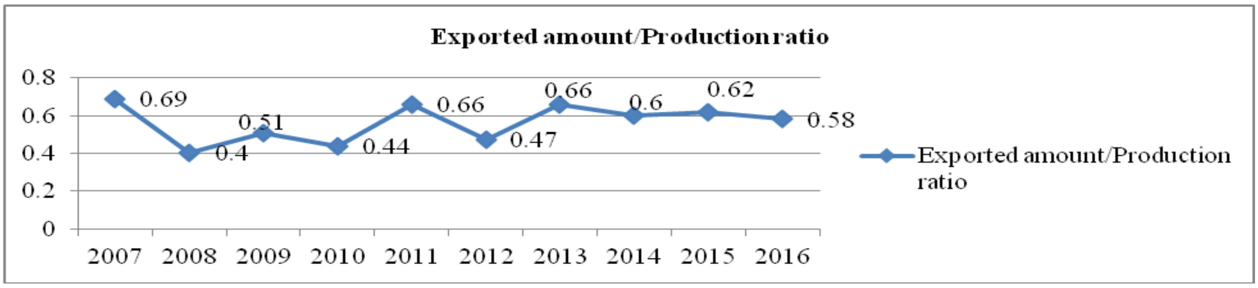

Fig.5. The ratio between the exported amount and production of sunflower seeds, Romania, 2007-2017
Source: Own design based on the data from [6]

Export value, import value and trade balance.

The export value recorded an ascending trend from USD 144.3Million in 2007 to USD 542.1 Million in 2016, meaning + 275.6% compared to the 2007 level.

The import value increased 3.44 times in the studied period from USD 44.5 Million in 2007 to USD 153.2 Million in 2016.

The trade balance of sunflower seeds had a positive value in all the years as a consequence of the higher value of export compared to import value. In 2016, it accounted for USD 388.9 Million, being 3.89 times higher than in 2007 (Fig.6).

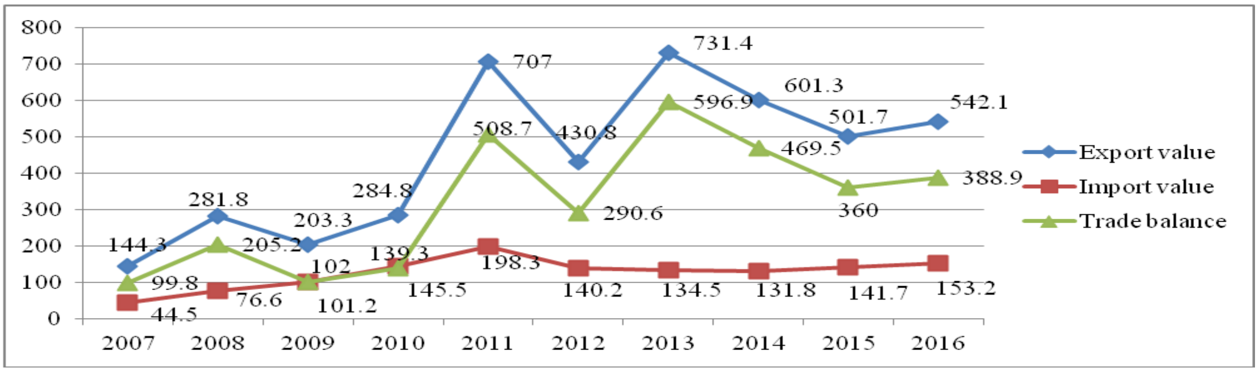

Fig.6. Sunflower seeds export value, import value and trade balance, Romania, 2007-2017 (USD Million)
Source: Own design based on the data from [6]

The key factors with a positive impact on the trade balance have been: the high production of sunflower seeds, the export price on special market segments and the low imports. But, Romania has still a low yield of sunflower seeds and in this respect farmers must do more to improve the performance.

Average export and import price of sunflower seeds.

The average export price (FOB) raised by 21.4 % from USD 377 per tonnes in 2007 to USD 457.9 in 2016. However, the highest export price was in 2012 when a tonne of sunflower seeds was sold for USD 659.4.

The average import price (CIF) varied from USD 668.6 per tonne in 2007 to USD 776.9 in 2016, reflecting a growth rate of 16.19 % in the whole analyzed interval.(Fig.7.).

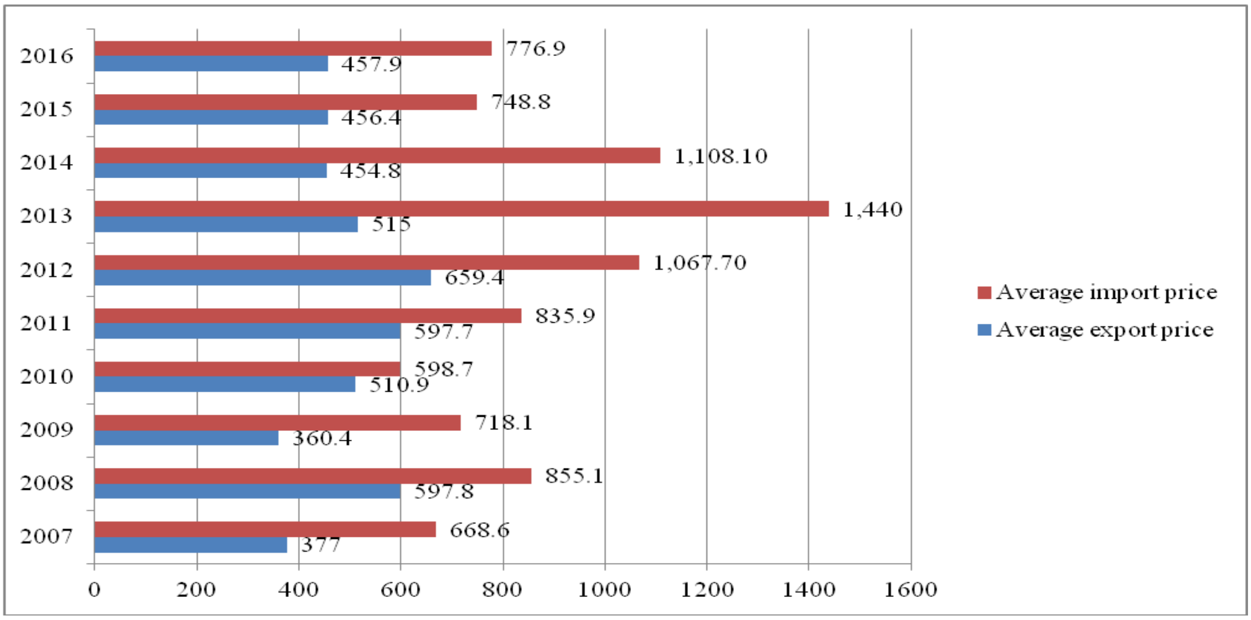

Fig.7. Sunflower seeds export and import price, Romania, 2007-2017 (USD/Tonne)
Source: Own calculation and design based on the data from [6]

The ratio between the export price and import price ranged between 0.56 in 2007 and 0.59 in 2016, as a consequence of the levels of prices. The highest ratio was 0.73 registered in 2010, and the smallest one was 0.41 recorded in 2014.

This ratio reflects that import price is not in favor of Romania as it has a negative influence on sunflower seeds trade balance.

Therefore, the positive trade balance is due mainly to the high quantity of exported sunflower seeds and to the smaller imported amounts.(Fig.8).

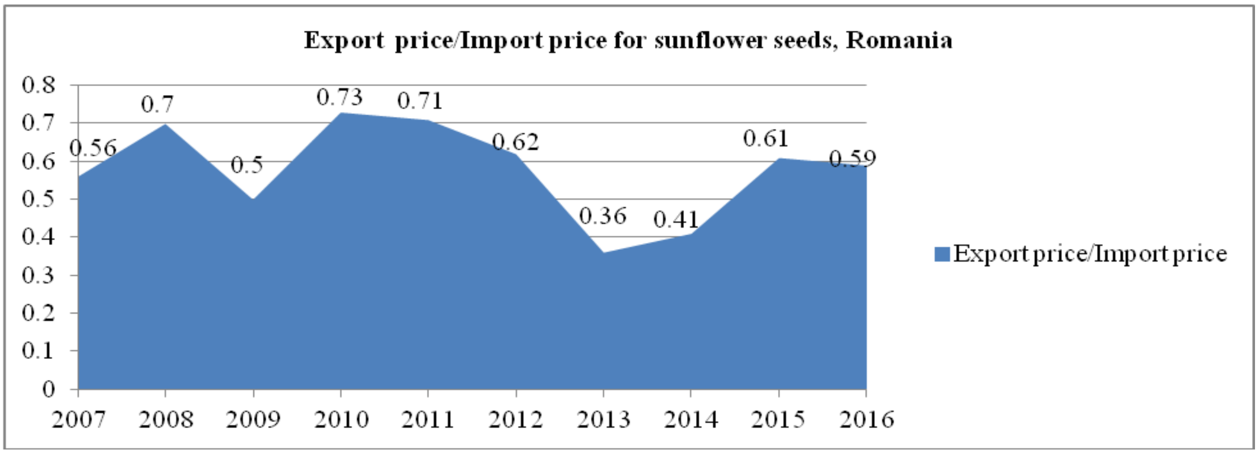

Fig.8. Sunflower seeds Export price/Import price ratio, Romania, 2007-2017
Source: Own determination and design.

Forecast of sunflower seeds production, export, import, trade balance for 2018-2022 horizon.

Production forecast started from the production level recorded in 2017, meaning 2,912.7 thousand tonnes and taking into account the average annual gain in production in the period 2007-2017, 236.58 thousand tonnes, it was estimated that Romania will produce 4,095.3 thousand tonnes or 4.1 million tonnes sunflowers seeds in the year 2022.

The exported quantity was estimated for 2,014.7 thousand tonnes in 2022, taking into consideration that in 2017 it was exported 1,322.2 thousand tonnes and the average yearly gain in the analyzed period was 138.5 thousand tonnes.

The imported quantity of sunflower seeds will increase in the forecast horizon from 211.7 thousand tonnes in 2017 to 284.2 thousand tonnes in 2022., meaning by +33%.

The average export price of sunflower seeds is estimated to reach USD 706.3 per tonne in the year 2022, when it is expected to be by 41.4 % higher than in 2017.

The average import price is expected to reach USD 1,031.3 per tonne in 2022, being by 25.8 % higher than in 2017.

Table 1. The estimates for production, exported and imported quantities, export and import price, export value, import value and trade balance in Romania for the 2018-2022 forecast horizon

	Production Million tonnes	Exported quantity Million tonnes	Imported quantity Million tonnes	Export price USD/tonne	Import price USD/tonne	Export value USD Million	Import value USD Million	Trade balance USD Million
2017	2.91	1.32	0.21	499.3	819.3	660.16	173.44	486.72
2018	3.14	1.46	0.23	540.7	861.7	789.80	194.91	594.89
2019	3.38	1.60	0.24	582.1	904.1	930.89	217.81	713.28
2020	3.62	1.73	0.25	623.5	946.5	1,083.45	241.54	841.91
2021	3.85	1.88	0.27	664.9	988.9	1,247.48	266.70	980.78
2022	4.10	2.01	0.28	706.3	1,031.3	1,422.98	293.09	1,129.89
2022/2017 %	140.8	152.2	134.2	141.4	125.8	215.5	168.9	232.1

Source: own determination.

The estimates for export value, import value and trade balance for the year 2022 are the following ones: USD 1,422.98 Million in case of export value, USD 293.09 Million in case of import value and USD 1,129.83 Million for trade balance. Therefore, it is expected as in 2022, the export value to be by 115.5 % higher, import value by 68.9 % higher and trade balance by 132.1 % higher than in 2017 (Table 1).

This forecast is available if the conditions will remain unchanged. In general, the cultivated surface with sunflower exceeds 1 million ha, but it is possible to increase this area in the future to balance the deficit which could be caused by unfavorable factors. For example, in 2018, the months with high humidity determined a delay of sowing and this affected production performance, Also, possible droughts could continue in the next years and could diminish yield and total production.

In the EU, other countries like Spain and Hungary have also extended the cultivated surface with sunflower, while other member states like Italy, Bulgaria and France have reduced it, which could be an advantage for Romania.

CONCLUSIONS

Based on this research it was found that Romania is the main EU producer and exporter of sunflower seeds, but also of oil and meal. The production of sunflower seeds has continuously increased both as volume and quality, and after covering the internal needs on the domestic market, over 60 % is exported. The amount of exported sunflower seeds has increased and also the import, but the last is 6 times smaller than export.

The export value has grown fast during the analyzed period and covers very well the import value leading to a positive trade balance.

Taking into account that the import price is higher than the export price, it is obviously clear that the main factors determining the positive trade balance are: the high quantity of exported sunflower seeds and the low imported amount.

Romania has a good position among the sunflower seeds producers and exporters in the world and has to continue to make efforts to preserve this rank. In this respect, farmers should use high value hybrids and varieties, to apply modern technologies, to increase production quality and improve distribution along the product chain. Export must remain an important tool for bringing foreign currency in the country as long as the demand of sunflower seeds is very high both for oil for human consumption, but also for meals used in animal feeding and for producing biodiesel. The import should remain at a low level for keeping a positive trade balance.

Investments in processing industry are required in order to produce and export more products with high value added, and not only raw agricultural products.

The expectations for the sunflower sector in the horizon 2018-2022 are following ones: in 2022, compared to 2017, it is expected as production to increase by 140.8 %, the exported amount by 52.2 %, the imported amount by 34.2 %, the export price by 41.4 %, the import price by 25.8 %, the export value by 115.5 %, the import value by 68.9 % and the trade balance by 132.1 %.

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SORGHUM - AN IMPORTANT CEREAL IN THE WORLD, IN THE EUROPEAN UNION AND ROMANIA

Agatha POPESCU, Toma Adrian DINU, Elena STOIAN

University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest Romania, Phone: +40213182564, Fax: +40213182888, Emails: agatha_popescu@yahoo.com, tomadinu@yahoo.fr, stoian_ie@yahoo.com

Corresponding author: agatha_popescu@yahoo.com

Abstract

The paper analyzed the status of Sorghum crop worldwide, in the EU and Romania regarding the cultivated area, production, yield and trade pointing out the main trends. The data provided by the Data bases of NIS and Faostat have been processed using usual methods such as fixed index and comparison. In 2017, the world Sorghum production reached 63.9 million tonnes, and the average yield 1,427 kg/ha. The main producers of Sorghum are the USA, Nigeria, Sudan, Mexico, Ethiopia and India. In 2017, the EU represented just 0.12 % of the world area cultivated with Sorghum. and produced 755 thousand tonnes of grains,i.e.1.18 % of the world output. But, the EU average yield is 5,580 kg/ha, being 3.81 times higher than the world mean. In main EU producers of Sorghum are: Italy, France, Spain, Romania, Austria, Hungary, and Bulgaria. In 2017, Romania cultivated 13,833 ha, representing 25.2 % of the EU area and produced 54,282 tonnes Sorghum grains, i.e.7.18 % to the EU output. Per surface unit, Romania carried out 3,879 kg/ha, 2.71 times more than the world mean and by 30 % less than in the EU. Romania is also an important exporter of sorghum grains and the trade balance is positive. Due to the advantages of this crop and taking into account the need to mitigate the effects of climate change, the EU policy provides a new perspective to grow the cultivated surface and production. Romanian farmers must use new technologies, paying attention to high value hybrids, fertilization and plant protection to improve yield, and production. Romania has to keep its position as an important producer and exporter of Sorghum in the EU by developing this agricultural sector.

Key words: *Sorghum, production, cultivated area, yield, characteristics, advantages, perspectives, worldwide, EU, Romania*

INTRODUCTION

Sorghum is a cereal belonging to "Kingdom *Plantae*, Phylum:*Magnoliophyta*, Class: *Liliopsida*, Order: *Poales*, Family*: Poaceae*, Tribe: *Andropogoneae*, Genus: *Sorghum"* [4, 45].

Sorghum has a large variety of annual and perennial species. The most important species is "*Sorghum vulgare*, *Pers. sin*, *Sorghum bicolor (L) Moench"*[4] which includes all the cultivated species. The cultivated Sorghum is classified into *"Sorghum var. eusorghum, Sorghum var. technicum, Sorghum var. saccharatum* and *Sorghum Sudanese"* [4, 42].

The origins of are in the tropical areas of Africa, somewhere in Sudan and Ethiopia, from where it was spread to the warm climate zones situated between 40-45^0 Nordic Latitude and 40-45^0 South Latitude, being named "the cereal of the arid areas" [4].

At present, Sorghum is cultivated in 110 countries from all the continents, mainly in Africa, Asia, but also in the North, Central and South America, in Oceania and Europe.

Sorghum crop has important characteristics and advantages. First, it is a plant resistant to drought as its root system is very well developed allowing the plant to reduce its growing intensity in the periods when water is not sufficient. This is the reason why Sorghum could perform better than maize and other crops in the areas where precipitations are less than 450 mm.

Secondly, Sorghum has a high adaptation capacity in the arid and semiarid zones on the soils with a different texture and pH (4.5-8.5). From this point of view, it could be successfully cultivated on the soils which are not suitable for other crops (sandy, salted and eroded soils) [4].

Also, Sorghum is a good plant in crop rotation, being used as previous culture for sunflower and maize and other crops [51].

It has a high grain production potential, but less than maize in similar conditions. It also could produce an important amount of green mass and dry matter. This is due to the large range of varieties and hybrids with a high production potential, but which are also highly resistant to drought, diseases and pests, have a lower tannin content and/or are lacked of "durrhina", a toxic glycoside which could produce intoxications to animals.

Sorghum requires low inputs: a low quality for agricultural land which can't be used by other crops, a low amount of seeds, fertilizers, a lower utilization of plant protection substances and water [24].

The plant has a short vegetation period ranging between 110 -150 days/year which allows farmers to obtain two harvests per year. This is possible as after moving, the plant is able to quickly regenerate its vegetative mass.

Sorghum is an environmental friendly crop as it has the capacity to absorb an amount of 50-55 t/ha C_2O from atmosphere and to release a huge amount of oxygen. The forests and cereals absorb a lower quantity of carbon dioxide, only 16 t/ha, and, respectively, 3-10 t/ha yearly.

The chemical composition of Sorghum reflects a high nutritional value quite similar to maize. As affirmed by Neucere and Sumrell (1980), the Sorghum grains contain: "10.g protein, 3.2 g fat, 73 g carbohydrates, 2.3 g crude fiber, 1.6 g ash, 329 kcal energy, minerals (27 mg Ca, 4.3 mg Fe, and also small amounts of Cu, Mg, Ni), vitamins mainly from the B group (Thiamine 0.3 mg, Niacin 2.83 mg and Riboflavin 0.138 mg), but also tannins depending on variety". [28, 34].

According to the synthesis made from literature results by Ratnavathi (2013), the variation thresholds of different chemical components are the following ones:"protein (4.4-21.1 %), water soluble protein (0.3-0.9 %), lysine (1-3.6 %), starch (55.6-75.2), amylose (21.2-30.2), soluble sugars (0.7-4.2), reducing sugars (0.05-0.53), crude fiber (1-3.4 %), fat (2.1-7.6), ash (1.3-3.3), minerals (Ca 11-586, P 167-751, Fe 0.9-20), vitamins (in mg/100 g: Thiamine 0.2-0.5, Niacin 2.9-6.4, Riboflvin 0.1-6.2), antinutritive components (tannins 0.1-7.2 5, phytic acid 8.7-2,211 mg/100 g)" [25, 34, 40, 47].

Other parts of Sorghum plant, like stalks and leaves, are rich in cellulose and hemicellulose, but also in starch [6].

Sorghum plant could be used entirely: grains, flowers, stalks, panicles, etc.

The diversity of Sorghum cultivars and hybrids has determined a large range of uses. Sorghum is on the 5th position as importance among the cereals in the world. It is a staple food in Africa, but also in Neat East and Asia (India, China, Bangladesh etc) [4, 40].

First, grains are used as human food, either as such, or boiled or in warm salads, or as flakes [42]. In food industry, grains are used to produce "floor, bread, biscuits, vermicelli, noodles, flakes, extruded products, weaning and supplementary food and bakery"[40], "tortillas, a sort of polenta, pizza, pastas and cakes" [42]. In some countries from grains are prepared "traditional meals such as: idli, dosa, chakli, papad"[40], and also vinegar [3]. In beer industry, Sorghum is utilized for malt extraction [13, 51]. From stalks, it is obtained a syrup which is an important sweetener in cakes and drinks, as this juice contains different sugars such as: sucrose 9.4 %, glucose 3.4 %, fructose 3 %, and other sugars 23.3 % [1, 3].

Sorghum is an important plant for animal feeding where it could substitute maize. Grains are a stock feed for poultry, pigs and cattle, and pets, mainly dogs [13, 38, 51]. Sorghum green mass, silage, hay, and pellets are good forages in dairy farming, steers and pig fattening [2, 31, 36].

However, the consumption of Sorghum leaves and stalks by animals could produce intoxications due to the existence of the tannin and glycosides. But, at present, the scientific research offered new hybrids with low tannin content and without glycosides.

Sorghum has many technical uses. First, grace to its capacity to develop 120-150 t phytomass, the plant it is used to produce energy: fuels (bioethanol, synthetic gases etc), electricity, and thermal energy [2, 4, 31, 36, 51].

As bio material, Sorghum flowers and stalks are used in the cellulose and textile industry, for producing cellulose, paper and textiles, and also are used as a good construction material [2, 51].

In the handicraft industry, Sorghum is used to produce "brooms, washing brushes, braidings (knittings), paper, wallboard, fences and also biodegradable materials" as mentioned by [2, 36, 51].

Sorghum could be used green manure and fertilizer, and also to eliminate weeds from other crops as happens mainly in the USA [3, 45].

In various African and Asian countries, from Sorghum flowers, leaves pods, and even stalks are extracted colorful substances which are later utilized to paint the fabrics, wool and skins [51].

The climate change affects more intensively our Planet during the last decades. In 2016, the temperature at the earth's surface was by 0.94 Celsius degrees higher than the average of the 20th century. In the last years, global temperatures exceeded all the records so far. The increased sea level due to the decrease of the melting glaciers, the strong rainfalls, storms, droughts, floods have affected agriculture, environment, economy and people's life causing material damages and financial losses [17, 21].

Due to the climate change and the demographic evolution of the globe population, agriculture is facing many difficulties in assuring a corresponding food from a quantitative and qualitative point of view, food security and the livelihoods for the rural population being threatened [8].

In Europe, the climate change produces the decline of agricultural production, an increased incidence of forest fires, losses in biodiversity and ecosystems disruptions, and also affects the population's health. The main countries affected by high temperatures, droughts, forest fires, floods and extreme weather events are situated in the South and South Eastern Europe such as: Bulgaria, Hungary, Portugal, Republic of Moldova, Romania, Ukraine, and the Southern part of the Russian Federation [12].

For this reason, important efforts are focused to set up new strategies and measures destined to mitigate the impacts of climate change on agriculture and environment.

Regarding agriculture, we could expect important changes in crop mapping and structure, and cropping technologies to keep the production at a level able to cover the consumption needs.

For this reason, Sorghum crop is reconsidered during the last decade in many countries due to its benefits and advantages and a new orientation to a larger cultivated surface and a higher production is more and more sustain.

In this context, the paper aimed to present Sorghum crop as an alternative cereal both at the world and Europe level, mainly in the EU and Romania. The study emphasizes the characteristics of Sorghum crop, and its advantages, and also the dynamics of production in the world, in the EU and Romania, and the main producers in order to point out the trends regarding cultivated surface, production and yield in the period 2007-2017.

MATERIALS AND METHODS

The research was carried out based on the study of a large range of published reports, articles and other materials, and on the data provided by the National Institute of Statistics and Faostat and for the period 2007-2017, for the following indicators: cultivated area, production, yield, export, import, trade balance, export and import price. Comparisons between Sorghum and maize were made in order to point out the similarities and differences between the two crops [18, 33].

The main trends have been identified using the graphical method and also the fixed method index allowed to determine the growth rate for the chosen interval.

The results were tabled and graphically illustrated, the interpreted and commented and also compared and finally the corresponding conclusions were drawn.

RESULTS AND DISCUSSIONS

World Sorghum harvested area and production. In 2016, the world Sorghum production accounted for 63,930,558 tonnes grace to the contribution of the 110 countries where this crop is cultivated [5].

The harvested area of *Sorghum bicolor (L.) Moench* at the world level registered a decreasing trend from 48 million ha in 1970 to in about 42 million ha in the year 2009. In the period 1970-2009, it was noticed an increased area cultivated with Sorghum in Australia, Brazil, Burkina Faso, Ethiopia, Mexico, Nigeria, and Sudan, but a decreasing trend in China and India [39].

In the year 2000, the cultivated area with *Sorghum bicolor* was 40.9 million ha worldwide [44]. In 2016, Sorghum occupied the 3rd position in the world for 44.77 million harvested ha after corn (187.96 million ha) and barley (46.92 million ha) [22].

The main countries cultivating Sorghum in the world are: USA, India, Nigeria, Mexico, Sudan, China, Argentina, Ethiopia and Australia [48].

The top 10 producers of Sorghum in the world and their market share are the following ones: USA (19%), Nigeria (10.8%), Sudan (10.1 %), Mexico (7.8%), Ethiopia (7.4 %), India (6.9 %), Argentina (4.7 %), China (3.7%), Niger (2.8%0 and Australia (2.8 %) (Fig.1.) [44].

By continent, Africa is on the top as Sorghum is produced in 43 African countries, the main important producers being Nigeria, Sudan, Ethiopia, Niger and Burkina Faso. In 2016, Africa produced 29,773,508 tonnes Sorghum grains, representing 46.5 % of the world production.

In Africa, Sorghum is used as food, feed and fuel. For the cultivated area, Sorgum comes on the 2nd position after maize and for its production it is ranked the 4th after maize, rice and wheat. However, Sorghum productivity is low in Africa, just one tonne/ha as it couldn't keep pace with the demand growth, the variation of the climate in dry land environments and the delay in developing new technologies like in case of other crops [29].

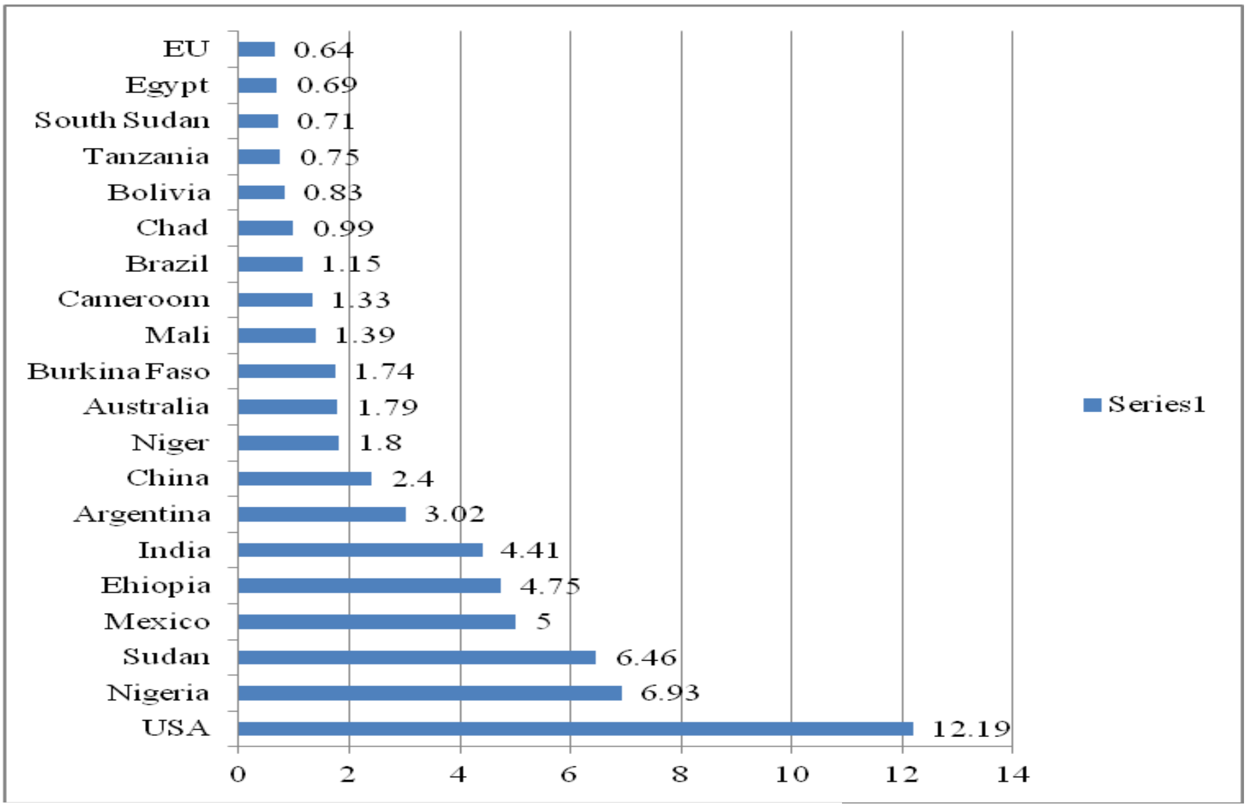

Fig.1.The top 20 producers of Sorghum in the world, in 2016 (Million tonnes)
Source: Own design based on [44].

In the Americas, the top producers are: the USA, the world leader, followed by Mexico, Argentina, Brazil and Bolivia. In Asia, the main producers are India, China, Burma (Myanmar), Pakistan, and Thailand.

In 2016, the USA produced 12.1 million tonnes Sorghum grains, of which 72 % were achieved by two states, Kansas and Texas. In the USA, Sorghum is used primarily for animal feed and for producing ethanol. In addition, taking into account as Sorghum is a gluten-free grain it is reconsidered at present as food for the people with celiac disease [44, 49].

The world Sorghum trade reflects an increase of export (+15 %), import (+15 %), production (+3.7 %), and consumption (+6.5 %). Consumption has exceeded production in the years 2011/2012, 2015/2016 and 2016/2017 which justify the intensification of the international trade (Table 1).

Table 1. World Sorghum balance, 2014-2018 (TY Million Metric Tonnes)

	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	Growth rate 2017/2011 %
Export	6.6	6.4	7.2	7.6	7.7	9.8	7.6	115.1
Import	6.6	6.4	7.2	7.6	7.7	9.8	7.6	115.1
Production	61.1	57.2	57.9	59.1	63.8	63.3	63.4	103.7
Consumption	59.9	58.4	57.8	59.1	63.1	63.8	63.8	106.5

Source: Own calculation based on [23].

Therefore, about 6-7 million tonnes are exported annually in the world, the main exporting countries being: USA, Argentina and Australia. The main importing countries are China, Japan and Mexico, but also Europe. The EU annual import of Sorghum is about 160 thousand tonnes a year, but it will increase for sure in the future to diminish the dependence on other markets [43].

Europe cultivated area and production. In the year 2000, in Europe, the cultivated area with Sorghum accounted for 216.9 thousand ha representing 0.53 % of the world surface with this crop. The largest surface was in Russian Federation, France, Italy, Albania, Ukraine, Spain, Hungary, Serbia and Montenegro and Romania [5].

In 2016, in Europe, there were 14 countries producing Sorghum, whose production totalized 1,256,541 tonnes, representing 1.96 % of the world production. In the decreasing order of their contribution to production, these countries are: Italy, Russian Federation, Ukraine, France, Spain, Romania, Austria, Hungary, Bulgaria, Slovakia, Greece, Croatia, Macedonia and Turkey [44].

The EU-28 Sorghum cultivated area and production. The EU cultivated area with Sorghum has registered a slight decline in the period 2007-2017. In 2017, it accounted for 55,233 ha representing 95.85 % of the 2007 level [16]. Therefore, the share of the EU surface cultivated with Sorghum in the world area is very small, only 0.12 %.

In 2016, the EU came on the 20th position in the world for 669,887 tonnes of Sorghum grains representing 1.01 % market share of the world level. The EU countries producing Sorghum are: Italy, France, Spain, Romania, Austria, Hungary, Bulgaria, Slovakia, Greece, and Croatia, whose production ranged between 313,788 tonnes in Italy and 206 tonnes in Croatia (Fig.2.)

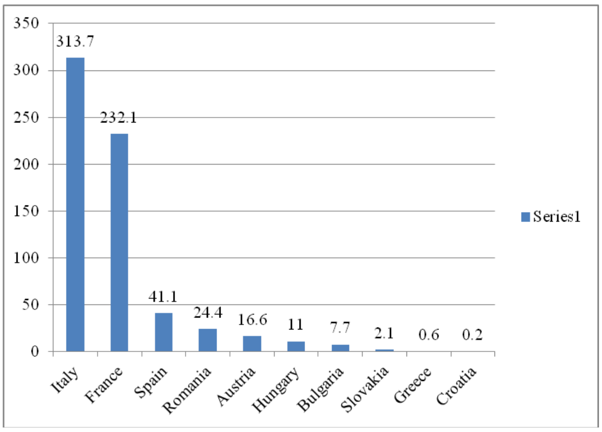

Fig.2.The top 10 producers of Sorghum in the EU, in 2016 (Million tonnes)
Source: Own design based on [44].

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The EU Sorghum producers' position in the world and market shares are presented in Table 2.

Table 2.Position in the world and market share for the top EU member states producing Sorghum grains in 2016

	Rank in the world Sorghum production	Market share in the world Sorghum production (%)
Italy	22	48.29
France	28	35.73
Spain	51	6.34
Romania	61	3.76
Austria	63	2.55
Hungary	68	1.70
Bulgaria	77	1.18
Slovakia	89	0.32
Greece	92	0.09
Croatia	08	0.03

Source: [44].

Analyzing the dynamics of Sorghum production in the period 2007-2017, one may notice a 44.3 % growth rate, as in 2017, the production reached 755 thousand tonnes compared to 523 thousand tonnes in 2007 (Fig.3.)

The EU Sorghum yield increased, despite that the surface cultivated with this crop declined, and this was because of the high crop technologies including first of all varieties and hybrids with high production potential, and resistant to droughts and diseases.

The yield level increased by 1.3 % from 5.37 thousand tonnes/ha in 2007 to 5.44 thousand tonnes/ha in 2017. Therefore, in the EU, the average yield is more than 3.8 times higher than the world average yield.

The evolution of Sorghum yield is comparatively shown with the dynamics of maize yield in Fig.4 to reflect the good production potential of this alternative crop to maize. Its performance is lower compared to maize yield, but higher compared to average cereal yield in the EU.

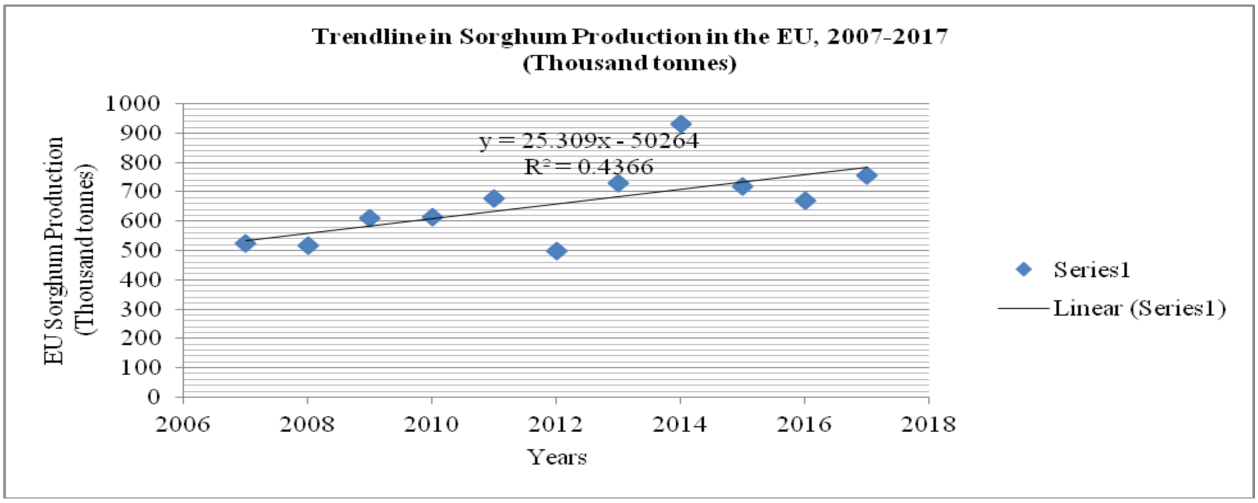

Fig.3. The dynamics and trend line in the EU Sorghum production, 2007-2017 (Thousand tonnes)
Source: own design based on [16].

France, Italy, Romania and Spain are the main producers of Sorghum in the EU.

In the EU, Sorghum is used as animal feed, a gluten free source, and also as a source of renewable energy (methanol, synthesis gases etc).

In France, Sorghum is used as feed either as silage or grain. As silage it is used in dairy cows and beef cattle feeding. The research results proved that the mixture of silage maize and Sorghum in the proportion 1:1, used in dairy cows feeding, could reduce the starch content in the diet, increase milk fat and feed efficiency. In case of the use of Sorghum grains, it was noticed an increased intake, but if the dry matter in the harvest is over 35 %, milk production will go down by 10 % and feed efficiency as well. In steers fattening, if the dry matter in Sorghum silage is over 25 %, the intake could higher depending on the breed, like in case of Limousine compared to Charolaise breed. The combination 50 %

grain Sorghum and 50 % maize silage could increase the dry matter and also the daily gain. The mix of Sorghum and maize silage could diminish the feed ingesta and increase daily gain [19].

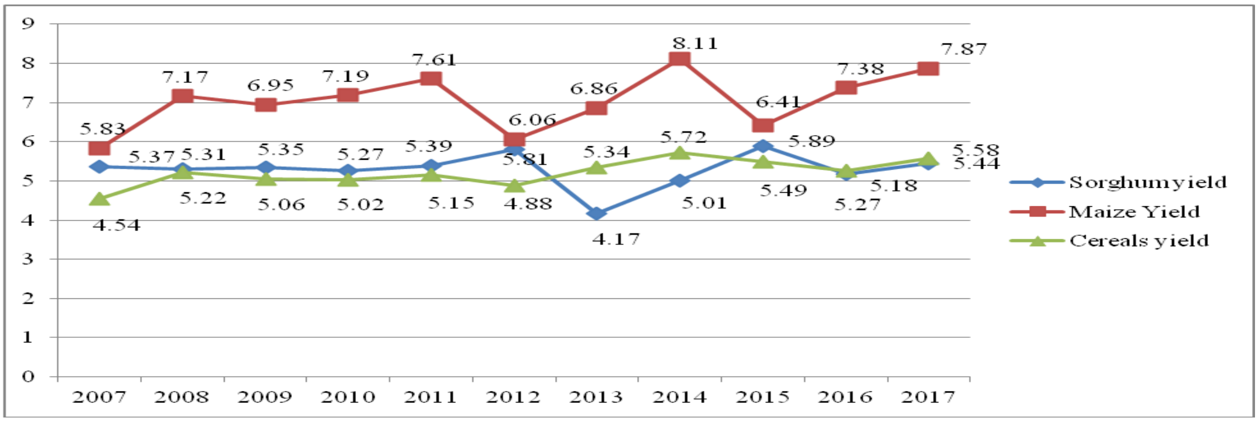

Fig.4. The comparative dynamics of Sorghum and maize yields in the EU-28, 2007-2017(Tonnes per ha)
Source: own design based on [16].

The absence of gluten in Sorghum grains in connection with the people who suffer of celiac disease has led to the reconsideration of this crop and new varieties were created to produce high-quality food and beverage products (flour, bread, noodles, cookies, waffles, and beer) [15].

In Italy, Sorghum is used for animal feeding as silage being produced in the areas where maize is not able to perform. The vegetation length is about 110 days, yield could reach 7-8 tonnes per year and the production cost per ha is by Euro 200-300 lower than in case of maize. Also, Sorghum is used as biomass for producing ethanol and biogas [10].

In Germany, Sorghum biomass is utilized to produce biogas and methanol, whose production is satisfactory [20].

In the EU, a special attention is paid to Sorghum seed quality which has to meet the standards regarding minimum germination (80%) and analytical purity (98%) and zero impurities. At present, in France for instance, there are many high potential cultivars which are registered in national and EU catalogues [41].

Romania's Sorghum cultivated area, production and yield.

In Romania, Sorghum is cultivated in the areas with a warm climate, mainly in the plain regions from South Muntenia, Oltenia, Banat, Crisana and the Central Moldova, but also in the Bucharest-Ilfov area and Dobrudja, therefore in the same areas where maize is cultivated. In these parts of the country, the hybrids have records by 40 % higher than the pure cultivars [51].

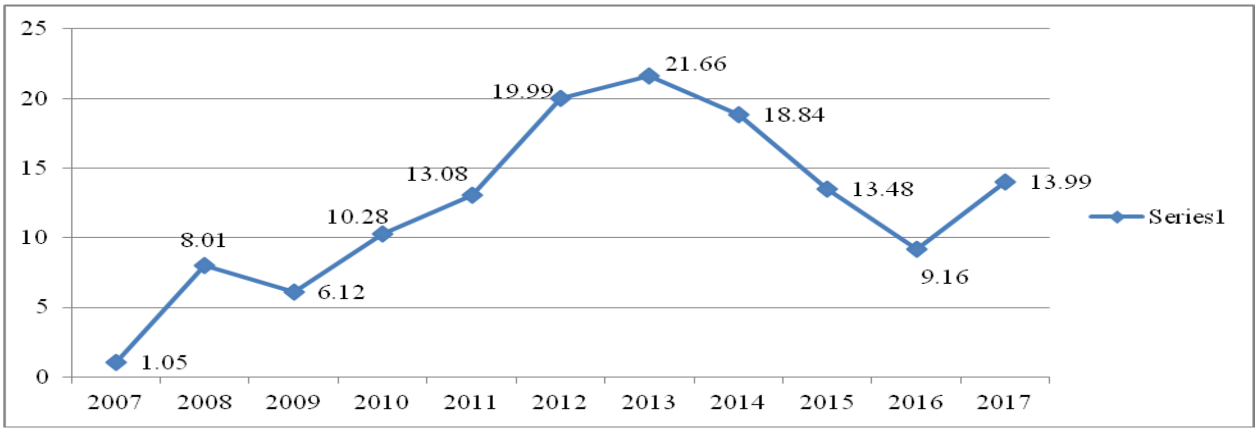

Fig.5.The evolution of Sorghum cultivated area in Romania, 2007-2017 (thousand ha)
Source: Own design based on the data from [33].

Romania has substantially increased the cultivated area with Sorghum in the interval 2007-2017 as this crop is important in agriculture and industry, it is a source of jobs and incomes, an alternative to maize crop, due to its advantages: good adaptability to various soil types, resistance to high temperatures and low rainfalls, resistance to diseases and pests, low inputs and production cost. This is a proof of the interest of the farmers to adapt to climate change and increase their income.

In 2017, Sorghum grain cultivated area was 13,933 ha being 13.2 times higher than in 2007 (Fig.5).

Therefore, the cultivated area with Sorghum in Romania represents 25.2 % of the EU cultivated area with this crop.

Sorghum production increased 45.5 times from 1,193 tonnes in 2007 to 54,282 tonnes in 2017 (Fig.6.)

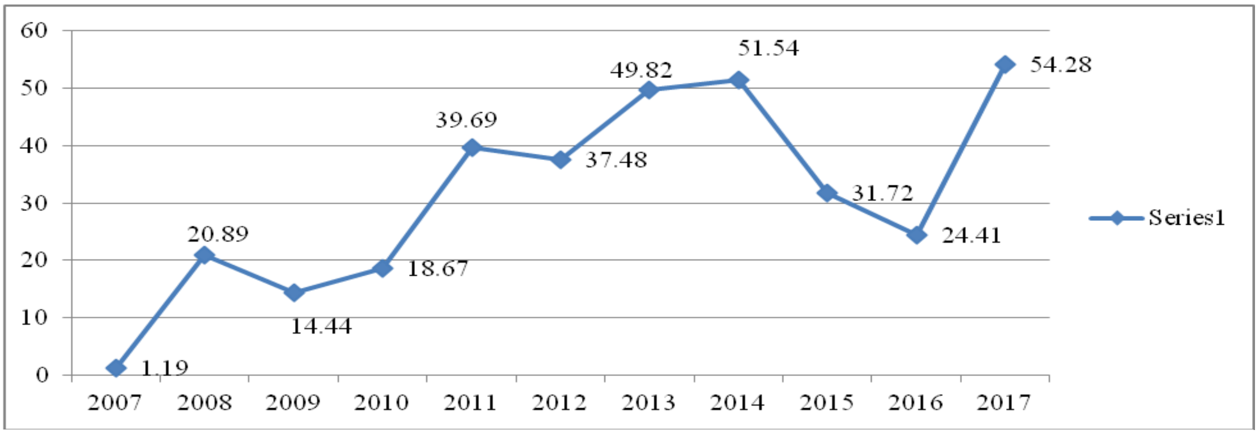

Fig.6.The evolution of Sorghum grain production in Romania, 2007-2017 (thousand tonnes)
Source: Own design based on the data [18].

The contribution of Romania to the EU Sorghum production is 7.18 %.

Sorghum yield followed a positive evolution both due to the growth in the cultivated surface and production of grains. In 2017, the yield was 3,879 ka/ha, being 3.43 times higher than in 2007 (1,128 kg/ha). But, comparatively with maize, Sorghum yield has a lower performance (Fig.7).

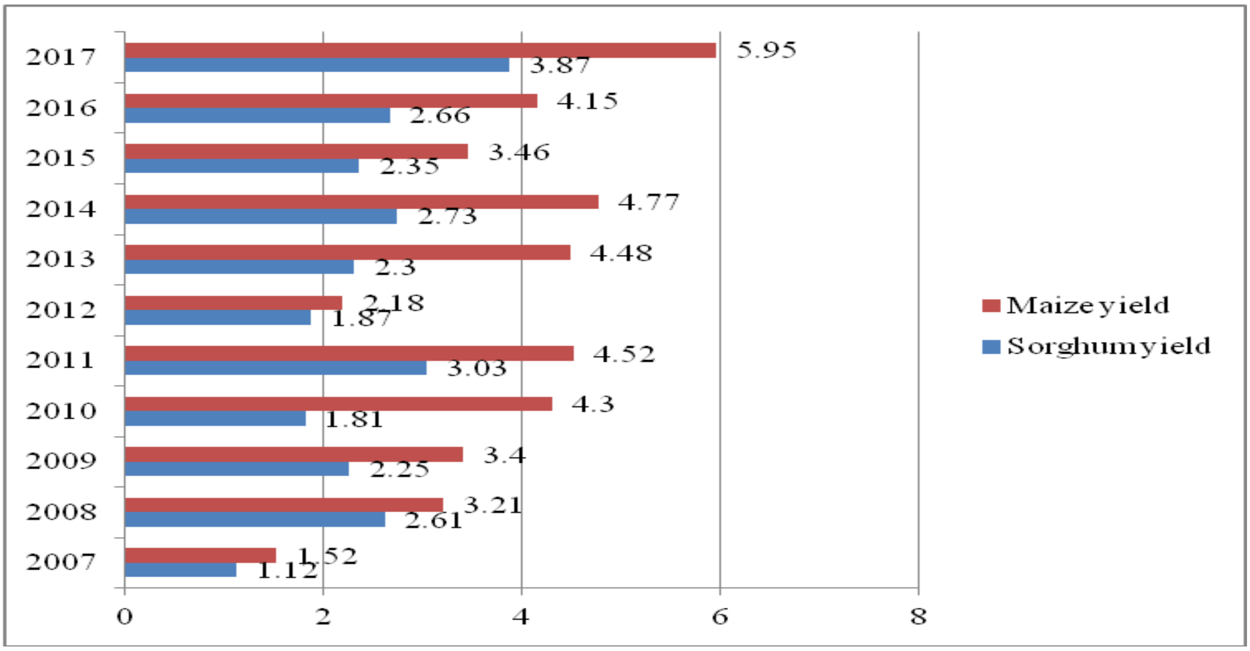

Fig.7.The comparative levels of Sorghum and maize grain yields in Romania, 2007-2017 (tonnes/ ha)
Source: Own design based on [33].

Romania's yield of 3,879 kg/ha is by 30 % lower than the EU average.

In Romania, there are used many varieties and hybrids of Sorghum as resulted from the scientific research works carried out by Fundulea Research and Development. The most important hybrids are the following ones: "Roza, Doina, Prut, Fundulea and Cernea for *Sorghum saccharatum*, Tutova, Tereza and Catinca for Sorghum Sudanese, Siret, Denisa and Donaris for Sorghum technicum" as mentioned by Antohe (2007) [2].

Hybrids like Fundulea 21, 30 and 32 are resistant to drought and diseases and have a short period of vegetation of about 108-128 days. The plants could reach 90-130 height and the agricultural works are mechanized [4].

The Romanian hybrids have a high production potential, are adapted to soil salinity and alkalinity, to diseases and pests, have an increased protein and starch content, and low tannin and hydrocyanic acid [2].

Sorghum saccharatum is a good cultivar in Romania as it is able to produce not only a high grain production, but also sugar yields. From 1 ha cultivated with this variety, it could be obtained a production of stalks ranging between 40 and 80 tonnes. From one tonne of stalks, it could be obtained 50-60 liters of sweet juice (syrup), and from the total production per ha it could be achieved 3 thousand liters alcohol [2].

This variety has also a good production of biomass, whose content in dry matter could reach 30 t/ha/year in low quality soils. From one ha cultivated with this variety, it could be produced as much as biomass to achieve five cubic meters bioethanol. Also, this cultivar has lowers inputs compared to maize. For instance, the amount of seeds necessary per ha is about 2.5 times lower, more exactly 15 kg/ha compared to maize which requires 40 kg per surface unit. Also, the requirements for fertilizers are lower and the water input it could be only 200 tonnes per tonne of dry matter. From an economic point of view, the production cost of one cubic meter ethanol is USD 250 [7].

Compared to Romania, in Portugal, from *Sorghum saccharatum*, it was achieved 90 tonnes biomass per ha, reflecting its production potential and its importance for producing energy. From one tonne of stalks, the ethanol production in Portugal could reach 55-60 and even 70 liters [32].

Sorghum production performance could be successfully increased in Romania using fertilizers as shown in case of F 32 and Arakan hybrids on a brown soil type by Coclea (2014) [9].

Also, grain production could be positively influenced by the use of herbicides. In the Central Moldova of Romania, after the application of herbicides, the grain yield reached between 3.4 and 5 tonnes per ha, depending on the herbicide and the dose [26].

In Romania, Sorghum is used in the compound feed for steers fattening replacing 20 % of barley. Also, 20 % Sorghum dietary grains could be successfully used in steers fattening based on silage leading to the reduction of the production cost [50].

A special attention started to be paid during the last years to Sorghum in Romania due to its strengths and advantages compared to other crops under the climate change conditions. The last decade brought extreme weather events, mainly droughts, high temperatures and low rainfalls which affected agricultural production, forests, water resources, environment and population. For this reason, the crop structure and mapping should be adapted to the variations of the climate conditions [11].

Romania's trade with Sorghum.

The exported quantity of Sorghum grains increased 56.1 times in the period 2008-2016 from 210 tonnes in 2008 to 11,798 tonnes in 2016.

The share of export in Sorghum production increased from 1 % in 2008 to 48 % in 2016. However, in 2009, Romania exported 81 % of production, the highest level.

In the studied period, the imported quantity increased 8 times from 63 tonnes in 2007 to 506 tonnes in 2016.

The ratio between exported and imported amounts varied from 1.1 in 2007 to 23.3 in 2016, but with a peak 0f 90.2 in the year 2009, reflecting that Romania is able to produce and sell amounts of Sorghum grains on the external market important (Table 3).

Table 3. The dynamics of the exported and imported quantities of Sorghum grains in Romania, 2007-2017 (Thousand Tonnes)

	Exported quantity Thousand tonnes	Imported quantity Thousand tonnes	Export/Production ratio	Export/Import ratio
2007	0	0.063	0	0
2008	0.21	0.18	0.01	1.1
2009	11.73	0.13	0.81	90.2
2010	4.05	0.41	0.22	9.7
2011	6.37	0.34	0.17	18.3
2012	19.49	0.49	0.52	39.5
2013	5.97	0.42	0.11	14.2
2014	25.53	0.42	0.50	59.9
2015	21.83	0.38	0.69	56.4
2016	11.79	0.50	0.48	23.3

Source: Own calculation based on the data from [18].

Sorghum export value increased 58.5 times from USD 38 thousand in the year 2008 to USD 2,224 thousand in 2016. The import value declined by 37 % from USD 2,043 thousand in 2007 to USD 1,290 thousand in 2016. In consequence, the trade balance was negative in the 1st year of the analysis, but positive in the last one (Fig.8.).

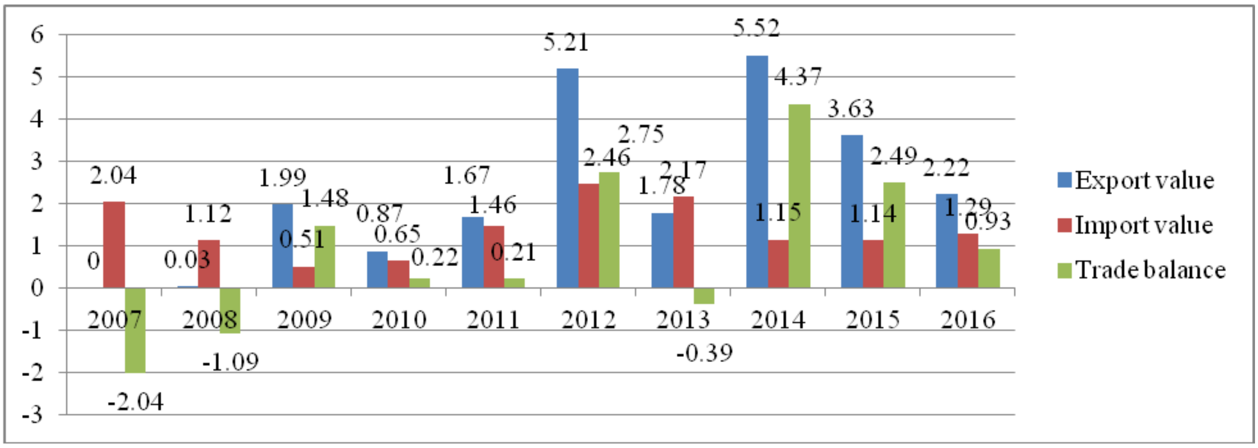

Fig.8.Sorghum export and import value, and trade balance, Romania 2007-2016 (USD Million)
Source: Own design based on [18].

However, across the period, it was noticed the highest export value, USD 5,527 thousand in the year 2014 and the lowest export value USD 38 thousand in 2008. The import value registered the peak of USD 2,460 thousand in the year 2012 and the lowest level USD 517 thousand in 2009.

Across the studied interval, the trade balance had in general a positive value, but in 2007, 2008 and 2013, it was a negative one.

The export price of Sorghum grains recorded a slight increase from USD 0.18/kg in 2008 to USD 0.19/kg in 2016 (+5.5 %).

The import price increased 7.9 times from USD 0.32/kg in 2007 to USD 2.54/kg in 2016.However, the export price varied between the minimum level USD 0.17/kg in 2009 and 2015, and the maximum level USD 0.3/kg in 2013.

The import price ranged between USD 0.32/kg in 2007, the lowest level, and USD 6.2/kg in 2008, the highest record.

This large variation was due to the demand/offer ratio, product quality, market segment etc (Fig.9).

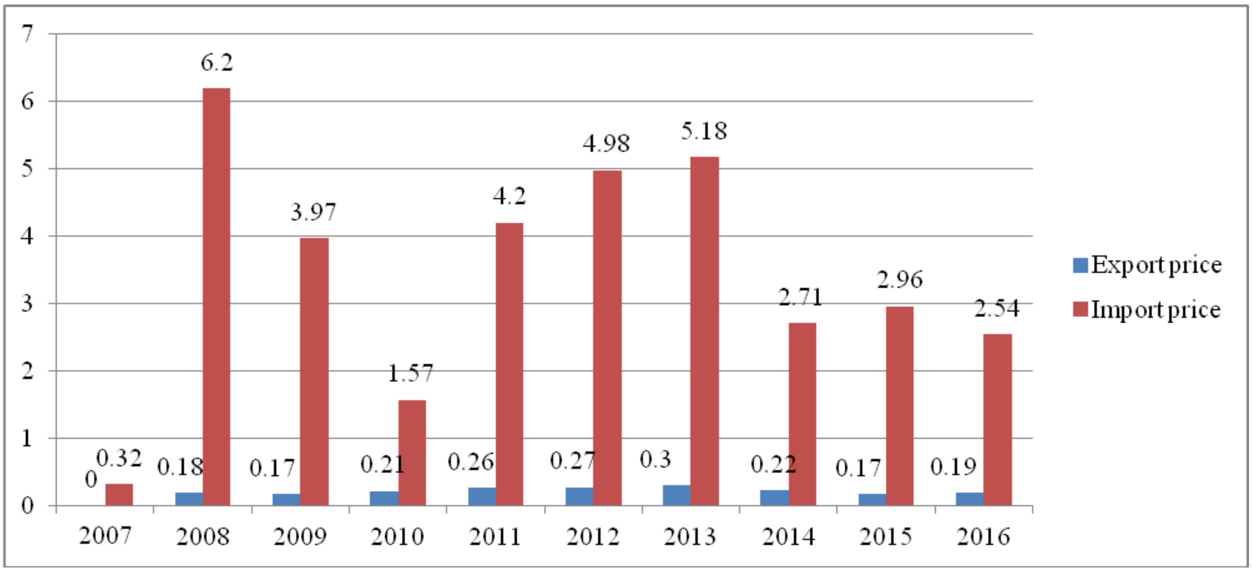

Fig.9. Sorghum grain export and import price, Romania 2007-2016 (USD per kg)
Source: Own design based on [18].

A new vision on Sorghum future in the EU.
In 2016, it took place the 1st European Congress on Sorghum crop where there were discussed the characteristics and advantages of this crop under the conditions of the climate change in Europe especially in the South and Eastern countries.
To mitigate the effects of climate change and strengthen Sorghum contribution to agricultural production and its efficiency as a source of bio raw materials, the EU established a Programme in June 2017 to promote Sorghum in the target member states: France, Spain, Italy, Bulgaria and Romania, but also in Russia and Ukraine [35].
The programme and the new EU regulations encourage the cultivation of Sorghum on larger areas, the increase of production and the producers, processors and consumers to pay more attention to this crop and its products [14].
In 2017, In Brussels, it was founded the European Sorghum Association, Sorghum-ID, an inter-professional organization including seeds producers, Sorghum farmers and processors which are aimed to increase Sorghum production for seeds, grains, silage and biofuels in Europe [27].
Also, the International INAGRA 2018 Fair has emphasized the importance of Sorghum among other agricultural crops, the fact that its production could be increased by the use of a large range of cultivars, taking into consideration the technical and economical advantages, opportunities and perspective of this crop in the EU and Romania's agriculture [37].
Also, the 2^{nd} European Sorghum Congress held in Milan Malpensa, on November 7-8, 2018 joined the key "actors" responsible of the development of sorghum crop along its value chain such as: agricultural producers, collectors, traders, scientists, representatives of European administrations, and business people. This forum presented the actual visions and prospects on Sorghum crop development at the global and European level [46].

CONCLUSIONS

Grace to its important economic and technical role in the perspectives of agriculture development, Sorghum will continue to be a key cereal for many countries from all the continents.
The world sorghum grains achieved 63.9 million tonnes in 2017 and it is expected to continue its growth in the next years. The world average yield is 1, 427 kg/ha.
In 2017, the EU cultivated 55,233 ha, representing 0.12 % of the world area cultivated with Sorghum and produced 755 thousand tonnes, accounting for 1.18 % of the world production. However, the average yield

in the EU, 5,580 kg/ha is 3.81 times higher than the world average.

Romania is among the most important producers of Sorghum in the EU. In 2017, Romannia cultivated 13,833 ha, accounting for 25.2 % of the EU cultivated surface with Sorghum. In the same year, Romania produced 54,282 tonnes sorghum grains contributing by 7.18 % to the EU production.

Average yield in Romania is 3,879 kg/ha, 2.71 times higher than the world average, but by 30 % lower than the EU average.

Romania has intensified its exports, but also its import, and has a positive Sorghum trade balance.

In Europe and mainly in the EU, this crop is seen in a new perspective and the specific Regulation recently issued is destined to stimulate the enlargement of the cultivated surface and the creation of high potential hybrids mainly in the countries where maize crop is affected by climate change.

It unanimously recognized as Sorghum could perform in an efficient way under low inputs (seeds, fertilizers, water etc), a low product cost and could increase farmers income and profit, and delivery of raw materials for industry.

For the Romanian farmers, Sorghum is an alternative to increase agricultural production in the areas where high temperature and droughts have a high incidence and to provide higher amounts for export. A special attention must be paid to the use of high value hybrids and production technologies, to fertilization and plant protection measures in order to increase yield and production. Also, the storage, marketing, and processing should be improved in order to increase the economic efficiency along the product value chain. The development of export could be another chance to sustain Romania's position as an important producer and exporter of Sorghum in the EU.

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THE EFFECTS OF AGRICULTURRAL IRRIGATION: AN APPLICATION IN TURKEY

Mehmet Arif ŞAHİNLİ, Ahmet ÖZÇELİK

Ankara University, Faculty of Agriculture, Department of Agricultural Economics, 06110 Dışkapı, Ankara, Turkey, Phone: +(90) 312 596 14 77, Email: asahinli@ankara.edu.tr

Corresponding author: asahinli@ankara.edu.tr

Abstract

In this study, we examined the Asartepe dam in Ankara province. Economic and social variables impact on agricultural irrigation were researched. Some variables were used as follows: usage of agricultural water, agricultural production, agricultural income, migration and etc. Primary data with related this research were taken from agricultural enterprises between 2015 and 2016 years. Simple Random Sampling (SRS) method was used to determine the selection of sample size. In this research, we had two different groups that one of them was pre-irrigation and the other was after irrigation group. After determining the sample size, this width of the size was 42. First strata was 31 and second strata was 11. SPSS Statistical package program was used during the data analysis environment. During the comparison between pre-irrigation group and after-irrigation group, Discriminant statistical analysis was used for.

Key words: *agricultural Irrigation, discriminant analysis, Turkey.*

INTRODUCTION

On an irrigation project for the different calculations of the return on Economic, technical, financial and sociological data are demanded for. Some of this information is to be found in studies done by specialists whose viewpoint is generally more technical than economic perspective [1].
We emphasized on the discriminant analysis of irrigation project in Turkey, in this study. An important part of the used main material includes the area of agricultural holdings engaged in various products from where the questionnaire was done. Sample agricultural establishments were selected by sampling method and questionnaires were filled by making face to face interview method by researcher. All of information were collected with the agricultural establishments from 2015 to 2016 years production period. Under the preliminary study, the characteristics that could represent the Ankara province Ayaş county as purposeful districts respectively were chosen. Simple Random Sampling (SRS) method was used to determine the sample size. Proportional method was used for finding the value of n [3]. At first, n value is founded by formula in the proportional method as follows:

$$\mathbf{n} = \frac{\mathbf{N}\sum \mathbf{N_h S_h^2}}{\mathbf{N^2 D^2} + \sum \mathbf{N_h S_h^2}}$$

Irrigation with agricultural establishments are splitted into 2 groups that these are the same. One of them was belong to pre-irrigation group and the other group was belong to after-irrigation according to the planting fields of products. The sample size was determined as 42 via SRS method. The first strata was 31, second strata was 11. 25% of the sample volume of the agricultural establishments has been reserved up.

MATERIALS AND METHODS

Data are gathered from the agricultural establishments via questionnaire by face to face interview method by researchers. Various variables were as follows: planting field, medicine, chemical fertilizer, total payment of water, water technics and diesel invoice and etc.
We used an important statistical analysis that is the Discriminant analysis. Discriminant analysis method is to find a set of prediction equations based on independent variables that

these are used to classify individuals into different groups. In a discriminant analysis, we have two possible objectives: One of this objective is to find a predictive equation for classifying new individuals and the other is to appraise the predictive equation to better understand the relationships that may exist among the variables [2].

In many directions, discriminant analysis similar to multiple regression analysis. The main difference between these two statistical techniques is that while regression analysis deals with a continuous dependent variable, discriminant analysis must have a discrete dependent variable that this punctuation is crucial. Namely, the main difference is about variables. The methodology used to complete a discriminant analysis is similar to regression analysis. During the process, there are many phases for implementing this analysis and these are as follows: First, using by software program, we make plot each independent variable versus the group variable. Second, you often go through a variable selection phase to determine which independent variables are beneficial. And later that, it is very crucial phase that how to conduct and evaluate a residual analysis to determine the accuracy of the discriminant equations [2].

The one-way Multivariate analysis of variance (MANOVA) is subject to very closely to the mathematics of behind the discriminant analysis. Especially, I want to explain what the relation between the discriminant analysis and MANOVA is in this phase. We can explain simply the roles of the variables are reversed. I emphasized strongly the classification (factor) variable in the MANOVA becomes the dependent variable in discriminant analysis. The dependent variables in the MANOVA become the independent variables in the discriminant analysis [2].

MS Office Excel environment was used to entry the information of the questionnaire data. SPSS Statistical package program was selected during the estimations of the discriminant analysis.

RESULTS AND DISCUSSIONS

Assumptions 1:

H_0: Covariance's matrix for groups are equal.

H_1: Covariance's matrix for groups are not equal.

Due to the significance value 0.000 < 0.05, H_0 is reject. That is, Covariance's matrices for groups are equal. When sampling size is high, significance value will be expecting to take a high value. Shortly, null hypothesis test equal population covariance matrices (Table 1).

Table 1. Box's m test results

Box's M		74.786
F	Approx.	74.153
	df1	1
	df2	20172.000
	Sig.	0.000

Df: Degrees of freedom
Sig.: Significance

Source: Own Calculation

Assumptions 2:

There is no problem with multiple connections between variables. For this, correlations between independent variables are examined (Table 2).

Very high correlation values are not available between variables. Therefore, Assumption 2 is provided (Table 2).

Table 2.Pooled within-groups matrices (Correlation)

Table 2. Pooled within-groups matrices (Correlation)

	Property	Rent	Watery	Dry	Domatoes	Fertilizer	Medicine	Water	Fuel	Forage	Number of animal
Property	1.000	-.230	.195	.740	-.039	-.001	-.034	.035	.068	.275	.366
Rent	-.230	1.000	.670	.137	.590	-.007	-.055	.378	.248	.235	-.053
Watery	.195	.670	1.000	-.006	.793	.000	.052	.534	.145	.133	.119
Dry	.740	.137	-.006	1.000	-.172	-.004	-.131	-.052	.201	.439	.262
Domatoes	-.039	.590	.793	-.172	1.000	.006	.044	.666	.120	-.140	-.094
Fertilizer	-.001	-.007	.000	-.004	.006	1.000	-.209	.021	-.118	-.178	-.097
Medicine	-.034	-.055	.052	-.131	.044	-.209	1.000	-.001	.052	-.144	-.087
Water	.035	.378	.534	-.052	.666	.021	-.001	1.000	-.129	-.004	-.092
Fuel	.068	.248	.145	.201	.120	-.118	.052	-.129	1.000	.043	.125
Forage	.275	.235	.133	.439	-.140	-.178	-.144	-.004	.043	1.000	.218
Number of animal	.366	-.053	.119	.262	-.094	-.097	-.087	-.092	.125	.218	1.000

Source: Own Calculation

Evaluation of importance for discrimination functions

Canonical Correlation, Eigenvalue and Wilk's Lambda statistics are used to determine how important the discrimination function is.

Canonical Correlation and discrimination scores measured relationship between groups and at the same time showed the total variance explained. Canonical Correlation value is 0.243.

If we make an evaluation this value, we must take a square this $(0.243)^2 = 0.059$. Namely, our model explains 5.9% of the variance at the dependent variable (before and after irrigation) (Table 3).

Table 3. Eigen values statistics

Function	Eigen value	% of Variance	Cumulative %	Canonical Correlation
1	.062[a]	100.0	100.0	.243

Source: Own Calculation

The fact that the eigenvalue statistic is large indicates that a larger part of the variant for dependent variable will be explained by that function. The Eigenvalue values greater than 0.40 with good precision are good but this proportion value is not exact value (Table 3).

Wilk's Lambda statistic shows the fraction of the total variance in the discrimination scores. It isn't explained by the differences between the groups. In this study, 0.941 (94.1%) of the total variance in the discrimination scores can't be explained by the differences between the groups (Table 4).

Table 4.Wilk's lambda statistics

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.941	4.941	1	.026

Source: Own Calculation

Here, Wilk's Lambda significance statistic is 0.026 < 0.05, then there is significance of eigenvalue statistic and only 1 discriminant function (Table 4).

Evaluation of importance for independent variables in discriminant analysis

If we evaluate the significance of the independent variables, we need to look at the discriminant function coefficients and the load of each independent variable in the structure matrix. The standardized separation function coefficients are given Table 5. The number of animals are an important independent variables that distinguishes in pre- and post-irrigation establishments. The number of animal's coefficient is 1,000. Therewithal, this coefficient is correspond to beta coefficients in the regression analysis. That is, it shows proportional importance of independent variables for estimation of dependent variable. Property, Rent, Watery, Dry, Tomatoes, Fertilizer, Medicine, Water, Fuel, Forage variables are not effective variables to distinguish in pre- and post-irrigation establishments. For that reason, you can't see these variables in Table 5.

Table 5. Standardized Canonical Discriminant Function Coefficients

	Function 1
Number of animal	1.000

Source: Own Calculation

Structure matrix is used for evaluating the importance of independent variable and it shows the correlation of each variable with the discriminant function. In this study, there is only one function due to the one function. When the number of categories at the dependent variable is large, the number of discrimination functions will also be large. Every column shows one function. Correlations in here may be liken factor loadings in factor analysis (Table 6).

Table 6. Structure Matrix Values

	Function 1
Number of animal	1.000
Property[a]	.366
Dry[a]	.262
Forage[a]	.218
Fuel[a]	.125
Watery[a]	.119
Fertilizer[a]	-.097
Tomatoes	-.094
Water[a]	-.092
Medicine[a]	-.087
Rent[a]	-.053

a. This variable not used in the analysis.

Source: Own Calculation

According to structure matrix, number of animal variable has the highest correlation with discrimination function. Property, Rent, Watery, Dry, Tomatoes, Fertilizer, Medicine, Water, Fuel, Forage independent variables are not an important estimators (Table 6).

Discriminant function and remarks

The discriminant function called the

Canonical root is a linear combination of independent variables (Table 7).

Table 7. Canonical Discriminant Function Coefficients

	Function 1
Number of animal	.014
(Constant)	-.368
Unstandardized coefficients	

Source: Own Calculation

That is,

$$Z = \alpha + b_1X_1 + b_2X_2 + \cdots + b_nX_n$$

Here,
Z: Discriminant score
α:Constant
b: Discriminant coefficients
X: Independent variables

The b coefficients maximize the distance between the averages of the independent variables.

Table 8. Classification Results

	Strata	Predicted Group Membership 1	2	Total
Count	1	**37**	5	42
	2	29	**13**	42
%	1	88.1	11.9	100.0
	2	69.0	31.0	100.0

Source: Own Calculation

Unstandardized Discriminant coefficients are given Table 7. These coefficients are correspond to unstandardized beta coefficients. Discriminant function is as follows:

Z= -0.368 +0.014 (Hayvan sayisi)

CONCLUSIONS

Z scores belong to establishments can be calculated by replacing animal numbers for all. It does not matter if the coefficients are plus or minus sign. Expresses whether the relation of the independent variables to the dependent variable is positive or negative.
The success of the analysis in the discrimination analysis is the correct classification percentage. The higher the percentage of correct classification, the more successful the analysis is. As given in the following table, 59,5% of the sample we included in this study were correctly classified. Namely, 50/84=%59,5 (Table 8).

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RATING METHODIC OF BIOGAS INSTALLATIONS WORKING IN RAREFACTION CONDITIONS

Oqil SALIMOV, Shavkat IMOMOV, Zulfiya MAMADALIEVA

Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, Tashkent, 39, Kori Niyoziy str., Phones:(99891) 4416931, (99891)1771155, Emails: shavkat-imomov@rambler.ru, mamadaliyeva.zulfiya@mail.ru

Corresponding author: mamadaliyeva.zulfiya@mail.ru

Abstract

This article describes about methods of rating and diagnostic safety of pilot and industrial biogas installations and diagnosing the reliability of biogas plant equipment to define different malfunctions and disturbances in its work. There were given sequences of the correct evaluation of the biogas plant equipment' reliability, as well as the diagnosis of failures in its operation, depending on the knowledge of the microbiological sequence of the anaerobic process and the experience of the plant management operators. There were given conclusions in comparison of the total costs for warning, detection and elimination of failures and malfunctions when using direct and diagnostic methods for monitoring the technical state of an energy installation based on renewable energy.

Key words: *methodic of rating, biogas installation, malfunction and disturbance, diagnostic and definition of malfunction*

INTRODUCTION

In the second phase of the Action Strategy of the Republic of Uzbekistan for 2017-2021 years, with a view to further strengthening macroeconomic stability and maintaining high rates of economic growth required a gradual transition to a new economic model by introducing in the production of "smart" technologies and the creation of cutting-edge ideas, know-how through the introduction of innovative models of development. It should be noted the importance of introduction of innovative criteria for evaluating the effectiveness of technologies and equipment. This article aims to develop methodology for assessing the reliability of biogas plants operated in rarefied conditions.

MATERIALS AND METHODS

At present, there are different methods of evaluation of pilot or industrial units biogas production, the totality of their principles, methods and process, as well as means of their realization. Many authors noted that a range of factors influence to the biogas production process, such as the potential of the feedstock, the design of the biogas plant, the physical and mechanical properties of the feed organic waste, the frequency of loading, internal and external mechanisms for maintaining temperature and humidity, and so on. [1,10,11,15] But besides this, it is necessary to note the importance of the human factor in the correct operation of the process of producing biogas and organic fertilizers.

Fig.1. Biogas plant: 1 container for pre-treatment of biomass to be loaded; 2-tank for heating and loading; 3-bioreactor; 4-filtration of biogas; 5 - gasholder; 6-heating boiler
Source: Photo of biogas plant at 120 m3 installed in Turakurgan district of Namangan region

Setting the correct assessment of the reliability of a biogas plant equipment, as well as diagnosis of failures in its work

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depends on knowledge of anaerobic microbiological control of the process and experience of the operator. Fundamentals certification and analysis equipment - is the presence of a unique functional link that allows to use them only for the technically simple components and mechanisms. In evaluating the reliability of complexes biogas plants, such as automated control system (ACS) fermentation processes, human factor [1,8,9,13,19] is the most vulnerable point, dependent on several features such as skills, experience and psychophysical condition etc. The biogas plant operator, at the beginning of his profession and social activities, the number of which is constantly decreasing, is approaching error methods and means of evaluation. The lack of continuity from one operator to several cases of the appearance in the work of the most erroneous stages, which greatly affect the operation of the installation itself.

In research, it was decided on analysis of existing factors of failure of work, that is not the effectiveness of the study and the possible reasons for failure.

RESULTS AND DISCUSSIONS

For the correct course of the process of biogas generation and uranium requires constant analysis and diagnostics of the equipment, which must be held by the operator of the biogas plant.

The basis of the probabilistic reliability evaluation method biogas installation laid method of analysis and identification of fuzzy properties as unity and quality, the appearance of symptoms and signs is intermittent, probabilistic. This is due to the fact that symptoms and signs with such qualities as unambiguous evaluation (diagnosis) of complex objects, such as a biogas plant, may not be, which ultimately complicates troubleshooting. However, a combination of such signs or symptoms carries information about the state of the objects being evaluated (diagnosed). Assess the combination of symptomatic symptoms and symptoms accompanying problems with evaluation matrices [2,7.8,10,14,16,17].

The appearance of malfunctions and their combinations in automatic PBX systems has limitations in accordance with cause-effect relations. Connections for biogas plants operating under vacuum conditions are shown in Fig.2 and Table 1.

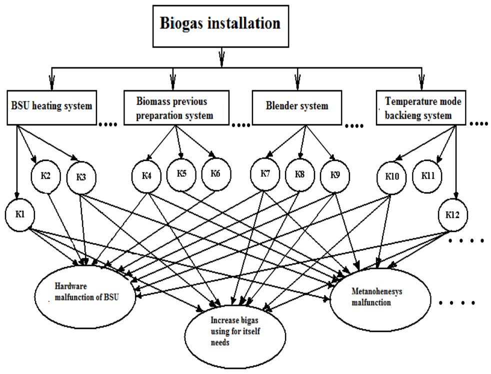

Fig.2. Scheme of cause-effect relations of failures in the work of BSU
Source: created by authors

The elements K1, K2, K3 .... Kn in Fig. 1. The faults (or structural parameters) of the relevant systems and mechanisms of the biogas plant are shown. Each fault alone or in combination, as a cause, leads to the consequence - an increase in the consumption of commodity biogas for heating the bioreactor, a decrease in the output of biogas and organic fertilizer (effluent), etc.

And, as a rule, all malfunctions can cause more than one consequence - their graphs intersect. The appearance of faults and their combinations is of a probabilistic nature [1,3,4,5,6, 9,12,14,18].

From Table 1, it can be seen that such factors as the use of old raw materials, the violation of the anaerobic process, the small grinding of the organic mass and the presence of antibiotics and other minced substances in it, the malfunction of equipment and other factors affect the increase in the percentage of the yield of CO_2. One of the most important indicators of BSU performance, namely the quantity of biogas output and the quality of organic fertilizer is affected by the correct or poor performance of the biogas plant operator, can cause many malfunctions in the operation of these technologies.

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One of the most important indicators of BSU performance, namely the quantity of biogas output and the quality of organic fertilizer is affected by the correct or poor performance of the biogas plant operator, can cause many malfunctions in the operation of these technologies.

Table 1.Diagnostic fault matrix of biogas plant

Possible causes	Symptoms							
	Increased%, CO2	Increases pH	Deterioration of biofertilizers	Reducing the amount of emitted biogas	Output of gases with an unpleasant odor	Absence of any gases exit	Increasing the amount of CH4	Increasing Of the duration of the process
Old initial organic waste	+	+	+					+
Daily dose of bioreactor loading			+	+	+		+	+
Violation of the anaerobic process	+	+	+			+		+
Disturbances in the heat supply and insulation system				+	+	+		+
Infringement of tightness				+	+	+		+
Weak milling of the organic mass	+	+	+		+			+
Antibiotics and other disinfectants	+	+	+			+		
Violation of the automated control system		+	+			+	+	+
Incorrect work of the BSU operator	+	+	+	+	+	+	+	+
Hardware malfunction	+	+	+	+	+	+	+	+

Source: created by authors

CONCLUSIONS

The proposed method for assessing malfunctions and malfunctions allows to determine the correct direction of the search for symptomatic combinations (diagnosis and analysis of the anaerobic process) and to establish a detailed diagnosis.

The main criterias for choosing this method is the comparison of the total costs for the prevention, detection and elimination of failures and failures in the use of direct and diagnostic methods for monitoring the technical state of a power plant based on renewable energy sources, as well as the duration of the procedure for obtaining biogas and high-quality organic fertilizers.

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CAPACITY BUILDING NEEDS FOR COMPLYING WITH THE REGULATION NO. 511/2014 – PECULIARITIES FOR AGRICULTURE

Camelia SAND SAVA, Maria-Mihaela ANTOFIE

University "Lucian Blaga" of Sibiu, Faculty of Agricultural Sciences, Food Engineering and Environment Protection, 7-9 Dr. Ioan Rațiu, 550012, Sibiu, Sibiu county Romania
E-mails***:*** camelia.sand@ulbsibiu.ro, mihaela.antofie@ulbsibiu.ro

Corresponding author: camelia.sand@ulbsibiu.ro

Abstract

Romania is a European Union (EU) country with a biological diversity in situ as well as ex-situ due to collections of microorganisms, plant and animal species. However, due to this peculiarity for Romania the implementation of the 3rd objective of the Convention on Biological Diversity (CBD), remain a great challenge. In 2014, the "Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity" (Nagoya Protocol), entered into force. Romania signed the Protocol and if ratifying it for the future, will have the chance to implement the 3rd objective of the CBD. Moreover, this activity may be further supported when Romania will comply with the Regulation (CE) no. 511/2014. The purpose of this article is to analyze our country institutional capacity's needs for harmonizing at the general level the implementation of this Regulation. Attention is paid to peculiarities of the country to implement Article 4 of the Regulation, on user compliance measures. The conclusions of this study support the idea that Romania has the capacity to implement and enforce this Regulation. All national authorities must join together for further developing required national procedures. Relevant for Romania are procedures development that are related to access to genetic resources as well as for defining traditional knowledge to users of the third countries. Recommendations are made on access to human resources and for developing innovative financial mechanisms.

Key words: *access for benefit sharing, biodiversity conservation, agro-biodiversity, capacity building, Regulation 511/2014*

INTRODUCTION

Romania with a rich biodiversity (i.e. species and habitats) is comprising native common species such as plant animals and macromycetes as well as new strains of microorganisms [40; 45], endangered and endemic species of plants [11; 22] and animals [7]. All these species, due to their genetic material and biomolecules may be defined as resources for further new economic uses and therefore they may become subjects of access for benefit sharing (ABS) if they are accessed by users of a third country. This action may be granted for non-commercial research but when it is proved to become relevant for commercial use, the users need to comply the third objective of the Convention on Biological Diversity or CBD [42]. This is connected for the EU countries to the provisions of Art. 4 of the "Regulation (EU) No 511/2014 of the European Parliament and of the Council of 16 April 2014 on compliance measures for users from the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization in the Union" (Regulation). The 3rd objective of the convention supports the development of innovative financial mechanisms that are supporting biodiversity conservation and its sustainable use [6; 25]. In other words, if the use of information inherited by a native living organism, may become a subject of financial gain the third Party have to payback the country of origin. In 2010 it was adopted the Nagoya Protocol and the Regulation entered into force in 2014, thus Romania must implement all required legal provisions for both [9], also considering the *Council Decision 93/626/EEC* [1; 14]. Therefore, all the European Union (EU) member states must develop harmonized procedures for complying to the Protocol on one hand and to the Regulation on the other hand. Romania ratified the CBD based on the Low no. 58/1994. The Romanian Ministry of Environment is the competent authority for biodiversity conservation. Other three legally binding agreements are already officially adopted under CBD and all of them are recognized in the context of the EU such as the following: the Cartagena Protocol on Biosafety (i.e. Cartagena Protocol that entered into force in 2003), the Nagoya Protocol (i.e. Nagoya Protocol entered into force in 2014) and the Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress to the Cartagena Protocol (i.e. Nagoya-Kuala Lumpur Supplementary Protocol entered into force in 2018). These three new instruments create the international legal framework for harmonizing measures for full implementation of the CBD [31]. For the EU countries by implementing the Nagoya Protocol become a challenge [39] as there is a need for harmonizing legal procedures for all 28-member states. The scope of this article is to emphasize the needs of Romania in capacity building terms, especially regarding the obligation for users related to the access on wild biodiversity and traditional knowledge (TK) related to of Art. 4 of the Regulation, Chapter II, user compliance [2].

MATERIALS AND METHODS

This paper follows the capacity building evaluation model for needs and gaps based on a top-down approach [24] and clearly define the central subjects of ABS in accordance with the provisions of Nagoya Protocol and requirements imposed by the "Regulation (EU) No 511/2014 of the European Parliament and of the Council of 16 April 2014 on compliance measures for users from the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization in the Union" [3].

RESULTS AND DISCUSSIONS

Building institutional capacity. At the national level of any country, the process of implementing new legislative subjects generally requires proactive measures for creating connections on an existing basis. Furthermore, there is a need for supporting the implementation of win-win solutions rather, by accessing mainly *long-term* memory at the institutional level [20]. Such an approach will also access the executive *long-term* memory that comes with an existing trained human resource and will contribute to the further information management on each subject, including cross-cutting issues [18]. Three different subjects of the Regulation are defined in the Art. 1 and are according to the objective of the CBD: genetic resources or GRs (i.e. genetic information), associated TK (i.e. the knowledge of rural communities in case of Romania) and benefit arising from their utilization (i.e. defining financial mechanisms needed for complying with the third objective of the CBD).

After 1980 progress was recorded for developing all kind of biotechnology branches based upon bioprocesses that can access cell factory for making them more consistently, cheap, accessible and fast technologies [29]. This was the very first stage proving that the genetic information of living organisms is an interesting subject in financial terms. A schematic representation of biotechnology fields as well as the main public authorities having interests for our country is described in Fig. 1.

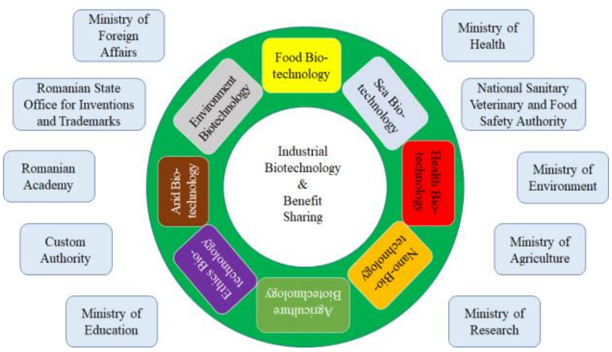

Fig. 1 Research domains and public authorities dealing with different domains of biotechnology as well as with ABS and or TK (Original).

Industrial biotechnology today, in their efforts for patenting life for commercial use, is

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accessing metabolomics as well as synthetic biology and associated TK depending on the final product [30].

In this context, it is relevant to mention that in paragraph 3 of the Preamble of the Regulation it is underlined that major stakeholders are accessing either GRs either TK. This paragraph is in line with Art. 8 j of the CBD. In this regard, for the scientific monitoring of biodiversity, the Romanian Academy through the Commission for Nature Monuments Protection should be involved as a major stakeholder for validating accessing to GRs at the national level (i.e. *in situ* and *ex situ*). In 1992 the CBD through the provisions of Art. 4, biodiversity is defined as a heritage of the country jurisdiction [9] and they are already defined as a scientific competent authority working under the Bern Convention. The sovereign rights of the states and parties to the CBD are completed by the provisions of paragraph 6 of the Regulation [36]. However, Romania as a future Party to the Nagoya Protocol should take into consideration how to grant access to GRs for a third Party. This may be complicated further if proves that implies the connectivity to local knowledge or TK of rural communities. One compulsory obligation of the signatory Parties to the Protocol is to report how the Protocol is implemented. The reporting in Romania should be managed by the competent authority for environment as a national focal point. In 2016 parties sent the 6th national report according to the requirements imposed by the Conferences of the Parties. As one of the main subjects of the Protocol is the access on GRs, the management of the subject needs to be addressed by competent authorities already working on biodiversity conservation considering examples of Norway, Brazil or European Union [32]. In this regard, the competent authority for environment should manage the subject and the implementation of the Regulation (Fig. 1-3). The need of experience in implementing similar procedures into the competent authority for environment may be supported by the competent authority for agriculture and namely by the Gene Bank of Suceava as the national focal point of the "International Treaty on Plant Genetic Resources for Food and Agriculture, or Plant Treaty". Today the Gene Bank from Suceava has the expertise to apply the Standard Material Transfer Agreement or SMTA. This mechanism is working under Multilateral System and up today in Romania have been recorded 3303 accessions to different plant GRs by the Gene Bank from Suceava [4]. A comprehensive paper describing the SMTA implementation was published 12 years ago [10] and Romania may further access the Gene Bank from Suceava for further developing procedures and expertise implying capacity building [13].

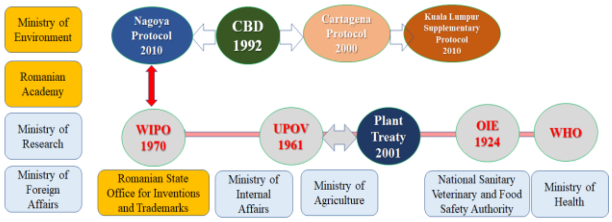

Fig. 2 Treaties and Romanian authorities dealing directly or indirectly with the scope of Nagoya Protocol (Original).

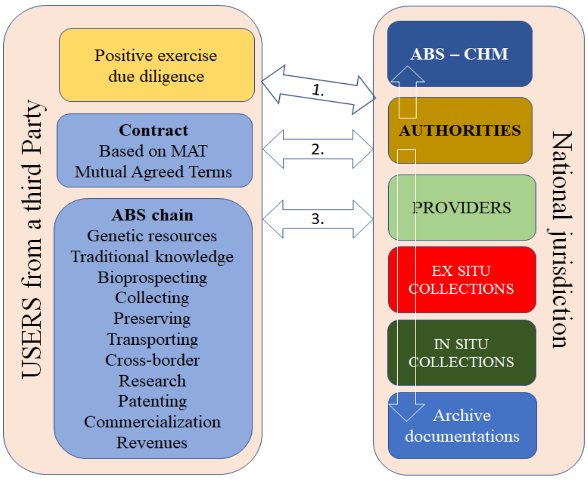

Fig. 3 ABS communication scheme between users and authorities in three stages: 1) the user should prove due diligence according to paragraph 1 of art. 4 of the Regulation; 2) contract signing based on mutual agreed terms and 3) procedures development according to the ABS chain at the national level (Original).

In this regard, it is recommended the close cooperation between the two national focal points. However, Nagoya Protocol is closely interacting with different other international agreements. Thus, aside other biodiversity conservation agreements (i.e. the "Convention on International Trade in Endangered Species of Wild Fauna and Flora" or CITES and the "United Nations Convention on the Law of the Sea" or UNCLOS) are other adopted under health (i.e. the "Pandemic Influenza Preparedness" or PIP, and the "Framework for the Sharing of Viruses and Access to Vaccines and Other Benefits", World Organization for Animal Health or OIE) [19; 21] trade (i.e. the "Trade-Related Aspects of Intellectual Property Rights" or TRIPS) and the UN World Intellectual Property Rights Organization or WIPO [34].

Therefore, capacity building for new subjects should be started by applying a top-down approach to address all competent authorities working in this case under all potential types of biotechnology, as well as all associated stakeholders having interests in the domain and especially for commercial-use of biodiversity such as GRs or/and related TK (Fig. 1). Paragraph 18 of the Preamble of the Regulation states that each of the Parties must promote and encourage research with non-commercial intent. However, according to Brundtland Report adopted in 1987, the research should generate knowledge and be a catalyst for developing innovative financial mechanisms for sustainable development. This is not against the scope of the EU Regulation and is only for clarifying the momentum between research without commercial intent and with commercial intent [35].

ABS capacity building and biotechnologies. Under the umbrella of the Romanian Academy, the Commission for Nature Monuments Protection should cooperate with other scientific commissions working under different authorities such as the Ministry of Health (i.e. GRs of human health importance), Ministry of Agriculture (i.e. GRs for food and agriculture), Ministry of Research and the Romanian State Office for Inventions and Trademarks. The scope of such a cooperation is to clarify procedural issues related to patenting the access to GRs originating from our country's jurisdiction on one hand and for preventing biopiracy on the other hand [33]. Consequently, the authorities generally responsible for the CBD implementation need to cooperate with those dealing with the scope of TRIPS and WIPO [44]. Among the major stakeholders are the Romanian State Office for Inventions and Trademarks [41] and the Ministry of Research. We add, the Ministry of Agriculture through the Gene Bank from Suceava [27] and the State Institute for Variety Testing and Registration [38] that have appropriate knowledge of closely working with TRIPS, WIPO, UPOV and Plant Treaty (Fig. 2). The competent authority for environment needs to network with the above-mentioned authorities for implementing this Regulation.

The research, either public or private of a third party, is the central stakeholder for accessing GRs and/or associated TK. To fully understand how should be further developed such unique procedures the competent authority for environment in Romania should cooperate closely with other competent authorities (i.e. for foreign affairs, internal affairs, agriculture, research, education, health) and the Romanian State Office for Inventions and Trademarks. All these stakeholders should be part of capacity building development especially due to research project implementation when they involve third parties. Also, the Romanian Academy through the Commission for Nature Monuments Protection plays already a key role under the current regulatory framework for wild biodiversity conservation [5; 8; 28].

The main concern of the Regulation related to the maintenance of wild GRs of national jurisdiction is that they need working *in situ* conservation measures. In this case, the Romanian Academy needs to closely work with a network of Scientific Councils including those for protected areas. The wild biodiversity and TK will become a central subject of interest for future strategies of developing the management plans in protected areas too. Furthermore, the custodians of protected areas should be part of stakeholders. Their major scope will be focused mainly on implementing procedures related to permit issues for bioprospecting in the wild for all types of research. However, a holistic national survey regarding TK related to GRs will be required, at least upon the implementation of the Regulation. We mention that such studies and researches regarding the TK related to wild biodiversity are already published for South - East Transylvania [15; 16; 17].

In case of ABS related to patenting products of biotechnologies covering health (i.e. human, animal and plant health), the ABS National Focal Point will closely cooperate with other two institutions. Thus, for human health, they will cooperate with the Ministry of Public Health already running databases under the European Medicine Agency or EMEA and for animal and plant health with the National Sanitary Veterinary and Food Safety Authority (ANSVSA) which is responsible for connecting with DG SANCO at the European level. Both national focal points need to be involved in capacity building developments under the ABS mainly due to pathogens of public concern to the health of human beings, animals or plants [9].

In all cases GRs are subject of trade as species, specimens or simply compounds or products and the ABS national focal point need a cooperation with specialized offices working under the Custom Authority of the country. In this case, all identified stakeholders need to be part of ABS procedures development for all chain (Fig. 3).

Users compliance. According to Art. 4 paragraph 2 of the Regulation it is stated that the transfer and use of GRs and TK knowledge will be in accordance with "mutually agreed terms" (or MAT) to sign a specific contract with the user. Romania needs to develop such legal procedures and all users need to exercise due diligence to ascertain that GRs and TK associated with the first which they utilize have been accessed in compliance with the national legislation based on paragraph 1 of Art. 4. To note the paragraph 5 of the preamble defined the TK in line with the provisions of Art. 8 j of the CBD.

In line with Art. 4 of the Regulation and connected to wild biodiversity we need to take care of the preamble recommendations stating that all native GRs need to be maintained *in situ* conditions and therefore the future strategy of biodiversity conservation need to address the Millennium Development Goals too. Such an aim will need to further integrate innovative financial mechanisms into all economic sectors that are dealing directly or indirectly with the sustainable use of biological diversity. In this case, protected areas management structures need to closely work with the Romanian Academy's scientific commissions as well as with the Ministry of Economy.

Based on this approach we mention that the competent authority for environment from Romania has a *long-term* capacity of working on international and European databases related to GRs if considering the Convention on International Trade in Endangered Species of Wild Fauna and Flora or CITES and Biosafety under Cartagena Protocol on biosafety. Therefore, to complete the development of national procedures a connectivity to the CITES database as well as to the Cartagena Protocol need to be evaluated. The access to *in situ* GRs can be realized based on bioprospecting or/and collecting from the wild protocols that should be part of a contract based on MAT. The procedure should relate to CITES and non-CITES permits' procedures when the user belongs to a third party. The monitoring system for collecting and transferring genetic material up to patenting and trade of final product/service should be in place in close connection with other research institutions.

The full implementation of the provisions of Art. 4 paragraph 3 needs an appropriate communication system development and the future ABS communication should be transparent, based on the provisions of Preamble of the Regulation, paragraph 10, to ensure the needed trust of cooperation between Parties. Also, integrating local communities in the future ABS communication system is relevant for all stakeholders when accessing GRs as such or by using the local or TK. Moreover, in the Preamble of the Regulation paragraph 15 it is underlined the need to clarify derivatives term under the ABS Protocol which is different compared to the CBD and Cartagena Protocol on Biosafety. However, the term includes biological compounds that may result in the action of the secondary metabolism and may not be directly connected to the codons of the deoxyribonucleic acid [26]. Based on this it becomes clear that it will be more difficult to accept wild PGRFA not listed in Annex I of the Plant Treaty to not be a subject of the future ABS regulatory framework of our country. In this regard, we mention that the development of terminology, processes, and concepts may rise more barriers in smoothing the future implementation of the Regulation [12].

In line with the same paragraph 3 of Art. 4 of the Regulation each of the countries need according to paragraph 16 of the Preamble of the Regulation to raise the attention on microorganisms and mainly on viruses that may be produced as well as on access to vaccines for human and animal health such as the PIP framework [23]. For all the above-mentioned cases, the users must apply, keep and even transfer to subsequent users the internationally recognized certificates of compliance and information related to MAT that are relevant and fall under the scope of further ABS monitoring system [37]. As mentioned above, such an expertise already exists in Gene Bank from Suceava working under the Multilateral System.

Archiving ABS documentation will be compulsory at the EU level as the European Commission will establish and maintain a register of collections within the Union according to Art. 5 of the Regulation. Moreover, all users are obliged to maintain for 20 years at least documentation after the year of their utilization according to paragraph 6 of the same article. The ABS Clearing-House mechanism is compulsory to be implemented. The term user is also defined under the paragraph 17 and this should be consistent with the definition of utilization of GRs as it is in the Nagoya Protocol (Fig. 3).

However, for wild PGRFA that are closely connected to the Plant Treaty implementation, the Gene Bank from Suceava need also to be involved. Users accessing and acquiring wild PGRFA others than those adopted in the list of species of Annex I of the Plant Treaty may become the subject to the terms and conditions of the standard MAT for the purposes set out under this treaty or not depending on the signatory Party. These users according to the EU Regulation, shall be considered to have exercised due diligence in accordance with paragraph 3 of Art. 4.

Thus, for Romania, a major subject of a debate should be wild PGRFA that are not listed in Annex I of the Plant Treaty.

We add herewith the TK that is not mentioned in the Plant Treaty, but it is defined by the CBD, Nagoya Protocol and the Regulation.

Therefore, in paragraph 4 of Art 4. of the Regulation it is not imposing to the member states to expand the mentioned list of species. This makes possible discussions to be conducted on this issue: if Romania will expand or not the list of Annex I of the Plant Treaty or simply is imposing to the user to comply with the provisions of paragraph 3 of the Art. 4 of the Regulation. We mention that in the Preamble of the Regulation, paragraph 12, it is stipulated the need for harmonizing the existing system working under the Plant Treaty such as the Multilateral System with the future working on a complimentary basis. This controversial issue is also outlined in Preamble of the Regulation in paragraph 13 where it is stipulated that PGRFA, not listed in Annex I of the Plant Treaty should be treated under the Multilateral System. We mention that here it is the case of wild PGRFA as well as related TK and differences between EU members states related to biodiversity may be. However, now it is still possible that each of the countries will decide on their own. In this regard, it is compulsory to harmonize for long-term effects under economic predictions the connectivity between the Romanian competent authority for environment and the Gene Bank from Suceava, in its capacity of the national focal point under the Plant Treaty as well as the Patenting Office.

The case study of collections is presented in paragraph 7 of Art. 4 of the Regulation opening the possibilities for the countries to consider as owning GRs with different origins if they can prove that they entered the country before 1992 with the adoption of the CBD [43]. According to paragraphs 27 and 28 of the Preamble of the Regulation, collections, and collectors from the wild are to be defined. Standards should be applied for the EU recognition of collections. Thus, Romania may provide to users the full access to all GRs from the wild as well as from public collections (i.e. microorganisms, plants, animals as species or specimens). The Botanical Garden Association already expressed their interest for supporting the implementation of the Nagoya Protocol. This is an opportunity for creating innovative financial mechanisms for further using biological diversity under the third objective of the CBD.

All potential pathogens are accordingly regulated in the provisions of paragraph 8 of Art. 4 of the Regulation and they should comply with the EU regulatory framework. A control ABS system should be in place and work for the implementation of the recommendation of paragraph 19 of the Preamble where it is stated that due to ethical issues the Regulation will not include access to human GRs.

For fully implementing the provisions of art. 4 of the Regulation all users need to comply the due diligence that is imposed to all potential users and applicants. Each of the Parties should develop appropriate diligence measures according to the business environment and by considering already working best practices. Of high interest will be users form non - parties' countries that intent to apply for ABS.

CONCLUSIONS

Regulation (EU) No 511/2014 will become a real challenge for the Romanian authorities to be implemented. It is compulsory that all relevant stakeholders to get together and discuss, based on the ABS chain, the substance for procedures development in harmony with those already existing or to develop new other. Scientific advisory bodies should be involved for developing appropriate procedures when setting MAT for contracting the access on GRs, and/or TK. The user compliance procedure for Romania will be harmonized in the EU context. However domestic procedures should be evaluated for their cost-efficiency and revenue for supporting biodiversity in Romania. The main principle guiding capacity building for implementing this Regulation is that of sustainable development and accordingly innovative financial mechanisms should be in place. This should include the re-definition of rural communities, local knowledge and TK related to the conservation and sustainable use of biodiversity. Romania has the capacity to fully implement the Regulation 511/2014.

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FORECAST SCENARIOS OF DEVELOPMENT OF THE INTERNAL CONSUMER MARKET OF ORGANIC PRODUCTS IN UKRAINE

Oleksii SHKURATOV[1], Halyna HRESHCHUK[2], Oksana LOBANOVA[3]

[1]Institute of Agroecology and Nature Management of National Academy of Agrarian Sciences of Ukraine, 12 Metrological St., 03143, Kyiv, Ukraine, Phone: +380445263336, Mobile: +380982824994, E-mail: shkuratov_ai@ukr.net
[2]Lviv National Agrarian University, 1 V. Velykoho St., 80381, Dublyany, Lviv Region, Ukraine, Phone: +380322242961, Mobile: +380676768622, E-mail: galyna0518@gmail.com
[3]State Agrarian and Engineering University in Podilia, 13 Schevchenko Str., 32300, Kamianets-Podilskyi, Ukraine, Phone: +380384925218, Mobile: +380683851005, E-mail: lobanovaoksanochka@gmail.com

Corresponding author: shkuratov_ai@ukr.net

Abstract

The article is devoted to substantiation of the forecast scenarios of development of the internal consumer organic products market in Ukraine. The essence of organic agriculture as a complete system and management of agro-ecosystems, including the assessment of environmental threats and risks of environmental safety in the agricultural sector, and establishes the relationship between economic actors in the agricultural organic production. The current state and trends of the main indicators of organic agriculture development in Ukraine are analyzed. Taking into account probable economic changes and possible variants of the transformation of market conditions, we have grounded three basic adaptation scenarios for the development of domestic organic agriculture for the future: inertial, moderate and innovative. The prognostic model of indices of the internal consumer market of organic produce is suggested, which provides for their modeling based on multiple regression. The study of trends and the calculation of predictive values of independent variables of the model for the near future are based on the extrapolation method. Based on the model data of organic farming, a forecast of the internal consumer market in this area for the period up to 2022 has been made. The use of the proposed model will enable the formation of credible prospect balances of demand and supply on the organic market, depending on the factors of influence and scenarios of its development.

Key words: *forecast scenarios, market, organic products, agricultural.*

INTRODUCTION

At the present stage of development of the agrarian sector of the economy, the degree of food and environmental security is significantly conditioned by alternative technologies in the field of agriculture and the preservation of the natural resources of the agrosphere. Today among these systems the most developed is in organic agriculture, practiced at the commercial level in many countries of the world [8]. Organic agriculture is a vibrant and dynamic system that responds to internal and external needs and conditions. Those who use organic farming methods can improve efficiency and increase productivity, but at the same time human health and well-being should not be at risk. However, despite the use of certain measures by the state and business entities, organic agriculture and the organic foods market are still not sufficiently developed.

With the growing role of organic farming and the expansion of its use as a tool for environmental management, attention to the scientific issues of this phenomenon has increased. Under current conditions, when organic agriculture and organic market in general are regarded as factors of sustainable development is a very important issue for strategic planning of the market of organic foods.

Today, fundamental research on the problems of the development of organic agriculture is widely researched in economic science. Among the recognized scientists who have made a significant contribution to the study of these problems, it should be noted M. Fukuoka, A. Howard, M. Okada, J. Rodale, R. Steiner, B. Williams. Problems of the formation of the domestic market of organic foods were considered in works of S. Antonets, V. Artish, N. Borodacheva, T. Zaychuk, E. Milovanov and others. Ecological and economic foundations of the development of organic production in agricultural were covered in his works by V. Chudovska, T. Zinchuk, O. Khodakivska, V. Kyporenko.

However, the problems of organic agriculture are need to the further research to improve the mechanisms for its development in terms of adaptation to the corresponding ecological and economic conditions and institutional environment. Particular attention should be paid to the problem of forecasting the development of organic production of organic produce market in general.

MATERIALS AND METHODS

One of the main tasks, amongst which we put forward, was to identify the forecast scenarios for the development of the internal consumer organic produce market, which was achieved through the calculation of their forecast indicators.

To predict the values of the indices of development of the market of organic products, a model of multiple regression is constructed and its adequacy is estimated according to Fisher's criterion. The study of trends and the calculation of predictive values of independent variables of the model for the near future are based on the "extrapolation method, namely, the Holt's exponential smoothing" [4]. The method is based on the estimation of the degree of linear growth (or falling) of the indicator in time. The coefficient of change of the indicator is estimated by the coefficient, which in turn is calculated "as the exponentially weighted average of the differences between the current exponentially weighted average values of the process and their preliminary values" [4]. Using the software *EViews 10*, dynamics indicators were investigated based on official statistical data of 2005-2017.

The information base for the study consists of documents, databases on organic farming, materials and reports of the State Statistics Service of Ukraine, the Ministry of Agrarian Policy and Food of Ukraine, the standards of the International Federation for the Movement for Organic Agriculture (IFOAM), EU regulations, as well as methodological recommendations of scientific institutions, materials of own research, other literary sources on research issues.

RESULTS AND DISCUSSIONS

As an independent direction, organic agriculture was founded in the USA and Europe since the 1940s, as opposed to dependence on synthetic fertilizers and plant protection products. J.I. Rodale, founder of Organic Farming and Gardening Magazine, was one of the first to popularize the term itself, emphasizing that organic products are the most beneficial to health [10; 11].

Given the diversity of the definition of the term "organic agriculture" [1; 3; 12; 16], it must be noted that they all reach agreement on the fact that this is a system based on production management. However, agriculture is not only a production system, but also a way of life of the rural population in certain environmental conditions, is an agrosystem. It is a system that takes into account the potential adverse effects on the environment and humans of such synthetic additives as mineral fertilizers and pesticides, genetically modified organisms, and the like. All these methods are subject to change in organic agriculture by special methods that preserve and increase soil fertility, prevent the multiplication of pests and the growth of diseases. Organic agriculture makes it possible in the future to coordinate and harmonize environmental, economic and social goals in the agricultural sector of the economy. In particular, the advantages of the production of organic agricultural products include: minimizing the negative impact on the environment; independence from mineral fertilizers and pesticides and their producers, and as a consequence, a decrease in the energy intensity of the national economy; the creation of additional jobs in rural areas, prospects for farms; production of healthy, organic and environmentally friendly food.

So organic farming is a system that relies on the management of agro-ecosystems, and not just agricultural production. That is, in addition to production management, the system of organic agriculture also includes the implementation of a set of measures that directly provide this production in order to achieve economic, environmental and social effect. Thus, organic agriculture can in its essence be defined as an integrated system of agro-ecosystem management, including an assessment of environmental threats and risks of environmental safety in the agricultural sector and establishes the procedure for the relationship of economic actors in the process of organic farming.

In recent years, having considerable potential of organic sector, in particular organic production and domestic consumption, Ukraine has achieved some results in developing this field of agrarian economy (Table 1).

According to the Ministry of Agrarian Policy and Food of Ukraine, as of the beginning of 2018, Ukraine ranks 11th among the countries of Europe and the 20th in the world for the total area of agricultural lands certified as organic. Over the past 5 years, they have increased by 54% and today make up 420 thousand hectares. Most among the organic products we grow grain, however is gaining popularity growing position crops such as berries. It is expected that the organic production in Ukraine will increase further, as European capacities are not able to meet local demand for it.

Table 1. Main indicators of organic agriculture development in Ukraine

Indicator	Year								
	2005	2010	2011	2012	2013	2014	2015	2016	2017
Area of organic agricultural land, thousand hectares	242.0	270.2	270.3	272.9	393.4	400.8	410.5	412.2	420.0
Share of organic lands in the general structure of agricultural lands, %	0.58	0.65	0.65	0.66	0.95	0.97	0.99	0.99	1.01
Number of certified organic agricultural enterprise	72	142	155	164	175	182	210	360	375
Share of organic producers, %	0.12	0.25	0.27	0.29	0.31	0.32	0.37	0.64	0.66
The internal consumer market for organic products, EUR million	0.2	2.4	5.1	7.9	12.2	14.5	17.5	21.2	29.4
Export of organic products, EUR million	–	–	–	1.2	16.5	18.0	21.2	40.1	99.0

Source: Calculated by the author based on the data of Ministry of Agrarian Policy and Food of Ukraine.

Exports have grown more than 20 times over the past ten years and reached 99 million euros in 2017. The main export products are cereals, oilseeds, legumes, berries, fruits and wild boars. The domestic organic foods market also has a tendency for rapid growth, in particular, in 2017 the consumer market for organic produce in Ukraine amounted to 29.4 million euros, and consumption per capita – 0.68 euros. For comparison, an average European spends on organic products 40.8 euros a year, and a citizen of the EU – 60.5 euros [18]. Currently, the internal consumer organic market in Ukraine is gradually expanding, especially through the network of supermarkets, which actively create and develop the attractiveness of organic agricultural products. The main types of foods on the internal organic market of Ukraine include veggies, fruits, greengrocery, grains, meat, dairy products, cereals and baked goods.

The high level of competitiveness of organic products in international and domestic markets and ensuring the innovative development of the agrarian sector is due to the improvement of the integrated marketing mechanism for the promotion of organic products, which enables to reduce the negative impact of external factors that restrain the growth of the regional economy. Taking into account the probable technological transformations on the world consumer market (which are related to the acceleration of the start of a new technological cycle or its delay caused by the large-scale replication of innovations) and the market situation, we proposed three basic alternative scenarios for the development of the organic foods market: inertial – conservation modern trends in conditions of moderate development, raw material orientation of organic farming and its dependence on external markets), moderate – gradual stimulation of innovation potential development and innovation – active development of the industry at the post-industrial stage (Table 2).

Table 2. Adaptive scenarios for the development of organic sector and market

The sphere of transformation	Development scenarios	Directions of development
Expansion of demand for organic products	Inertial	Redistribution of efforts to promote products in favor of business associations and contact audiences, differentiation of incentive tools
	Moderate	Commodity advocacy and promotion of products from organic products, its useful and nutritional properties
	Innovative	Creation and implementation of tools to stimulate demand for organic products and support its proposals; stimulating the use of minimum sizes of trade mark-ups for socially significant types of goods
Development of the organic sector	Inertial	Emphasis on situational solutions and soft reforms. Adaptation of ready-made organizational forms of management, infrastructural elements and technologies
	Moderate	Active involvement of non-budgetary funds in organic agriculture (public-private partnership), large-scale localization of production and sales entities
	Innovative	Improvement of the wholesale realization system on the basis of the formation of trade and production associations, expansion of the sphere of activity of marketing cooperatives of various levels, development of consumer cooperation, organization of the work of the exchanges, including electronic, clusterization of the regional production and marketing system of functioning of the organic sector
Formation of equal economic relations	Inertial	Conservation of basic institutions. Soft law reform within the framework of traditional law
	Moderate	Targeted support of business climate, support of integration and cooperation of market interaction subjects; improvement of antimonopoly and tax policy, intensification of the professional level of participants in the organic market
	Innovative	Principal improvement of institutional conditions: provision of effective antimonopoly policy, support for competition (overcoming of corrupt mechanisms of functioning of agribusiness, reduction of administrative barriers); increase the volume of preferences and tax breaks in order to introduce innovations and ensure sustainable economic growth
Creation of a single economic space	Inertial	Manual management of the economy, including innovative processes, point-based solutions to improve the marketing and innovation of the business climate.
	Moderate	Gradual development of the general economic environment in the organic sphere, infrastructure of marketing and innovation activity
	Innovative	The introduction of differentiated tariffs for transportation of products, merging into a single management process of production and marketing with the aim of identifying at the zero stage of the life cycle, flexible pricing, carrying out research work on the development of market novelty products, indicative planning and forecasting of demand, attracting investment and financial resources, organization of effective promotion and distribution
Information provision of participants in the organic market	Inertial	Gradual creation of information databases of organic producers and products that they produce in response to emerging inquiries
	Moderate	Organization of the system of information support available to market participants, which reveals information about prices, sales volumes, commodity stocks in this market, forecast indicators of its functioning
	Innovative	Development of a holistic marketing information system for the selection of communication tools (PR, advertising, etc.) facilitating the exchange of information about products, their qualitative characteristics, business reputation and entrepreneurial activity of enterprises with real and potential consumers in order to increase the prestige of trademarks.

Source: formed by the author for [2; 5; 6; 15; 13; 19].

Implementation of the scenario of innovation development involves organizing measures to improve the mechanisms of economic relations in the organic sector, which includes the involvement of state incentives along with marketing mechanisms. Note, that the effectiveness of state support in the organic products market directly depends on the existing mechanisms of state support and their ability to compete with the market.

At the same time, in practice, the likelihood of a successful implementation of any clean scenario is very low due to the high level of investment costs of innovation development. State support in this case is limited to a predefined list of measures and is placed on the axis of coordinates depending on the amount of funding, the effectiveness of institutional transformations, etc.

Despite the obvious difficulties at the stage of realization of innovation scenarios of innovation development, they remain the most promising for implementation due to rising risks, and as a consequence of losses from delays in their implementation in geometric progression. Taking into account institutional conditions such as: mitigating administrative barriers, expanding preferential taxation, restricting the activities of agricultural producers, which do not provide financing for innovation development and modernization of production, it is necessary to accumulate expenditures to meet the innovative needs of farms and ensure the inflow of investments into innovation activities [9].

The introduction of the innovation development scenario allows state authorities to introduce a regulatory mechanism, which to a certain extent can also be used to implement scenarios aimed at developing competition in the organic market, regulating the level of formal and informal preferences, breaking economic barriers and improving the competitive mechanism for public procurement. That is, this approach cannot be called ideal, however, it can act as a basis for the implementation of flexible government programs aimed at adjusting the assortment quality, price, distribution blocks of the marketing strategy of organic enterprises in the market in the course of monitoring their implementation.

In general, the implementation of the strategy for the development of the market for organic farming will transform the process of production management into a continuously updated strategic activity aimed at developing and making new management decisions based on the results of current marketing research and innovation imperatives.

An important element of strategic planning for organic market development is forecasting the volume of demand in this market, in particular, the internal consumer market [7; 17]. As already mentioned, in recent years, there has been a trend to growth the volume of organic production in Ukraine. The forecast of development of the internal market for organic foods should be developed on the basis of certain scenarios with different rates of growth of volumes of production, directions of development, areas of land resources, structure and placement of production.

In order to plan the future development of the internal consumer organic products market, a model of multiple regression is proposed and an evaluation of its adequacy according to Fischer's criterion is proposed. Multiple regression model in general can be represented as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_m X_m + \varepsilon, \quad (1)$$

where Y – dependent (resulting) variable;
$X = X$ ($X1$, $X2$, ..., Xm) – independent vector (factor) variables;
β – vector of parameters (to be determined);
ε – random error (deviation);
β_0 – is a free member that defines the value of Y in the case when all the explanatory variables Xj are equal to 0.

In order to form multiple regressions, we introduce the following symbols of variables: denote the dependent variable of the internal consumer market for organic products through *ICMOP*; Independent variables: *AOFL* – the area of organic agricultural land; *QOF* – number of organic farms; *EOP* – organic products export.

Given the designations made by us multiple regression model of dependence of the market will impact on factors like:

$$ICMOP = \beta_0 + \beta_1*AOFL + \beta_2*QOF + + \beta_3*EOP + \varepsilon, \quad (2)$$

The result of the multiplier correlation coefficient $R = 0.986$ indicated a strong correlation between the resulting index and factor characteristics. The determination coefficient R^2 is then 0.972. Since the actual value of $F > Fkp$, the determination coefficient is statistically significant and the regression equation is statistically reliable.

In general, as a result of the calculations with the software *EViews 10* was received an equation of multiple regression:

$$ICMOP = -12.5835 + 0.05042* AOFL + + 0.02502* QOF + 0.1131* EOP, \quad (3)$$

Possible economic interpretation of the parameters of the model: increasing in the area of organic agricultural land by 1 thousand hectares will increase the volume of domestic consumption of organic products by 50.42 thousand euros; increasing in the number of organic farms even on 1 farm will also increase this figure by 25.02 thousand euros; increasing in exports of organic products – will lead to an increase in the volume of consumption of organic produce – 113.1 thousand euros. The statistical significance of the equation is verified using the determination coefficient and Fisher's criterion. It has been established that in the studied situation, 97.2% of the overall *DCMOP* variability is explained by the change in the factors introduced into the model.

On the basis of model data, the forecast of the domestic consumer organic products market for the period up to 2022, depending on the scenarios of the development of organic agriculture in Ukraine (Table 3).

According to the scenario of inertial development, which depends on the current trends in the organic farming, moderate growth of exports will occur as a result of increased demand for internal organic products in foreign markets and the conclusion of forward contracts for future harvests. At the same time, with the growth of domestic demand, there will be a tendency to increase import operations, which will cover the deficit of domestic products. In general, according to the inertial development scenario, the volume of domestic consumption of organic produce will increase to 20.822 to 38.8 million euros.

Table 3. Forecast of indices of the internal consumer organic market for the period up to 2022, depending on the factors, EUR million

Year	Scenario development		
	Inertial	Moderate	Innovative
2018	25.7	34.9	43.9
2019	28.9	39.2	52.3
2020	32.2	41.9	60.5
2021	35.5	46.4	73.9
2022	38.8	49.6	81.7

Source: author's calculations.

The scenario of moderate development includes taking into account the policy of import substitution in the organic sector, as well as the use of organizational and economic instruments for the development of the sector of production and processing of organic products, which will enable the internal consumer market to increase to 49.6 million euro by 2022. With an optimistic scenario of innovation development, due to increased demand from domestic processors, the indicator of the domestic consumer organic market will reach 81.7 million euro by 2022.

The considered strategic scenarios for the development of organic sector should be adopted as target principles for the development of the state program for the development of organic agriculture, as well as regional and local programs for the development of this industry [14]. This will allow to implement the planned measures to ensure the balance of their target and targeted directions, supported by the necessary resources. To fulfill the set tasks, a consistent state policy is needed, as well as the formation of a system of practical actions at each enterprise to improve the production process using a set of organizational, economic and social measures of economic incentives.

In the long term, the introduction of the scenario of innovative development will enhance the efficiency, balance and competitiveness of the organic farming.

CONCLUSIONS

Thus, taking into account the level of influence of the identified factors, medium-term scenarios of the development of organic agriculture in Ukraine have been formed, which provide an opportunity to predict the development of this sector of the economy depending on the economic situation. The formation of one or another scenario of organic agriculture development depends both on the trends of the world economy development and on the internal course of the state economic policy. The functioning of this sector depends primarily on the trends that will be observed in the agricultural sector as a whole, since traditional and organic technologies of agrarian production are interdependent and complementary production lines. As the analysis of key factors has shown, creation of favorable conditions for conducting agribusiness is a priority measure for the development of the internal consumer market of organic agriculture produce.

In order to plan the future development of the agricultural organic sector, it is possible to apply the developed model, which involves modeling their indicators on the basis of multiple regression.

The use of the proposed model will enable the formation of credible prospect balances of demand and supply on the market of organic foods, depending on the factors of influence and scenarios of its development.

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PREDICTIVE MANAGEMENT COMPONENTS ON REDUCING THE RISK AVERSION COEFFICIENT: MAIZE FARMERS OF NORTHWESTERN IRAN

Mojtaba SOOKHTANLOU[1], Hesamedin GHOLAMI[2]

[1]University of Mohaghegh Ardabili, Faculty of Agriculture and Natural Resources, Ardabil, Iran, Email: m.sookhtanlo@uma.ac.ir
[2]Agricultural Research, Education and Extension Organization (AREEO), Tehran. Iran, Email: h.gholami@areeo.ac.ir

Corresponding author: m.sookhtanlo@uma.ac.ir

Abstract

Increasing agricultural risks is a major challenge in economy and efficiency in the agricultural sector that affect income and production decisions of farmers and sometimes is a major obstacle in the sustainable development. Thus, the main purpose of study was to predict the management components in reducing the risk aversion coefficient (RAC) among maize farmers in Moghan plain (Iran). 278 farmers selected using multistage random sampling. RAC calculated through Safety First Rule model and predictive management components were determined by ordered logistic regression (OLR) by STATA software. Results revealed that the most of maize farmers (65.10%) were risk-averse. Also, results of OLR revealed that the probability of placing the farmers at higher levels of risk aversion increased significantly by increasing age, farming experience, farm input costs and facing with more agricultural risks; while increasing education level and farm income, better farm and technical infrastructure management and better risk-sharing management, the probability of placing the farmers at lower levels of risk aversion increased.

Key words: *maize farmers, risk management, risk aversion coefficient, Moghan plain*

INTRODUCTION

The maize (*Zea mays*) is one of the main and strategic products in northwest of Iran. More than 70 percent of the Iran country needed maize is provided in Moghan plain. Due to three important features (fertile soil, available water resources and suitable heat and moisture for agriculture), this plain always has been considered as one of the important pillars of agriculture in the country; but due to the new climatic changes and increasing occurrence of phenomena such as drought and reduction of water resources, nip and spread of pests and weeds, farmers facing with the phenomenon of risk as a major challenge in the region [17].

Risk is one of characteristics of agricultural. In this activity, a variety of natural, social, economic and public hazards lead to a fragile set for farmers that its final results are the threatened income, loss of productivity and reduction in the quantity and quality of their production. Thus, the farmers will be forced to make decisions about allocating resources to their agricultural production in facing with environmental conditions and different natural and unnatural risks; while they don't feel enough stability and confidence in environmental conditions, the status of inputs and outputs prices and their agronomic performance. Marginally, this influence farmers' agronomic decisions and under such circumstances, the results of farmers' decisions are different from the results in safer conditions. There are also different values of inputs consumption in condition of existence of agricultural risks and without risk and this values also depend on the other factors such as variance of the product price, the degree of risk aversion and the marginal share of inputs in production variance in addition to outputs and inputs prices and production levels [32]. In addition, farmers' decisions under risky terms can affect the productivity, farm income, using a variety of inputs, recommendations of agricultural experts, the marketing process and providing agricultural products and production price fluctuations and also may hinder the adoption of new technologies and agricultural sciences [15, 18]. Risk management is an important managerial activity of any operational unit with gaining awareness and understanding of the environment and sources of risk. It is actually one of the ways to increase productivity of production factors and to improve the efficiency of farming operation systems by making suitable decisions about controlling risk factors and resources. Therefore, the main strategy for facing with agricultural risks is the comprehensive utilization of risk management components in agriculture activities [22]. The risk resources of agricultural production are very broad and may include weather conditions (drought, flood, temperature changes, hail, wind, frost, tornadoes, earthquake, etc.), pests and diseases, weeds, soil conditions, production methods and financial and technical risks [2]. risks resources can be divided into four categories of economic, social, natural and market risks that this set of factors provide the conditions of vulnerability for farmers and its ultimate result is the instability of income for farmers. In other words, risk management involves the identification, assessment, evaluation, supervision and risk control and is consisted of a set of precautionary components, specific reactions and unorganized processes [18].

Olarinde et al. [18] studied the factors affecting risk aversion of farmers in the Savannah area (Nigeria) through econometric methods. In this study, maize farmers were divided into three groups based on attitude towards risk: low, medium and high risk-averse. Safety first rule model (SFR) was used to calculate RAC. The results showed that the majority of maize farmers (48.56%) were risk-averse but 42.53% were neutral and 8.91% were risk-taker. The most important factors effecting farmers' risk aversion were: age, household size, farm income, off-farm income, financial security for farmers, agricultural extension and education and business management.

Sulewski and Kłoczko-Gajewska [32] did a research regarding the risk perception, risk aversion and strategies for facing the production risk among Polish farmers. According to the results, the most important factor in increasing risk of farm productions was drought. Also, the majority of Polish farmers were risk-averse. Furthermore, the factors that lead to increased levels of agricultural risk aversion were consisted of the debts ratio, production wastes rate in recent years, soil quality and giving high priority to financial independence (improper management of risk-sharing). One of the most important strategies for facing risks among farmers was the crop insurance. Other findings showed that factors such as improved farmers understanding of sources of risk, reduction of the risk aversion level and implementing appropriate strategies to cope with risk consistent with the conditions and needs of farmers, were assumed as the main strategies for agricultural risk management.

Haneishi et al. [9] studied the attitudes of Ugandan rice and maize farmers about the production risk and its impact on agricultural productivity and decisions. findings revealed that most farmers were risk-averse and their attitude to risk affected their agricultural productivity. Age and religion were also effective in their attitudes; so that risk-averse farmers, by increasing land size, showed better agronomic performance and outputs than neutral-risk and risk-taker farmers respectively. The other results showed that age index has an inverse relationship with risk aversion attitude of farmers.

Akinola [5] Studied about risk preferences and strategies to cope with risk among Abeokuta farmers in Nigeria. results showed that most farmers (81%) had previous risk experience. The market risks (83%), production risks (69%), disease outbreak factors (63%) and political factors (61%) were the most important sources of risk among farmers. The factors which were positively and significantly effective in agricultural risk preference were age, education level, household size, cooperatives participation, credit access and income level. Thus, it was suggested that government efforts should be directed towards reducing production and market risks; enhancing farmers' participation in cooperatives and facilitating access to agricultural credit facilities to indirectly insure farms against risks.

Ullah et al. [33] studying factors affecting farmers' risk attitude and risk perceptions in Pakhtunkhwa (Pakistan), concluded that the majority of farmers were risk-averse. Variables of age, education of household head, off-farm income, land ownership status and access to informal credit sources, significantly affected farmers' attitude towards risk. The effect of socio-economic and demographic factors on risk-taker farmers were insignificant, while access to formal information and informal credit sources adds to the risk perception of farmers.

Gunduz et al. [8] studied the risk aversion degree and estimated the factors affecting risk aversion degree of apricot farmers in Turkey. results revealed that the mean RAC of farmers was 0.06 and most apricot producers in Malatya had the moderate level of risk aversion and the percentage of risk taking among the apricot producers was very low. Spring frost was the most important risk sources and monitoring the apricot market and sharing the market information with apricot farmers may decrease the market risk faced with apricot producers. OLR model was used to determine the effects of socio-economic variables and risk management strategies on RAC of farmers. Also, interestingly, farmers were not aware of the benefits of agricultural insurance. Furthermore, factors of education level, farming experience, household size, economics and marketing management, risk-sharing management and off-farm investment were effective in RAC of farmers.

Qasim and Ahmad [22] studied the agricultural risk sources and risk management strategies in the region of Pothwar of Punjab in Pakistan. In this study, exploratory factor analysis (EFA) was used. According to the findings, most farmers (50%) were risk-averse; 31 percent were risk-neutral and 19 percent were risk-taker. The most important sources of risk for farm households were inadequate extension services and rainfall shortage while crops, animal health problem and lack of farmers' cooperative were less important risk sources. In addition, the results showed that construction of small dams/turbine schemes, weather forecasting, off-farm income and production diversity are the most important risk management strategies applied by farm households. Also, Saqib et al. [27] in studying the effects of socio-economic factors on risk attitudes of farmers in flood-prone area of Pakistan, concluded that the majority of farmers were risk-averse in nature. The results for the logit model showed that education level, farming experience, landholding size and off-farm income significantly affect the risk attitude of farmers.

In sum, in this study, the effective components on reducing production risk among maize farmers were age [10, 21, 18, 32, 9, 24], education level [6, 11, 32, 9, 8, 24, 27], farming experience [10, 9, 8, 24, 27], household size [18, 32, 9, 8, 27], land size [16, 10, 21, 11, 19, 9, 24], maize yield [6, 10, 32], farm income [34, 10, 21, 18, 11, 19, 9, 22], off-farm income ([18, 32, 33], farm input costs [34, 9, 24], the number of agricultural machineries [10, 15, 18], the number of agricultural risks [18, 5, 24], planting management of maize [33, 24], growing management of maize [33, 24], harvesting management of maize [18, 33, 24], economics and marketing management [10, 18, 19, 32, 5, 33, 8, 24], farm and technical infrastructure management [18, 19, 5, 33, 24, 8, 22] and risk-sharing management [10, 5, 8, 22].

Most residents of Moghan plain in north of Ardabil province (northwest of Iran) are employed in agricultural jobs due to existence of suitable conditions for farming. The most important agricultural products in the region include maize (the most maize production in the country) wheat, barley, rice etc.; But with increasing range of production risk and the importance of the maize production in Moghan plain led to investigate and determine the predictive management components in reducing the coefficient risk aversion among maize farmers of Moghan plain in Iran.

MATERIALS AND METHODS

Area of study and sampling method

This study was an applied one based on descriptive-correlative method that was designed and implemented in 2016-2017. Area of study was Moghan plain located in north-western Iran. Moghan plain is in the northern part of Ardabil province, that shares borders in the north and east with Republic of Azerbaijan. Its maximum height above sea level is 500 meters and minimum of it is 40 meters (Fig 1). Moghan plain is considered as one of the important agricultural pillars in Iran for production of wheat, maize, barley, cotton and sugar beets.

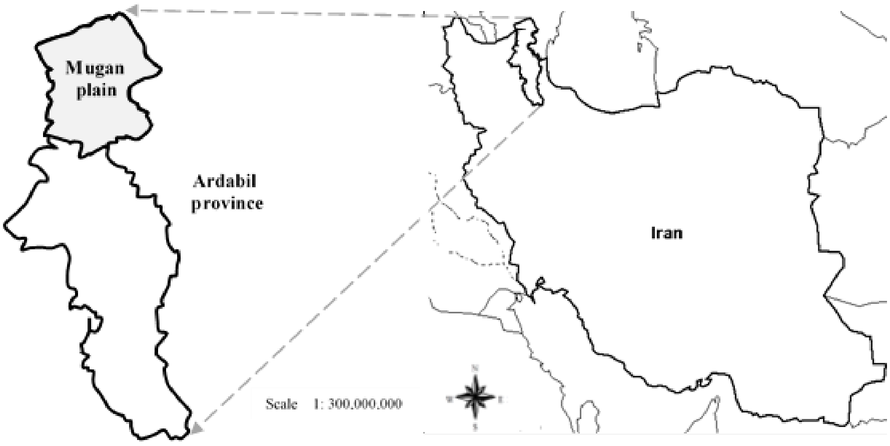

Fig 1. Area of study (Moghan plain, Ardabil province, Iran)
Source: Solgi et al. [29]

This plain contains 3 counties including Pars-Abad, Bileh-Savar and Germi covering an area of nearly 5245 Km^2. Given that most of the maize cultivation in the Moghan plain is limited to the Pars-Abad County (95% of the produced maize of the Moghan plain); so, the study population was consisted of all maize farmers of Pars-Abad County (915 farmers). This County is composed of three districts of Central, Aslan-Duz and Tazeh-Kand. Sampling method was multi-stage random. Applying the Yamane (1967) formula (equation 1), a sample size of 278 maize farmers in 9 villages was determined to be at a 95% confidence level with a ±5% margin of error [27]:

$$n = N/\left(1+Ne^2\right) \qquad (1)$$

where:
n = Sample size
N = Total number of maize farmers in an area
e= Precision value, set at ±5% (0.05)

The sample size consisted of 278 maize farmers in districts of Central (4 villages, 120 maize farmers), Aslan-Duz (3 villages, 95 maize farmers) and Tazeh-Kand (2 villages, 63 maize farmers).

The research instrument

The research instrument was a questionnaire including 69 items in three main sections i.e. personal and professional characteristics, RAC measurement and risk management components. Items of questionnaire consisted of the personal and professional characteristics of respondents such as age, farming experience, etc. in 18 items; variables of measurement of RAC such as subsistence income, expected income, etc. in 19 items and risk management components such as plant management of maize, growing management of maize, etc. in 32 items.

Risk management components consisted of sowing management of maize (suitable time of maize planting, use of agricultural drought-resistant varieties, etc. in 5 items), growing management of maize (suitable time of irrigation, appropriate use of fertilizers for increasing soil fertility, etc. in 5 items), harvesting management of maize (suitable time of maize harvest, appropriate use of harvest machines, etc. in 4 items), economics and marketing management (pre-sale of product, selling product to intermediaries, etc.

in 5 items), farm and technical infrastructure management (participation in extension and education, use of pressurized irrigation methods, etc. in 7 items) and the risk-sharing management (crop insurance, membership in agricultural organizations and cooperatives, etc. in 6 items). Items of risk management components with equal weights were collected by five-point Likert-type scale (1: very low to 5: very much). Given that some farmers were illiterate and some parts of the questionnaire included of detailed questions that need to be explained to the farmers, thus, some farmers were interviewed to complete each questionnaire. To determine the reliability of the questionnaire, first 30 questionnaires were distributed among farmers inside the statistical population, but outside of the sample size. The reliability of questionnaire was computed above 0.7 using Cronbach's Alpha and ordinal theta which represents the reliability of the research instrument. The face validity of the questionnaire was confirmed by a panel of experts including some faculty members of agriculture fields and a number of experts of Agriculture-Jihad organization in Moghan plain.

Calculation of RAC

To calculate RAC in maize farmers' decision-making, we used safety first rule (SFR). Randhir [23], Sekar and Ramasamy [28], Ajetomobi and Binuomote [3], Ajijola et al. [4], Sookhtanlo et al. [30], Onyemauwa et al. [19] and Akinola [5] used this equation (2) in their studies to determine farmers' risk-aversion degree. The basic premise of this rule is that the aim of the person is to minimize the possibility of a drop in income to a certain lower level. According to this rule, farmers select a technology and implement its certainty in the production of a specific crop while they feel comfortable and ensure that their subsistence needs are supplied [20, 19].

$$R_i = [E^*_i - E_i] / [\delta_i] \qquad (2)$$

where:
R_i: RAC of maize farmer
E^*_i: Disaster level of income
E_i: Expected income from the farm
- δ_i: The standard deviation of household income
- $i = 1$ to n
- n: Number of maize farmers (sample size).

The standard deviation of household income (δ_i) was obtained based on total approximate household income of farm and off-farm, during the recent three years' average. The cause of choosing an average of three years is to avoid cross standard deviation and reduce the likelihood of errors.

In the next step, two remain variables of disaster level of income (E^*_j) and expected income (E_j) should be estimated. Disaster level of income is given by Equation 3 ([19]):

$$E^* = (CN_{min} + CO) - (LA + NI) \qquad (3)$$

where:
CN_{min}: The minimum consumption needs of farmer' household that is calculated by equation (4).
CO: Credit outstanding, which include both institutional and non-institutional credit
LA: Liquid asset, which include farm and non-farm assets
NI: Non-farm income.

The minimum consumption needs of farmer' household (CN_{min}) is calculated as follows (equation 4):

$$CN_{min} = CA\,(HS - (CHI / 2)) \qquad (4)$$

where:
NC: Minimum number of calories per person
HS: Household size of farmer.
CHI: Number of children.

And marginally also, equation (5) is applied to calculate the expected income from the farm (Ei):

$$E = VF\,(1 + DMG) - TC \qquad (5)$$

where:
VF: Value of farm output (maize)
TC: Total Cost of farm inputs (maize)
DMG: weighted crop damage variable
DMG is given by Equation 6 ([26], [19]):

DMG = (Expected yield- Actual yield) / Expected yield (6)

RAC expressed above was regressed on the determinants of the risk aversion levels of the farmers.

Estimate of OLR model

Ordered logit models are used to estimate relationships between an ordinal dependent variable and a set of independent variables. The ordinal logistic regression model can be expressed as a latent variable model [1, 14]. So, Let "y_i" be the observed R_i value for the i^{th} respondent, $y_i = 1, 2, 3\ldots$, $i = 1, 2\ldots, N$. Given the discrete nature of y_i, we assume there is a latent variable (equation 7) [7, 36]:

$$y_i^* = \beta x_i + \sigma \varepsilon_i \qquad (7)$$

where x_i is a row vector consisting of a constant term and K characteristics associated with respondent i,

β is a $K+1$ column vector of coefficients,

ε_i is an error term assumed to be logistically distributed with mean and variance ($\pi^2/3$), and

σ is a scale parameter.

The relationship between the observed R_i value, y_i, and its unobserved, latent value, y_i^*, is given by the following (equation 8) ([12], [13], [25], [31]):

$$\begin{aligned} y_i &= 1 \quad \text{if} \quad -\infty < y_i^*/\sigma < k_1/\sigma \\ y_i &= 2 \quad \text{if} \quad k_1/\sigma < y_i^*/\sigma < k_2/\sigma \\ y_i &= 3 \quad \text{if} \quad k_2/\sigma < y_i^*/\sigma < k_3/\sigma \qquad (8) \\ y_i &= 4 \quad \text{if} \quad k_3/\sigma < y_i^*/\sigma < +\infty \end{aligned}$$

where k_j/σ are the "outpoints" that cause the observed value of the respondent's R_i to change in discrete units. The model above is known as the "OLR model [13, 36].

Given that the dependent variable of research (risk aversion levels of maize farmers) is an ordinal scale and of course shows different categories of RAC; therefore, to determine the most effective and predictive components on maize farmers' groups (grouped on the basis of risk aversion levels), the OLR model was used by STATA software.

In OLR model, the amount of Pseudo R^2 which is between 0 and 1, doesn't have the natural and usual interpretation of R^2 and in its interpretation we can only say that by increasing the amount of the model goodness of fit, its value increases [25]. In this model, the marginal effect or marginal probability is also calculated to obtain the effect of independent variables on the dependent variable's predicted probabilities or to choose the alternatives order. Also, due to the sum of the probabilities is always equal to 1, therefore, the sum of the marginal effects is equal to 0 for every variable. β coefficients are not directly relevant to marginal effects; so, we can calculate the marginal effects of variables in 4 levels of probabilities (risk aversion levels of maize farmers) using the following equations of 9, 10 and 11 [35, 36, 31]:

$$\frac{\sigma Prob\,(y=0 \mid x)}{\sigma Xi} = F\,(-x'\beta)\beta \qquad (9)$$

$$\frac{\delta Prob\,(y=1 \mid x)}{\delta Xi} = [F(-x'\beta) - F\,(\mu_1 - x'\beta)] \qquad (10)$$

$$\frac{\sigma Prob\,(y=\text{j} \mid x)}{\sigma Xi} = F\,(\mu_{j-1} - x'\beta)\beta \qquad (11)$$

According to the expressed points, previous studies and data results, research model is shown as below regression relationship:

$Y_i = \beta_0 + \beta_1$Age $+ \beta_2$ Education $+ \beta_3$ Experience $+ \beta_4$ Household $+ \beta_5$ Land$+ \beta_6$ Yield $+ \beta_7$ Income $+ \beta_8$ Offincome $+ \beta_9$ Cost $+ \beta_{10}$ Machinery $+ \beta_{11}$ N.risk $+ \beta_{12}$ M.planting $+ \beta_{13}$ M.grow $+ \beta_{14}$ M.harvest $+ \beta_{15}$ M.market $+ \beta_{16}$ M.infrast $+ \beta_{17}$ M.sharing

where: Yi: dependent variable of model (RAC)

So, considering Ri level is the ordinal outcome, y, ranging from 1 to 4, where 1= Risk-taker, 2 = Risk-neutral, 3= Low risk-averse and 4 = High risk-averse.

In indicated regression equation, the concept of listed items is as below:

Age: age (year); Education: education level (year); Experience: farming experience (years), Household: household size (person); Land: land size (hectare); Yield: maize yield (ton); Income: farm income (million rials);

Offincome: off-farm income (million rials); Cost: farm input costs (million rials); Machinery: the number of agricultural machines; N.risk: the number of agricultural risks; M. sowing: sowing management of maize; M.grow: growing management of maize; M.harvest: harvesting management of maize; M.market: economics and marketing management; M.infrast: farm and technical infrastructure management and M.sharing: risk-sharing management.

Totally, the independent variables entered into OLR, consisted of 17 main variables. Predictive components of different groups of farmers (on the basis of risk aversion levels) are obtained by ordered logistic analysis and calculating the marginal effects in STATA software.

RESULTS AND DISCUSSIONS

Demographic characteristics of respondents

The most frequency of farmers' age range (32%) was from 41 to 50 years. In terms of gender, 98.2% were male and 1.8% were female. most dominant education level was 4 to 6 years that were 41% of the sample. household size of most of the respondent (34.2%) was 5 people. In terms of land size, the most frequency of land size range, was 2.6 to 5 hectare (48.2%). The highest maize yield was between 11 to 15 tons per hectare (32.7%) and the most frequent farm income range (49.6%) was from 1,010 to 1,500 million rials; while the most frequent off-farm income was from 200 to 1,200 million rials (39.2%). Range of 260 to 1,000 million rials (34.9%) was the most dominant farm input costs among farmers. Majority of farmers (35.3 %) had ownership of three agricultural machines and the most of the farmers (40.6%) have faced between 3 and 5 agricultural risks. The other supplementary information is provided in Table 1.

Table 1. Statistical summarization of demographic characteristics among respondents

Variables	Mean	SD	Minimum	Maximum
Age (year)	46.1763	11.70769	25	74
Education level (year)	5.5288	2.60884	0	12
Farming experience (year)	21.9029	11.62538	5	50
Household size (person)	4.5396	1.20028	2	7
Land size (hectare)	5.0054	3.61167	0.5	30
Maize yield (ton)	17.0432	5.33177	5	36
Farm income (million rials)	2,627.42	970.24	645.83	5914
Off-farm income (million rials)	1,410.023	1028.391	50	3800
Farm input costs (million rials)	1,548.058	1028.391	100	4100
The number of agricultural machineries	3.5144	1.0008	1	5
The number of agricultural risks	4.9209	2.48334	2	13

Source: Own calculation.

Prioritization of risk management components among respondents

According to the table (2), for the research components, the first priorities were the suitable time of maize sowing (sowing management of maize); the suitable time of irrigation (growing management of maize); suitable time of maize harvest (harvesting management of maize); pre-sale of product (economics and marketing management); participation in extension and education programs of maize cultivation (farm and technical infrastructure management) and crop insurance (risk-sharing management).

Estimate OLR model

- Categorization of maize farmers into groups based on the RAC

Ordinal dependent variable for conducting OLR was RAC among maize farmers.

According to table 3, maize farmers with different RAC, categorized into four groups: code 1: risk-taker (15.1% of respondents); code 2: risk-neutral (19.8% of respondents); code 3: low risk-averse (37.4% of respondents) and code 4: high risk-averse (27.7% of respondents).

Table 2. Prioritization of items related to risk management criteria among the respondents

Risk management components	Items	Mean	SD	Rank
Sowing management of maize	- The suitable time of maize planting	2.752	1.192	1
	- Use of agricultural drought-resistant varieties	2.601	1.363	2
	- Use of improved seeds	2.255	1.179	3
	- Cultivating varieties with a short growing period	2.086	1.228	4
	- Use of disinfected and cleaned seeds	1.978	1.213	5
Growing management of maize	- The suitable time of irrigation	3.126	1.303	1
	- Appropriate use of fertilizers for increasing soil fertility	2.694	1.182	2
	- Appropriate use of herbicides	2.435	1.196	3
	- Appropriate use of pesticides	2.291	1.113	4
	- Appropriate control of weeds	2.022	1.222	5
Harvesting management of maize	- The suitable time of maize harvest	1.921	1.108	1
	- Appropriate use of harvesting machines	2.162	1.299	2
	- Use of skilled labor	2.507	1.130	3
	- Setting the harvesting equipment	2.896	1.091	4
Economics and marketing management	- Pre-sale of product	3.248	1.476	1
	- Selling crop to intermediaries	2.853	1.256	2
	- Selling crop to cooperatives	2.504	1.167	3
	- Access to formal credit	2.259	1.198	4
	- Access to informal credit	1.921	1.045	5
Farm and technical infrastructure management	- Participation in extension and education programs of maize cultivation	3.227	1.103	1
	- Use of pressurized irrigation methods	3.004	1.200	2
	- Contact with extension agents	3.000	1.546	3
	- Drainage of irrigated land under cultivation	2.935	1.485	4
	- Observance of crop rotation	2.827	1.198	5
	- Land leveling of the land under cultivation	2.813	1.159	6
	- Use of fallow	2.673	1.167	7
Risk-sharing management	- Crop insurance	3.223	1.085	1
	- Membership in agricultural organizations and cooperatives	3.155	1.184	2
	- Willing to grow maize in common lands	2.655	1.154	3
	- Willing to partner with others through their financial contribution in growing maize	2.612	1.327	4
	- Willing to partner with others through their workforce contribution for growing maize	2.543	1.244	5
	- Willing to partner with others through their agricultural machineries contribution for growing maize	2.162	1.268	6

Source: Own calculation.

Table 3. Categorization of maize farmers based on Ri levels

Codding	Range of risk aversion	Risk aversion class	Frequency	Percent	Cumulative Percent
1	$Ri < -10$	Risk-taker	42	15.1	15.1
2	$-10 \leq Ri < 0$	Risk-neutral	55	19.8	34.9
3	$0 \leq Ri < 10$	Low risk-averse	104	37.4	72.3
4	$Ri \geq 10$	High risk-averse	77	27.7	100.0
Total	-	-	278	100.0	-

Source: Own calculation.

According to initial regression model, 17 components entered the analysis for doing OLR, so that the main predictive components determined groups of maize farmers in terms of their RAC.

- Results of OLR model

According to Table 4, Log likelihood (-180.96913) and level of significance ($p < 0.001$) showed statistically significance of the regression model. Pseudo R^2 as a goodness of fit measure, shows a value of 0.5126.

Given that the level of significance and Z-statistic values for all components entered in the analysis, 7 of 17 components were significant at 1%, and only one component was significant at 5%. High pseudo R^2 measure the goodness of fit, combined with the 8 significant components at 1% and 5%, which indicated the model is desirable. In other words, predictive components consisted of age, education level, farming experience, farm income, farm input costs, the number of agricultural risks, farm and technical infrastructure management and risk-sharing management.

Components of age, farming experience, farm input costs and the number of agricultural risks had significant and positive effect on RAC of maize farmers; but components of education level, farm income, farm and technical infrastructure management and risk-sharing management had a significant and negative effect on RAC of maize farmers.

Table 4. Results of estimating OLR model

Dependent variables: Maize farmers' groups in terms of RAC (1- Risk-taker; 2- Risk-neutral; 3- Low risk-averse; 4- High risk-averse)						
Components	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
- Age	.1186016	.0168269	7.05**	0.000	.0856215	.1515817
- Education level	-.3147014	.0641758	-4.90**	0.000	-.4404836	-.1889192
- Farming experience	.0551569	.0149854	3.68**	0.000	.0257861	.0845277
- Household size	-.0023695	.1207222	-0.02	0.984	-.2389806	.2342416
- Land size	-.044631	.0439325	-1.02	0.310	-.130737	.041475
- Maize yield	-.033344	.0293146	-1.14	0.255	-.0907995	.0241114
- Farm income	-.0000628	.0000171	-3.67**	0.000	-.0000963	-.0000292
- Off-farm income	-.0002122	.0000133	-1.12	0.216	-.076450	-.0254321
- Farm input costs	.0003593	.000158	2.27*	0.023	.0000496	.0006691
- The number of agricultural machineries	.0640128	.1470662	0.44	0.663	-.2242316	.3522571
- The number of agricultural risks	.3499123	.0729115	4.80**	0.000	.2070083	.4928163
- Sowing management of maize	-.3656514	.2694839	-1.36	0.175	-.8938302	.1625273
- Growing management of maize	-.2816512	.2377433	-1.18	0.236	-.7476194	.1843170
- Harvesting management of maize	-.0137051	.2369253	-0.06	0.954	-.4780701	.4506599
- Economics and marketing management	-.3132176	.2577654	-2.26	0.294	-.8675098	.2145546
- Farm and technical infrastructure management	-.9314794	.1700532	-5.48**	0.001	-1.264778	-.5981812
- Risk-sharing management	-1.045945	.2257065	-4.63**	0.000	-1.488321	-.6035679
Log likelihood = -180.96913; LR chi^2 = 380.58		Pseudo R^2 = 0.5126; Number of obs= 278			Prob > chi^2 = 0.000	

* P< 0.05; ** P< 0.01(2-tailed).
Source: Own calculation.

- The marginal effects' determination of the predictive components

To measure the effect of each component on dependent component of model, the marginal effects is calculated. The sum of marginal effects of each component for different levels of risk eversion (total levels) is equal to zero; because the sum of the probabilities for different levels of risk aversion is equal to one. Therefore, the amount of increase in probabilities of a level is equivalent to probabilities reduction in the level or other levels. Also, the amount of marginal effects of each component in each level of risk aversion represents probability of more or less the amount of component at each level of risk aversion (levels of 1,2,3,4) in comparison with other levels of risk aversion. According to the results presented in table 5, the amount of the marginal effects among components of age, farming experience, farm input costs and the number of agricultural risks in the first and second levels (risk-taker and risk-neutral) were negative; but in the third and fourth levels (low risk-averse and high risk-averse) were positive and had an increasing trend. In other words, increasing the mentioned components increases the probability of placing maize farmers in higher levels of risk aversion. But the marginal effects among components of education level, farm income and farm and technical infrastructure management in the first and second levels (risk-taker and risk-neutral) were positive; but in the third and fourth levels (low risk-averse and high risk-averse) were negative and had a decreasing trend. For risk-sharing management, the amount of the marginal risks in the first, second and third levels was positive; but for the fourth level (high risk-averse) was negative and had a decreasing trend. In other words, increasing the mentioned components, decreased the probability of placing maize farmers in higher levels of risk aversion. According to the marginal effects coefficients (Table 5), the highest marginal effects found in components of age (high risk-averse (0.2448)), education level (risk-taker (0.3456)), farming experience (high risk-averse (0.4939)), farm income (risk-taker (0.2504)), farm input costs (high risk-averse (0.4446)), the number of agricultural risks (high risk-averse (0.4855)), farm and technical infrastructure management (risk-taker (0.3437)) and risk-sharing management (risk-taker (0.1723)).

The marginal effects of each component indicates the amount of change in the predicted probabilities of dependent variable, per a unit of change in that component (if other factors remain fixed). For example, according to the marginal effects in table 5, per a unit of change in component of risk-sharing management, the probability of placing maize farmers in the first, the second and the third levels of risk eversion will be increased to 17.23%, 7.34% and 0.72%, respectively; but in the fourth level, it will be reduced to 25.30%. This results and provided interpretations can be seen in table 5, for the other components. Totally, according to marginal effects, the most important effective components were “farming experience” and the “number of agricultural risks”.

Table 5. Marginal effects of predictive components in the OLR model

Indexes	**Y=1**	**Y=2**	**Y=3**	**Y=4**
Constant	-	-	-	
Age	-0.2174	-0.1062	0.0788	0.2448
Education level	0.3456	0.1041	-0.0780	-0.3718
Farming experience	-0.4422	-0.1296	0.0779	0.4939
Farm income	0.2504	0.0541	-0.0344	-0.2701
Farm input costs	-0.2807	-0.1752	0.0112	0.4446
The number of agricultural risks	-0.3420	-0.15950	0.01600	0.4855
Farm and technical infrastructure management	0.3437	0.0827	-0.0790	-0.3474
Risk-sharing management	0.1723	0.0734	0.0072	-0.2530

Source: Own calculation.

CONCLUSIONS

Increasing the risk aversion among maize farmers and improper management of risk in long term, can have a negative impact in the economic, social and cultural conditions of farmers. Also, improper management of risk impacts affects farmers’ decision making in production and adoption of new technologies and it reduces the quantity and quality of the maize product [18, 33].

Therefore, determination of the predictive components on reduction of production risk among maize farmers can play a vital role in any plan for increasing production and income of farmers and reducing poverty and migration conditions; also, it increases the probability of adoption of required innovations and technologies for increasing farmers' production.

The results of calculating RAC (consistent with the findings of Ullah et al. [33] and Saqib et al. [27] showed that, majority of maize farmers were risk-averse (65.1%) and farmers with more RAC were facing with more agricultural risks.

Financial components of farm income and farm input costs also affected the farmers' risk aversion level. Due to t recent unprecedented droughts in the studied area maize farmers have faced different financial, environmental and psychological shocks while they didn't have enough experience and knowledge to manage drought risks.

Thus, seemingly, effects of this phenomenon has caused the majority of maize farmers to be more cautious and conservative in facing farm risks. Another important point is that, most maize farmers in the area are smallholder farmers (mean of farm lands size: 5.0054 hectares).

The smallholder farmers compared to other farmers, are very vulnerable to agricultural risks [10]; so this leads to increase risk aversion level of maize farmers in the Moghan plain. In this regard extension education courses related to drought risk management, strengthening supportive and governmental and non-governmental credits and facilities for maize crop and especially damaged farmers, providing the agricultural infrastructure programs including use of appropriate seeds for drought conditions and agricultural crops insurance can be recommended. Based on the research results and due to insignificance effect of risk-sharing management component, consistent with the findings of Akinola [5], and the marginal effects of this component and its prioritization results, it is suggested that efforts must shift to programs and politics that encourage farmers' cooperation. In this regard, local associations or farmers' organizations should be strengthened. Because of poor position of cooperative agricultural activities in the research area, it is necessary that initially the government take leadership role to promote programs but after developing common activities in maize production, the activities assigned to local associations or farmers' organizations. Encouraging farmers for membership in cooperatives and improvement of extension plans is proposed to accept the agricultural and drought insurance among farmers.

Furthermore, component of farm and technical infrastructure management (consistent with the findings of Olarinde et al. [18] has the power of differentiating farmers with different levels of risk aversion. According to marginal effects and results of prioritizing this component, it seems that technical assistance and credit support for applying pressurized irrigation methods and strengthening extension programs about optimal cultivation have a considerable impact in reducing production risk [8]. Since older, more experienced and less educated farmers have higher levels of risk aversion (consistent with the findings of Riwthong et al. [24]; it is suggested that visual and experiential extension methods such as "method demonstration", "result demonstration" and "field day" be applied for instruction of farm operations and risk management of maize production

Totally, the results of OLR model predict that older formers with more farming experience, more farm input costs and more agricultural risks, have more level of risk aversion. Higher level of education, more farm income, better farm and technical infrastructure management and better risk-sharing management, will increase probability of placing maize farmers in lower levels of risk aversion. Findings from this study could contribute to the development of a framework to address risks in agricultural activities. The implementation of such a framework will complement the various research and efforts hitherto aimed at increasing maize production, increasing smallholder farmers' income and alleviating their poverty in research area and similar regions.

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ANALYSIS OF THE AQUACULTURE SECTOR AT THE LEVEL OF GIURGIU COUNTY

Simona SPÂNU[1], Marin FLOREA[2]

[1]"Lucian Blaga" University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environment Protection, 7-9 Ion Rațiu, Sibiu, Romania, Phone: 00 40 748 675 375; Email: simona_spanu@yahoo.com
[2]"Lucian Blaga" University of Sibiu, Faculty of Engineering, 4 Emil Cioran, Sibiu, Romania, Phone: 00 40 771 589 170; Email: floreasb@yahoo.com

Corresponding author: simona_spanu@yahoo.com

Abstract

The paper presents the existing situation of aquaculture sector at the level of Giurgiu County, based on some data on fish consumption and a price analyse. Based the legal framework for organic fishing, sustainable fishing in studied in relation to environmental protection, and the main measures taken by the state are the goal to encourage and develop sustainable and lasting fisheries. Last but not least, it includes assessments of ecological aquaculture, the eco-label and measures that Romania takes to protect biodiversity, focusing on the balanced exploitation of the fishery resource. The paper employed a quantitative and a qualitative analysis using the data regarding from the tempo on line data base and the analysis is also based on interviews with the consumers. The results reveal that applying eco-friendly fishery methods, the environment can be kept cleaner, and the beauty of the fish and terrestrial wildlife around the rivers will be able to enjoy, along with fishermen, the rural community and tourists who come to the area.

Key words**:** *aquaculture, fisheries sector, environment protection, sustainability*

INTRODUCTION

Given that Giurgiu County is particularly rich in environmental heritage elements through avifaunistic protection sites, a number of restrictions have been imposed on the activities to be carried out within these protected areas. Interest in fish products is very high and demand exceeds the current production capacity. Although it is still a fairly small market, Romania has real growth potential in this sector. With European funding to finance the fisheries sector, in the coming years it will reach at least half of the average EU fish consumption, meaning 10 kilograms per capita. At present, Romania ensures from its own production only 25% - 30% of total fish consumption, which amounts to 90,000 tons.

Romania is one of the top eight European countries according to the annual consumption of fish and could export certain species that do not have a search on the local market but are wanted by other states. The problem is that the European Union could ban the delivery of fish from Romania to the Member States of the Union if it does not meet certain conditions. For example, if the fish contain a high level of certain chemicals, above the level accepted by the EU, steps will be taken to stop the movement, in order to protect the European consumer. Over the past 18 years, fish exports from the Romanian market have declined considerably, at which time the trade balance is negative. The main cause: the range of products on the market. A major handicap for indigenous producers, which start fishing in the country and try to enter the Western markets, is the production conditions, which do not amount to the level of technology of the EU competitors.

According to the Register of Aquaculture Units (RUA) managed by the National Agency for Fisheries and Aquaculture, 41 fish farms are registered in Giurgiu County, of which 5 nurseries and 36 farms. Below is a list of fishing facilities (Source: RUA, 31.12.2017)

At the level of the county, 60 professionals have been identified who have specific fishing and aquaculture activities covering the exploitation of marine and freshwater resources for the purpose of capturing or collecting fish, crustaceans, molluscs and other creatures as well as other marine products for example: aquatic plants, pearls, sponges, etc. They are included in Division 03 Fisheries and aquaculture and activities that are normally integrated in the making of their own production (e.g. sowing oysters for pearl production).

At the level of the county there are 8 retail units of fish/fish products, sanitary-veterinary registration. Six fish/fish shops with prohibited activity were identified, out of which 4 were based in Giurgiu and 2 were based in Bolintin Vale. From the sanitary-veterinary point of view, only 4 direct fish sales units are registered at the county level [1]. At the level of Giurgiu County, according to the information presented by the Sanitary Veterinary and Food Safety Department Giurgiu, there are not registered as sanitary-veterinary: collection centres for batrachians, gastropods, crustaceans; aquaculture farms; fishing boats.

MATERIALS AND METHODS

In this paper, time series have been used with regard to the total catches of commercial fishing in Giurgiu County in 2017, total capture from aquaculture in Giurgiu County in 2017 and total catches (tonnes) reported by economic operators authorized to fish commercially in flowing waters under Romanian jurisdiction over 2008-2015. Also, statistical data on fish consumption were used including a questionnaires addressed to fishermen and aquaculture units in Giurgiu County [5].

RESULTS AND DISCUSSIONS

For the Danube sector of Giurgiu County, the total allowable catch was 89 tonnes in 2015 and increased to 112 tonnes in 2016 and 2017. The increases were for native Cyprinids from 68 tonnes in 2015 to 75 tonnes in 2016 and 2017, at raptors species ranging from 12 tonnes in 2015 to 16 tonnes in 2016 and 2017, are mackerel from 5 tonnes in 2015 to 6 tonnes in 2016 and 7 tonnes in 2017, and in other species there have been reductions in quotas from 5 tonnes in 2015 and 2016, to 3 tonnes in 2017.

The total allowable catch for rapacious species (asp, catfish, zander and pike) recorded oscillations in 2015 – 2017 periods. Thus, a total allowable quantity of 131 tonnes was set in 2015 and 174 tonnes for 2016 and 2017 tonnes.

An increase in the total allowable catch for all four raptors (catfish, chicken and pike) is noted with approx. 35% in 2016 compared to 2015, which remained the same in 2017 as compared to 2016, even though it varied on the Danube sectors. The total catch for the asp was set at 16.2 tonnes in 2015 and 20.1 in 2016 and 2017. For catfish, was set a total allowable quantity of 53.3 tonnes in 2015 and 74.9 tonnes in 2016 and 2017. For the zander, the quantity increased from 41.8 tonnes in 2015 to 54.4 tonnes in 2016 and 2017 and at pikes 19.7 tonnes in 2015 and 24.6 tonnes in 2016 and 2017.

In Giurgiu County, the total allowable quantity decreased from 5 tons in 2015, half in 2016 and 2017 (2.5 tons), while the other abundant species was allowed to increase.

Regarding to the total allowable catch on cyprinids, the situation for the 2015-2017 period shows an increase for 2016 and 2017, as compared to 2015, of approx. 20%, the largest being carp grown (28.5%).

At the Prussian Carp, the total allowable quantity was 241.5 tonnes in 2015 and increased to 255.6 tonnes in 2016 and 2017; for Bream, an allowable quantity of 129.3 tonnes in 2015 and 152.1 tonnes in 2016 and 2017. The allowable quantity for the Vimba was 50.2 tonnes in 2015 and 60.1 tonnes in 2016 and 2017 and for Barbell was 56.2 tonnes in 2015 and 66.3 tonnes in 2016 and 2017. For the Roach an allowable quantity of 30.4 tonnes for 2015 and 43.1 tonnes for 2016 and 2017 was set. Finally, an allowable quantity of 23.7 tonnes in 2015 was set for the White Bream, which increased to 36.8 tonnes for 2016 and 2017.

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On the Danube sector of Giurgiu County, the total allowable catch at native Cyprinids was 67 tonnes in 2015 and 75 tonnes in 2016 and 2017. The 2008-2015 data provided by Eurostat on total catches reported by economic operators authorized to fish commercially in flowing waters under Romanian jurisdiction show a decrease.

Based on Eurostat data, we graphically chart the evolution of the total catch reported by economic operators authorized to fish commercially in the Romanian waters under the jurisdiction of Romania for the period 2008-2015.

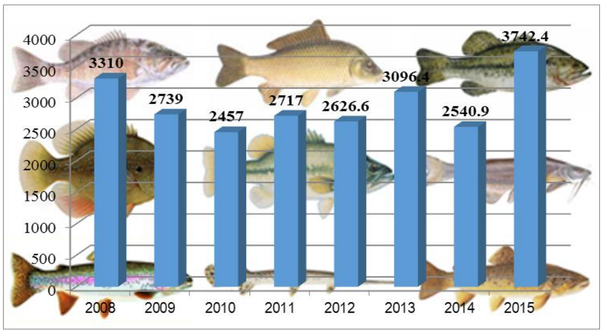

Fig.1. Total catches (tonnes) reported by economic operators authorized to fish commercially in flowing waters under Romanian jurisdiction over 2008-2015

Statistical data on fish consumption

There is a steady decrease for the period 2008 - 2011, an increase for the period 2012-2013, followed by a sharp fall in 2014 to a value below 2012 and a spectacular increase for 2015, when the largest amount catches resulting from commercial fishing, reported for the period considered.

Statistical data on the quantity of fish caught and fish species are provided by the National Agency for Fisheries and Aquaculture.

Table 1. Total catches of commercial fishing in Giurgiu County in 2017

Fish species	Total capture (kg)	Fish species	Total capture (kg)
Red eye	535	Catfish	1,705
Batter fish	640	Luce	230
Crucian	8,973	Avat fish	109
Carp	6,363	Cornel	7,603
Fishmonger	1,718	Mackerel	125
Flat-fish	3,500	Other fish species	1,130
Zander	1,012		

Source: Address NAFA SR Muntenia no. 960/24.04.2018

The quantities of fish and species captured in Giurgiu County in the year 2017 show high aquaculture fishery values (897,785 kg) compared to commercial fishing (33,654 kg).

Aquaculture production recorded in 2017 important values for the following fish species: carp, bighead, crash, chalice, blood, sleep.

Table 2. Total capture from aquaculture in Giurgiu County in 2017

Fish species	Total capture (kg)	Fish species	Total capture (kg)
Carp	623,988	Novac	64,112
Crucian	41,885	Fish cowboy	1,700
Other fish species	26,700	Zander	18,175
Cornel	110,254	Catfish	10,971

Source: Address NAFA SR Muntenia no. 960/24.04.2018

Price analysis

Romanians consume twice less fish as during communism and are the last in the EU in this chapter. The high food price, given that almost 90% of the fish sold in Romania is imported, is the main reason why the food is not the most sold product.

The price, the type of fish and its look in the display are the most important purchase criteria.

Table 3. Fish purchase prices from fishermen / aquaculture units

Species	Average purchase price from fishermen (RON)	Average shelf sales (RON)
Carp	14-18	18
Phytophagus	8	10-12
Silver Carp	8	10-12
Prussian Carp	6	8-10
Pike	15	19
Bleak	5	7
Chub	8	10-12
Bighead Carp	8	10-12
Perch	8	10-12
Bream	7	9.5-10
Rudd	7	9.5-10
Catfish	14	19
Asian Carp	8	10-12
Asp	8	12
Zander	14	19

Source: questionnaires addressed to fishermen / aquaculture units in Giurgiu County

The analysis of fish prices was made by comparing the existing offers on the Romanian market, from the moment of purchase from the fishermen to the consumers, and at the prices displayed on the shelves in the shops, depending on the type of fish most consumed.

The above table shows the average prices found on the market, but due to the legislative instability, the exchange rate increase, changes in the value added tax rate, as well as price increases due to wage increases, price changes often occur. There are also price differences between fish species from aquaculture and fish species in the Danube.

Ecological fishing capacity

The Common Fisheries Policy (CFP) aims to ensure that fisheries and aquaculture are environmentally, economically and socially sustainable and provide healthy food for EU citizens. It also aims to support a dynamic fishing sector and ensure a decent living for fishermen. Although it is important to maximize catches, there must be limits. We need to ensure that fishing practices do not affect the reproductive capacity of fish populations. The current policy sets out to establish sustainable catch limits in the period 2015-2020 to ensure the continuity of long-term fish stocks [3].

The CFP adopts a prudent approach that recognizes the impact of human activities on all ecosystem components. It aims to convince fishing fleets to be more selective with the species fished and to gradually eliminate the practice of discarding unwanted catches.

In Romania, a series of measures have been adopted for the protection of fish species of economic and / or ecological value. In 2005, the Order on the establishment of protective measures for some fish species of economic and / or ecological value was adopted, prohibiting commercial fishing and recreational / hop fishing for five years, of species with ecological value.

Ecological fish species forbidden to fish for commercial purposes for commercial purposes and for recreational / sport fishing were: huchen (*Hucho hucho*), grayling (*Thymallus thymallus*), river lamprey (*Eudontomyzon danfordi*, *Eudontomyzon mariae*), ide (*Leuciscus idus*), striped zander (*Stizostedion volgense*), bleak (*Chalcalburnus chalcoides mentho*), striped chub (*Leuciscus agassizi*), *Romanichthys valsanicola*, small chub (*Leuciscus leuciscus*), common chub (*Petroleuciscus celestis*), pond chub (*Petroleuciscus borysthenicus*), common zingel (*Zingel Zingel*), streber (*Zingel streber*) and Nera subspecies (*Zingel streberi nerensis*); *Umbra krameri*; loach (*Misgurnus fossilis*); racer goby (*Bentophylloides brauneri*), *Cobitis eleongata*, pond cobitis (*Cobitis megaspila*, *Cobitis tanaytica*), golden loach (*Sabanejewia radnensis*), Danube golden loach (Sabanejewia bulgarica), three-spined stickleback (*Gasterosteus aculeatus*), Techirghiol three-spined stickleback (*Gasterosteus crenobiontus*), Ukrainian stickleback (*Pungitius platygaster*), roach (*Rutilus pigus*), thermal rudd (*Scardinius racovitzai*).

Ecological aquaculture is a healthy alternative that produces fresh and local food. The quality of fish meat is a thing of the kind, providing the human body with Proteins, but also an important source of vitamins and nutrients. It is obvious that overfishing is endangering world fish stocks. Rational exploitation of fish or aquaculture can help mitigate this pressure on fish and the environment, even in the face of a growing demand for fish, both in the EU and globally.

Fish-farming, one of the most spectacular food industries on the world produces about half of the fish consumed each year, with figures rising. Without aquaculture, there is not enough fish to meet demand, and excessive fishing could jeopardize the long-term viability of wild fish stocks [2].

Fish produced in fish farms provide good quality protein for human diet, and local aquaculture products contribute to the economic development of the area, for the benefit of the community. More than 80 000 people work directly in European aquaculture and their number increasing as EU farmers provide more and more aquaculture products.

Through policy reforms and specific financial support, the European Union is constantly supporting the economic growth of this sector, the creation of jobs and the high quality of farmed fish produced in Europe, because aquaculture products are healthy and ensure development sustainable area. The reform of the Common Fisheries Policy aims at fully harnessing the potential of EU aquaculture in line with the Europe 2020 objectives: sustainability, food security, growth and employment.

As in organic farming, priority in aquaculture and ecological farming is the production of healthy food for consumers, the protection of the aquatic environment and for fish species. Farmers rely on clean water and sanitation. There are many situations where fish find food in the environment, but where it is insufficient; farmers provide additional food to ensure healthy, balanced nutrition in full compliance with strict environmental and consumer protection standards.

Since 2010, as a result of strict EU rules, organic fish production has grown in European countries, with the growing interest of consumers in organic products and the possibility of using the eco-label to identify and describe these products, accounting for almost 4% of total EU aquaculture production, around 50,000 tones in 2015 [4].

Ireland is the first to fish in UE organic aquaculture, with over 44% of European production. It is followed by Italy (17%), Great Britain (7%) and France (6%).

The main species of freshwater aquaculture grown according to ecological standards are salmon, carp, trout and bass.

Economic performance in aquaculture varies across EU Member States due to constraints limiting its development.

In Romania, organic fish farming started in 2010 with support from the European Fisheries Fund (EFF), 2007-2013. The conversion process focused on common carp, since the differences between traditional farming practice and ecological practices were not significant [1].

Fish farming in Romanian ponds and fish farms is managed mainly by extensive and semi-intensive technologies, which are based on the natural productivity of ponds with additional local cereals (corn, wheat, sunflower).

Ecological fish production in Romania was 2042 tonnes (in 2014), generally based on carp growth, by 29 certified companies, covering 14,840 ha of certified ponds.

Carp is one of the most widespread fish species in European fisheries, especially in Eastern Europe. Total carp production reached 83400 tonnes in 2015.

According to Eurostat data, the main EU organic carp breeders are Hungary (over 3,000 tonnes in 2015), Romania (2,700 tonnes) and Lithuania (1,200 tonnes). Smaller quantities are produced in Austria, Germany, Poland and Latvia.

The cost of growing carp in an ecological system is considerably higher than the cost of traditional carp (from 0.65 euro / kg in Germany to 0.89 euro / kg in Poland, which means an additional cost of 30% in Germany and 46% in Poland). The main costs that make up the difference are those for sapling and those for fish food, which are doubled under the conditions of organic farming.

In organic fish farming it is necessary to use additional sapling because of the low survival rate of the sapling in the additional year of growth. In Germany and Poland, a double quantity of saplings is required for traditional breeding and in Romania the cost is higher because the Romanian farms buy older broilers (compared to organic farmers in Poland and Germany that produce their own brood) and the additional needs of brood is estimated at 50%.

Food consists mainly of cereals. The nutritional value of organic cereals is equal to that of conventional cereals, but the price is double. Because of the problems rose during breeding (lower growth rate), an additional year of growth is needed, which generally leads to a 15% conversion rate of food. The additional year of growth required for organic carp also explains the additional labour costs. The studies show that the profitability is much lower for organic carp than for the one grown in the conventional system. The data clearly show that organic farming of carp is unsustainable without subsidies. In Romania, there is currently no difference between prices for organic aquaculture products and non-organic products. For example, the retail price for carp is 14-16 lei / kg (3.11 - 3.55 euro / kg).

Fishing techniques and ecological tools (nature friendly)

In Romania, organic fish farming has begun to develop with the implementation of funding programs that encourage this type of fish farming, namely the European Fisheries Fund - EFF 2007-2013. The funding granted was limited to encouraging aquaculture and less to developing the ecological / sustainable segment at the commercial level, especially with applicability on the Danube River.

Concerning nature-friendly fishing at commercial level, the authorities have taken a number of measures to limit the ecological imbalances created by overfishing and poaching. Thus, to restrict the population of fish, it was decided to limit, in some cases even prohibit, fishing for certain periods of time, strict rules on commercial fishing, regulation of fishing gear by fishing category and last but not least commercial fishing monitoring actions were organized.

With regard to aquaculture, the conversion process has focused on common carp, since the differences between traditional farming practice and ecological practices have not been significant.

Although Romania has transposed into national legislation the European framework for organic farming, environmental certification, the legal framework to legislate on environmentally friendly fishing gear, fishing techniques, was not identified. In the current legal framework, certified organic operators are required to produce cleaner food, more suited to human metabolism, in full correlation with environmental conservation and development, to comply with the rules on eco-labeling. One of the main purposes of organic farming is the production of fresh and authentic agri-food products that respect natural and environmental factors. At the same time, they have the obligation to collaborate with inspection and certification bodies in order to check compliance with the provisions of the legislation on organic production.

Recreational fishing has identified a number of fishing techniques and tools that can be considered nature friendly. It is also noted the emergence of ecological fishing tackle on the profile market, such as alternatives to fishing lead. Among these we mention:

Still fishing is the most practiced fishing method. This is a type of static fishing, praised in an area prepared by prior priming to group the fish once.

As an ecological alternative to classic fishing lead, the "Stonze" natural stones, produced in a wide range of weights, are used for most fishing styles.

Widespread use can have immediate beneficial effects by reducing lead pollution.

Sheffield fishing is an adaptation of stationary fishing. It is practiced with a reel and a telescopic or telescopic jaw, with telescopic rings. This offers some advantages:

- In a not too deep pond, whose bottom is on a slight slope, often more deep depths are found at 20 - 30 meters shore;
- Far off shore, the fish are less disturbed by the noise and fewer will hesitate to bite the bait.
- Large fish with relatively thin and elastic dwarf yarns can be caught (French producers write it with "anglaise", the Italians write it "affluent" and the English producers with "sinking"), then thanks to the reel brake, the thread also reserves the parabolic action of a good rope for Sheffield fishing.

Fly fishing is undoubtedly the most "green" fishing. This style of fishing has developed in the UK, Sheffield, but has spread to Europe and the world. It also represents a way of contributing to the preservation of species in the context of drowning fish in a drought-water course. Due to the absence of the hook, the fish will be released more quickly and will not keep track of the catch.

Lagoon fishing: trout fishermen often practice this fishing technique, but it can also be used for other fish species. As bait, insects, larvae and worms are found on the water's edge, which moves the hook in the water in the most natural way possible.

Itinerant fishing is a way for the fisherman to reconcile his passion for fishing and walking.

Surfcasting fishing: “ Looking for fish in the waves”, also known as “surfcasting”, is practiced from shore (sand, rocky shore) and especially from a sandy beach, with a vertically mounted pin on a stake and with a lace where the bait is attached. Wherever you fish, the material, tools and baits are basically the same. Surfcasting is based on the use of a lead rod with lead between 50 and 200 g, and then the fisherman only has to wait. If itinerary fishing can be practiced for catching small fish (eg, roach), surfcasting is generally practiced for catching fish from the edges of rivers, rivers and torrents. Often, amateur catfish fishermen use various natural or artificial baits in their search.

Bomb fishing is a relatively recent method. Biking allows you to fish far away from the shore, with light natural baits, to move the bait from a distance, and to thoroughly search for all water layers. It is an extremely effective method of catching trout from mountain chutes or lakes, but the technique is also currently interesting for the raptor catching fishermen such as catfish, pike or perch, and sometimes for the seashore fishermen. Experienced fishermen know the best fishing methods that do not have a negative impact on the environment. Given the emphasis on "green life" in today's society, it is important to ensure that each fisherman does everything he can to support fish stocks and protect wild habitats that make fishing a pleasure but also a pleasure. Here are some recommendations of good practice in the field of organic fisheries.

Lead has traditionally been used in fishing, but if the level of lead in a body of water increases, it can poison fish and other aquatic animals. It is therefore advisable to change the lead plates with environmentally friendly fishing gear that uses steel or tin and biodegradable fishing rods.

All fishermen should comply with the limits on the quantity and size of captured fish that are set at government level and assumed at local and regional level. This prevents overfishing of certain species of fish in a given area.

The fish once captured, can be used entirely in the household. What is generally thrown away can be mixed with leaves, tree bark or sawdust and used as fertilizer, because the compost thus obtained is more prone to nutrients. It is also recommended to use a small amount of bait. Types of foreign bait can affect the local ecosystem if introduced into excess water without being used. It is preferable to use live bait rather than plastic, as unused living bait can be left in the river bed. If the fisherman does not need to keep the fish, he can try to catch it and then release it to allow the fish to live and reproduce, supporting the increase in the number of specimens. For this, the fisherman needs to know the best techniques of catching and releasing the fish.

Also in favour of environment-friendly fishing, the recommendation is to use traditional boats, rowing, or canoeing in favour of motorists. This reduces the carbon footprint by reducing emissions from engine boats. However, if a motorboat is used, the use of these must be done in accordance with local rules in different habitats and in certain sectors of the shore so that birds nesting in the vicinity are not disturbed.

The Triad "Reduce, Reuse, Recycle" also applies to fishing. Awareness of the impact that waste has on the environment should cause fishermen to pick up plastic scrap, worn off gear, household waste on the banks of the river (especially plastic boxes, aluminium cans, plastic bags and packs, canned cans), because all of these not only disturbs visual and olfactory but can become traps for the animals in the area.

By applying these simple rules, the environment can be kept cleaner, and the beauty of the fish and terrestrial wildlife around the rivers will be able to enjoy, along with fishermen, the rural community and tourists who come to the area.

CONCLUSIONS

The Fish Market is the best business environment on this market by providing major benefits to buyers / traders and fish suppliers (fishermen, fishermen associations) at least at the theoretical level, given that in reality the Romanian authorities have difficulties in implementing this type of entity.

The benefits of a fish market are:
-product traceability from manufacturer to buyer (via batches and identifiers used);
-increasing the transparency of transactions on the fish market;
-stimulate competitive behaviour on the market,
-real monitoring of the quantities of fish traded;
-price monitoring on the fish market;
-applying equal and non-discriminatory treatment to all trading partners;
-the possibility to communicate with fish suppliers and to manage the real problems in the territory;
-the possibility for buyers to participate in more transactions within a short period of time;
-buyers will benefit from products marketed under optimal hygiene and conservation conditions;
-concentrating all fish resources in one place;
-ensuring compliance with quality and control procedures, hygiene standards;
-maintaining a market balance between supply and demand;
-guaranteed payment to fish suppliers.

In recent years, several fish stocks have been established in Romania through the Operational Program for Fisheries 2007-2014. Most are inoperative or provide imported fish.
The future of inland fishing depends on the protection of biodiversity, with a focus on the balanced exploitation of the fishery resource.
In principle, inland fishing is considered to be sustainable in relation to the environment if it fulfils two fundamental conditions:
- limit the adverse impact on the environment;
- ensure the conservation and preservation of biodiversity of biotopes as well as the natural restoration of exploitable fish resources;

In order to ensure the environmental sustainability for processing activities, the use of non-environmental processing technologies is required both for waste and wastewater management and for the higher exploitation of by-products, including energy.
Fishery areas benefit from exploitable fish resources as well as significant water areas that allow for various complementary activities (tourism, recreational fishing). Cultural heritage is rich in areas such as fishing, fish farming, agriculture, animal husbandry, handicrafts.

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ECOLOGICAL AQUACULTURE IN SOUTH MUNTENIA REGION

Simona SPÂNU[1], Virgil NICULA[2], Marin FLOREA[3]

[1]"Lucian Blaga" University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environment Protection, 7-9 Ion Rațiu, Sibiu, Romania, Phone: 00 40 748 675 375; Email: simona_spanu@yahoo.com
[2]"Lucian Blaga" University of Sibiu, Faculty of Economics, 17 Calea Dumbravii, Sibiu, Romania, Phone: 00 40 745 311 090; Email: niculavirgil@yahoo.com
[3]"Lucian Blaga" University of Sibiu, Faculty of Engineering, 4 Emil Cioran, Sibiu, Romania, Phone: 00 40 771 589 170; Email: floreasb@yahoo.com

Corresponding author: simona_spanu@yahoo.com

Abstract

The paper presents the sustainable fishing in relation to environmental protection, the main measures taken by the state to encourage and develop sustainable and lasting fisheries. Time series have been used with regard to the total catches of commercial fishing in Giurgiu County in 2017, total capture from aquaculture in Giurgiu County in 2017 and total catches (tonnes) reported by economic operators authorized to fish commercially in flowing waters under Romanian jurisdiction over 2008-2015. Also, statistical data on fish consumption were used including a questionnaires addressed to fishermen and aquaculture units in Giurgiu County. Last but not least, it includes assessments of ecological aquaculture, the eco-label and measures that our country takes to protect biodiversity, focusing on the balanced exploitation of the fishery resource. Conversion to organic and ecological aquaculture requires a financial support to continue to develop in Romania.

Key words: *ecological aquaculture, fisheries sector, environment protection, sustainability*

INTRODUCTION

Ecological aquaculture is a relatively new field of organic production, compared to organic farming, which has long been experienced at farm level. Given the growing consumer interest in organic aquaculture products, it is expected that the number of units going into organic production will continue to grow. This will quickly lead to the accumulation of experience and technical knowledge. In addition, it is to be expected that the planned research activities will result in the acquisition of new knowledge, in particular on restraint systems, the need to use organic feed ingredients or the stocking density for certain species.

It is necessary to provide for the development of an environmental assessment, in order to optimally adapt the space devoted to this activity to the environment and to mitigate possible negative effects.

It should be considered that such assessments should ensure that the production of aquaculture animals is not only environmentally acceptable but is, in relation to other options, predominantly consistent with wider, appropriate and sustainable public interests in environmental point of view.

Since water is a soluble environment, it is imperative that organic production units be properly separated from non-organic aquatic units. Given the diversity of situations existing in EU countries, with regard to both freshwater and marine environments, it is preferable that the separation distances are set at the level of each Member State, best placed to manage this issue, having view the heterogeneity of aquatic environments.

All EU Member States are facing shortages in the supply of organic probiotic crops. At the same time, imports of organic protein feeds are insufficient to cope with demand. The cultivation area of organic probiotics is not high enough to meet the demand for organic protein; therefore it is necessary to conditionally authorize the feeding of protein feeds from parcels in the first year of conversion.

The general principles of organic production are based on the proper design and management of biological processes based on ecological systems that use the natural resources of the system, using methods that use, in particular, aquaculture practices that respect the principle of sustainable exploitation of fisheries resources. Only in this way can biodiversity of aquatic ecosystems be maintained in aquaculture production. These principles are optimistically based on risk assessment and the use of precautionary precautions when appropriate.

Artificial stimulation of reproduction of aquaculture animals by means of hormones and hormone derivatives is incompatible with the notion of organic production and the way consumers perceive organic aquaculture products. Thus, in Europe, the maximum admissible percentage of non-organic young farmed aquaculture animals introduced in the farm was 80% in 2011, 50% in 2014 and 0% in 2015.

Given that the organic production of aquaculture animals is at an early stage, this sector also faces an insufficient availability of ecological originators. This is why it is necessary to introduce very young and non-organic specimens in the involved states. Organic aquaculture production must ensure that the needs of the animals are met, depending on the species. In this respect, growing practices, management systems and basin systems are based on meeting the animal welfare needs.

MATERIALS AND METHODS

The evolution of the means and methods in recent years in the production of aquaculture animals has led to an ever wider use of closed recirculation systems. These systems, however, depend on external inputs and have high energy consumption, but reduce waste discharges and prevent animals from escaping. In accordance with the principle that organic production must be as close as possible to the natural environment, the use of such systems for organic production is not recommended but exceptionally the use of closed systems is only allowed for artificial breeding, incubation and nursery plants.

Animal health management must be based mainly on disease prevention. Certain substances for cleaning, for treatment against organic deposits and for disinfection of equipment and/or production facilities should be allowed, but under strict control. The use of substances in the presence of live animals requires special precautions and measures to ensure that their application is not harmful.

Feed allocated to livestock in organic aquaculture establishments must meet their nutritional needs, while respecting the health requirements imposed by Community regulations in the field. Raw materials used in fish feed are recommended to be the result of the sustainable exploitation of fisheries resources or organic food from organic aquaculture sources [1].

Nutrients, water, the site chosen for the farm are the most important aspects of the ecological sustainability of aquaculture farms. Efficient use of nutrients needed for food is also essential for ecological sustainability. One of the most important elements is the reduction of food losses through an advanced feeding system and the proper selection of animal feed. The feed source used is another aspect that can contribute to ecological sustainability.

In this paper, time series have been used with regard to the total catches of commercial fishing in Giurgiu County in 2017, total capture from aquaculture in Giurgiu County in 2017 and total catches (tonnes) reported by economic operators authorized to fish commercially in flowing waters under Romanian jurisdiction over 2008-2015. Also, statistical data on fish consumption were used including a questionnaires addressed to fishermen and aquaculture units in Giurgiu County [3].

RESULTS AND DISCUSSIONS

The incipient nature of organic aquaculture and the sustainable exploitation of fisheries resources sometimes justify the inadequacy of organic food or food obtained as a result of the sustainable exploitation of fisheries resources. This is why clear provisions need to be made in the area of non-organic food use, thereby establishing sanitary rules for fish raw materials that can be used in aquaculture, but prohibiting the feeding of a fish species with fish products of the same species. It is also allowed to use under control certain raw materials used for non-organic food, certain food additives and organic auxiliaries.

In Romania, there were about 100,025 ha of aquaculture farms, structured in 84,525 ha (84.5%) and 15,500 ha of nurseries (15.5%). Virtually all of this area was used by Cypriot farms, except for a 25-hectare area of salmon farms.

In 2013, according to ANPA statistics, there are 748 aquaculture licenses for an area of 102,356 ha, of which 6,673 ha of nurseries (6.5%) and 95,682 ha of farms (93.5%). If the surface for aquaculture was largely kept within this 9-year period, there is an increase in the share of farms at the cost of nurseries.

According to the Register of Aquaculture Units (RUA), there are 518 units in the aquaculture sector, which hold 575 aquaculture farms (pond, lakes, ponds, etc.). The 518 registered units are divided as follows: 19 nurseries (holding only a nursery license); 324 breeders (holding only farm license); 175 breeders and nurseries (both holding a nursery and a farm license).

Basically, aquaculture in Romania is currently being conducted exclusively in freshwater and is technologically characterized by two directions:

- intensive growth (especially of salmonids);
- extensive and semi-intensive growth of cyprinids in polyculture, in ponds (ponds, ponds and lakes).

Growth of cyprinids in polyculture in land basins and in extensive or semi-intensive regime has the advantage of preserving the water quality in the case of extensive growth or generates a minor or negligible risk to water quality in the semi-intensive growth regime. Most aquaculture farms have a relatively long history and fit well into the natural landscape, playing an important role in enhancing ecological balances, taking over water, securing and maintaining large areas of wetlands [2].

According to the Market Survey for the Romanian fisheries sector, the structure of aquaculture production by 2005 was dominated by Cypriots, both indigenous (carp, caraway) and Asian origin (Silver carp, bighead fish, grass carp), representing 85% of the total, the remaining 15% being trout, zander, pike, perch, catfish, sturgeon, etc.

In the period 2006 - 2013, this species structure was largely preserved, the tendency being slightly increasing towards cyprinids (carp, Prussian carp, silver carp, bighead fish), representing an average of 87%, as can be seen from Table1. The remaining 13% are the other species, the most important of which is trout.

Table 1. Volume of aquaculture production by species (tonnes)

Species	2006	2007	2008	2009
Carp	3,136	3,544	3,977	4,142
Prussian carp	1,268	1,653	1,462	1,623
Silver carp	2,091	1,696	2,959	2,971
Bighead fish	894	2,056	2,228	2352
Grass carp	256	41	426	283
catfish	19	26	149	133
zander	60	93	49	45
pike	80	27	14	22
perch	7	5	1	6
trout	123	725	1,037	1,238
sturgeons	-	-	-	-
African catfish	-	-	-	-
Other species	184	446	230	316
mussels, oysters	-	-	-	-
crab	-	-	-	-
Total quantity	8,088*	10,312*	12,532*	13,131**
Species	2010	2011	2012	2013
Carp	2,888	2,652	3,266	3,395
Prussian carp	934	1,048	868	1,004
Silver carp	2,016	1,323	2,087	2,031
Bighead fish	1,020	1,289	2,110	2,110
Grass carp	84	62	182	190
catfish	164	33	43	44
zander	57	42	56	43
pike	31	34	31	28
perch	6	4	7	2
trout	1,400	1,710	1,074	1,106
sturgeons	39	19	11	16
African catfish	-	72	150	94
Other species	342	64	112	68
mussels, oysters	-	1	9	16
crab	-	-	1	-
Total quantity	8,981**	8,353**	10,007**	10,147**

Source: FAO*, ANPA**

Traditional cypher culture in land basins is compatible with sensitive habitats and provides environmental benefits and services. In many of the Natura 2000 sites in Romania, aquaculture activities are carried out, which are fully compatible with the conservation of the natural values of the sites, the most eloquent proof being the designation of the aquaculture farm as a NATURA 2000 site. Extensive aquaculture farms have become firm multifunctional where other social and environmental services are provided: recreation, biodiversity maintenance and improved water management.

In Romania, the different configuration of the relief and the variety of aquaculture potential allow the development of aquaculture forms specific to each area. Thus, if the mountainous area is predominantly salmon culture, the cyphered farms are representative in the plain and meadow areas. In addition, in recent times, irrespective of the geographical area, intensive, recirculating aquaculture farms are being developed for a wide range of crop species.

Issues related to land use planning to harness the potential of aquaculture fall within a wider sphere of sustainable development. The execution of hydro technical works (sewage installations, dams, dams, dams) have morphological, hydrological and biological consequences, which is why studies are needed to correct the disturbances created in the original natural biotopes. In this context, the protection and sustainable use of water as a living environment for fish is essential.

There is also potential for the development of organic aquaculture, niche production, such as crayfish or shellfish, as well as for the diversification of aquaculture products with valuable species of indigenous ichthyofauna (linseed, chalice) or exotic species.

Romania has the potential and resources to increase fish production in aquaculture, as it will create an economic environment compatible with that in EU countries. Exploiting the exceptional potential of aquaculture in the European context, harmonized with an appropriate legal and institutional framework, will increase the competitiveness of Romanian aquaculture.

Starting from the current problems of aquaculture, specific to the sustainable development of the sector, in line with the European Union's economic and social policy, whose main objective is to reduce disparities and reduce development gaps between regions, investments have been promoted since 2007 through public and private participation.

Restructuring and modernization processes were imposed because in the area of aquaculture, the main added value of the primary sector (aquaculture) at the level of all the regions of the country was lower than that of the secondary sector (the fish processing industry). Primary sector values reflect the very low level of labour productivity due to poor equipment and equipment, excessive fragmentation of privatization and poor management of some private aquaculture farms.

Another phenomenon present in current aquaculture is the growing population/ repopulation of aquaculture farms, as owners are interested in turning traditional aquaculture farms into recreational / sport fishing. Thus, many artificial breeding stations of cyprinids have lost their activity. This situation was also determined by the lack of capital for the annual purchase of pre-developed larval and brood and market orientation towards imports.

At the South-Muntenia Region level, 12 farms for aquaculture were established since the NRDP 2007-2013, the most numerous being located in Prahova County (5 of which 2 for practicing sturgeoning, 1 for floating fish in floating life, 1 (3 salmon farms) and Dâmboviţa County (2 intensive sturgeon farms), and the least in the Călărași and Teleorman counties (as a percentage of the total number of cyprinids in polydropon and 1 salmonic farm). On Measure 2.1.2, 10 projects were implemented in the region on 8 aquaculture farms, in Călăraşi and Giurgiu being two companies that have repeatedly accessed funds. According to the crop species, 8 projects were carried out in 6 cypheric farms, one for the completion of a salmonic farm and one for a sturgeon farm.

Areas that are favourable areas for the development of aquaculture are mainly represented by:
-untapped areas: abandoned aquaculture farms; natural lakes and reservoirs; certain areas of the watercourses, rivers and the Danube River; small areas having access to quality water, conducive to the establishment of recirculating aquaculture farms;
-landscaped but inefficiently exploited: partially productive aquaculture farms due to stuffing, clogging, etc.
The untapped potential of Romanian aquaculture is represented by: unproductive aquaculture farms; storage lakes; abandoned irrigation channels; exploitation of abandoned ballasts, etc.
Natural and anthropic freshwater ecosystems, both for direct and aquaculture in floating life, are represented by:
-permanent rivers (including the Danube River) - for the application of the technologies for the cultivation of the reophyll species;
-natural lakes or storage lakes - for the application of stagnant species culture technologies.
The reasons for non-productive aquaculture farms are:
-farms are undergoing redevelopment - modernization works are being carried out, dykes reconstruction, hydro technical works etc .;
-the farms were left without water after interventions/work at the source of supply or emptying for unblocking;
- investments in progress (new, still under construction, evidence or not in operation);
- farms belonging to some economic agents who have ceased their activity; firms in bankruptcy / insolvency;
- farms in conservation;
- non-concessional farms;
- companies in litigation/ judicial liquidation, with assets purchased by various economic agents, with facilities put up for sale by ANAF.
There is a category of economic agents who hold farms that are active, do not practice aquaculture, but only recreational/sport fishing. In the South-Muntenia they have identified 35 farms unproductive for aquaculture, the most numerous being located in Călăraşi (20), followed by Ialomița (5 farms) and Prahova (with 3 farms in each county). In the Argeş and Dâmboviţa counties, unproductive surfaces are negligible. In Călăraşi County, from the total non-productive area (approximately 443 ha), the largest is an abandoned steel basin (50 ha), the rest being smaller areas, fragmented on different farms. A special situation has been found in the County the farmed salmonids where no water left in the reservoir as it is emptied in order to supply the clogging, and to resume the feed pipes is necessary to construct a new river Ialomiţa.
The analysis of aquaculture needs based on the options received from key stakeholders in the sector concerned, on the one hand, a SWOT analysis for each development region and, on the other hand, the need to make production more efficient, how to use allocated funds and action lines/State intervention measures in close alignment with EU priorities [1]. The analysis of encouraging environmentally sustainable, resource - efficient, innovative, competitive and knowledge-based aquaculture in the South Region identified a series of needs on three levels:
- making production more efficient, proposals on how to use the funds and the action lines / state intervention measures that are outlined below:
- making investments for the re-technologic of production activity in aquaculture, making new investments;
- investments in the realization of the specific infrastructure: roads, warehouses, processing capacity;
- sustained efforts at national level to promote the consumption of fish and fish products and to inform consumers about the organoleptic characteristics of the different species of fish grown in aquaculture farms;
-proper labelling of fish products, with indication of provenance, implementation of quality standards for aquaculture products;
-financial support for research in the aquaculture sector: achieving efficient feeding recipe, developing laboratories for water quality control for aquaculture, development

of ihtio-pathological specialists for the monitoring of fish diseases;
-elimination of unfair competition, achievement of producer associations.
- proposals for the allocation of funds
- allocation of funds for the re-technologic of aquaculture farms;
-allocation of funds for the construction of new aquaculture farms;
-allocating funds for primary storage and processing capacities at farm level;
-allocation of compensation funds as a result of the action of protected ichthyophos birds;
- allocation of funds for a fish stock.
-the needs identified at national level for encouraging environmentally sustainable, resource-efficient, innovative, competitive and knowledge-based aquaculture support the achievement of both new investments and investment in the rehabilitation and modernization of farms existing aquaculture, taking into account the existing productive potential, by:
-the implementation of new aquaculture technologies (including ecological and intensive), competitive with those in EU Member States;
-introducing new species (from the endemic and not only panel) with good market prospects;
-implementation of new technological equipment in aquaculture;
-making investments to improve infrastructure in aquaculture farms (aquaculture facilities, hydro-technical installations and constructions, technological roads, warehouses, etc.);
-introduction of new species with high productivity, short growth cycle and good market prospects;
-developing technologies in traditional aquaculture;
-adopting a code of good fish farming/ aquaculture code and associating compliance with this code with a label / logo / brand;
-creating producer associations to streamline both inputs and outputs.

In addition to these main needs and identified as common in most development regions, there are a number of technical/technological needs, such as:
- the need to inform the general public on the benefits of fish consumption and, on the other hand, the actors involved in this activity, producers - producer organizations on the latest innovations in the field, new technologies, equipment and cutting-edge machinery, new treatments applied in aquaculture farms, etc. This is basically determined by the lack of collaboration between the central authorities in charge of the sector, the research activity in the sector and producers / producer organizations;
 the need to specialize the lucrative staff in aquaculture farms, both for technology engineers and for skilled workers;
-the need to support research in the aquaculture sector with a view to developing new techniques and technologies that are appropriate to be applied in each region of the country, drawing up regional regulations in the light of current aquaculture conditions and not last but not least, technological transfer to producers in order to develop a competitive and sustainable aquaculture.

Similar to the investment needs of the sector, granting state tax incentives to stimulate the development of the aquaculture sector is an important necessity in all development regions. Producers in the sector feel discriminated because other areas of activity in the large branch of agriculture (animal husbandry, agricultural crops, vegetable growing, etc.) also benefit from tax incentives.

From the point of view of the administrative needs, identified at the regional levels, it is remarked:
-the need to increase and make transparent the dialogue between authorities and producer / producer organizations in order to make more efficient the problem solving in the sector;
-stimulating the consumption of fish among the population by applying communication and marketing strategies at all levels of the country;
-implementing an effective control and inspection system that, on the one hand, protect aquaculture farms against fish theft and, on the other hand, identify aquaculture farms conducting their productive activity;
- stimulating research on aquaculture;

In order to make aquaculture activities more efficient, producers / producer organizations in all development regions support the need to allocate funds for the rehabilitation and modernization of existing aquaculture farms, including the abandonment of abandoned farms [4].
For the aquaculture sector at regional level, the following needs were identified:
-developing the processing and marketing capacity of the fish produced, while promoting the consumption of fresh domestic fish;
-granting compensations as a result of the action of the birds protected on all farms;
-harmonizing the funding ceiling so that a maximum number of aquaculture farms can be funded;
-increasing the financial allocation for pilot projects to be carried out only in partnership with research institutes, whereby the new technologies identified as generating higher profits are tested at macro level;
-financial support for the setting-up of producer organizations.
Recognizing that European aquaculture needs support for its development, four priority action lines are identified to unlock the potential of European aquaculture: simplification of administrative procedures, coordinated spatial planning, competitiveness and a level playing field.
In this context, the general objective of developing Romanian aquaculture is to stimulate environmentally sustainable, resource-efficient, innovative, competitive and knowledge-based aquaculture:
-modern aquaculture is an essential area for the sustainable development of the fisheries sector, which is why specific activities must undergo a process of technical and technological modernization, through investment and innovation, through a more efficient management of financial, material, aquatic and human resources, such as and through the transfer of scientific knowledge, in the field of applied and managerial research, with strict respect for environmental conditionality and biodiversity;
-the viability of aquaculture involves commercial competitiveness, economic and financial profitability and environmentally sustainable activities;
-the competitiveness and profitability of operators, including SMEs, are conditioned by increased consumption of fish and fish products by the population, increasing demand by the processing industry and demand for fishery products on EU and non-EU markets.
These conditional factors have as a basis for their activation the existence of a permanent and increasing offer of high quality fish and affordable unitary price. Given that the supply of fish caught by fishing is limited for reasons of maintaining aquatic biodiversity, species perpetuation and overexploitation through fishing, the increase in supply of fish as close as possible to demand can be achieved by modernizing, rehabilitating or expanding farms of existing aquaculture and the construction of new farms. This obliges public authorities responsible for a global territorial approach to the development of aquaculture, which implies the identification and mapping of aquaculture areas; in which aquaculture was practiced and activity was abandoned; favourable to aquaculture activities by setting up new farms.

CONCLUSIONS

Promoting environmentally sustainable aquaculture and ecological aquaculture ensures the protection, conservation and restoration of biodiversity in aquatic ecosystems, and conversion from traditional aquaculture to ecological aquaculture, requiring financial support and compensation for losses during conversion to organic aquaculture.
The competitiveness of aquaculture is also ensured by the quality of human capital involved in the relevant activities of this field. In this regard, the strategy envisages a sustained intervention to increase the qualities and professional competencies of all categories of staff working in this important fisheries area which target specialized education activities organized within the fisheries, zoo technical education units and /

or of veterinary medicine, as well as continuous training for all categories of staff.

Given that the financial availability of aquaculture operators and those wishing to develop a business in this sub-area is in most cases limited in order to ensure co-financing of investments in aquaculture, it is intended to facilitate access to financial resources complementary banking through financial engineering techniques. The key condition for financially supporting the development of the aquaculture sector is strict compliance with relevant national and EU regulations.

The European Commission has committed itself to implementing a coordinated management plan at different levels without compromising the objectives of the Birds and Natura 2000 Directives, which also protect fish stocks and aquatic ecosystems. It is envisaged:

-the numerical increase of the aquaculture farms, respectively the afforested area, implementing additional environmental measures;

-support by granting compensation to aquaculture farms located in and around Natura 2000 sites;

-support for aquaculture farms providing social and environmental services, ecological tourism, recreational / sport fishing, educational activities related to knowledge, protection and conservation of aquatic biodiversity, improvement of water management;

-the use of multispecies populations that increase the quality of production;

-periodic maintenance and hygiene of aquaculture basins (discoloration).

The sustainable development of aquaculture is one of the main priorities of the EMFF. The money allocated to this priority may include:

-innovative equipment investments, upgrading to improve productivity, to limit negative environmental impacts and maximize positive effects;

-farm management and consultancy services;

-training and certification of staff;

-identifying and mapping appropriate aquaculture areas to improve territorial planning;

-support for new farmers entering the sector;

-consultancy and support for conversion into environmental management schemes;

-the provision of additional environmental services in favour of revenue growth based on production;

-eradication of diseases and schemes to improve the health and welfare of animals.

For 2014-2020, approximately 20% of the European Fisheries Fund and Maritime Fund (FEPAM) funding is planned to be invested in the aquaculture sector. Each Member State has developed an operational program which is then adopted by the Commission and outlines how funding from both national and EU sources will be geared towards the strategic priorities for sustainable jobs and growth in the aquaculture sector, in line with multi-annual strategic plans.

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PROSPECTS OF EMPLOYMENT OF DEGRADED ARABLE LANDS IN UKRAINE

Nataliia STOIKO, Olha STADNYTSKA

Lviv National Agrarian University, Ukraine, 1, V. Velykoho str., Lviv Region, 80381, Ukraine, Phone: +38 032 22 42 961; E-mails: n_stoiko@ukr.net, olysyy@email.ua

Corresponding author: n_stoiko@ukr.net

Abstract

Degradation of arable lands makes ecological and social-economic threats for sustainable development of rural territories in Ukraine. The most spread kinds of degradation of arable lands are water and wind erosion of soils. To solve the problems of land and soil degradation, the national ecological policy expects reduction of the area of degraded arable lands by conservation and improvement of the directions of economic activity on rural area. The present research gives argumentation of such alternative directions of employment of degraded arable lands as growing of energy willow and hazelnut, sowing of perennial herbs for production of forage and honey. Evaluation of the projects efficiency is made according such criteria as net present value, profitability index and payback period. Calculations prove reasonability of investments into alternative employment of degraded arable lands. Ecological benefits of the projects implementation include anchoring of the soil top layer with root systems of plants on erosion-dangerous land parcels; enrichment of soil cover layer with nutrients under perennial herbs; raise of biological diversity of the territory. To improve the directions of economic activity on rural area it is recommended to introduce grant-project form of development of territorial communities.

Key words: *degraded arable lands, alternative directions of activity, efficiency, sustainable development, rural territory*

INTRODUCTION

Reclamation of degraded lands and soils, as well as efforts of the whole world not to deteriorate land conditions, are the main tasks of sustainable development of society [26].
In the global context, solution of the problem of land degradation needs application of the approach, which is focused on synergy and interrelations of such tasks as stop of the processes of land degradation, protection of biological diversity and control for climate changes. It means that measures, intended to stop land degradation, should improve the situation with biodiversity of territory, climatic changes and vice versa. However, the problem should be solved at a local level, considering particular conditions and reasons of degradation progress. It is necessary to plan local solutions concerning land protection and improve local policy of land resources management [9].
Soil degradation is the main negative process of land degradation, which causes deterioration of its useful properties and fertility. It is a result of a complex effect of natural and anthropogenic factors. Soil degradation started its accelerated development in the 20th century due to intensification of agriculture, urbanization and cutting down of forests. The heaviest soil degradation is observed on arable lands in the form of water and wind erosion [13] [22].
According to the data of Food and Agriculture Organization of the United Nations (FAO), in Ukraine soil erosion causes annual loss of 300-600 million ton of soil. Total area of degraded and low-productive arable lands constitutes more than 6.5 million ha. It causes decrease of yield of agricultural crops and losses due to under-production in the amount of above 20 billion UAH (approximately USD 759 million annually) [7].
Conservation of arable lands, which is done by withdrawal of them out of economic use for a definite period or for permanent through grassing or forestation, is an important measure to protect agricultural landscapes and to stop degradation processes of soil [4]. Nowadays, in many countries, land

conservation is done to protect not only soils and agricultural lands, but also to increase biodiversity of the territory. In spite of the fact that conservation of arable lands excludes their intended use, landscape approaches to land protection still have not only ecological but also economic and social benefit in the form of ecosystem services, secured by the nature (food, fibre and fuel, natural medicine, fresh water, climate regulation, pollination, erosion control, recreation and tourism, aesthetic values, etc.) [8] [24].

In Ukraine, solution of the problem of land degradation and security of sustainable development of the territory also expects a set of tasks of ecosystem character, in particular, reduction of the area of degraded arable lands through conservation and improvement of the directions of economic activity on rural territory [2]. However, although intensive use of degraded arable lands is of poor efficiency, alternative kinds of activity on rural area of Ukraine are introduced at slow rates, and land grassing is an unfavourable way to employ erosion-dangerous land parcels.

The aim of the research is to argue alternative directions of employment of degraded arable lands, which will support sustainable development of rural territories in Ukraine.

MATERIALS AND METHODS

The research is based on one of the principles of the sustainable development concept, i.e. “to secure a sustainable and long-term character of development in order to meet needs of people, living now, along with the possibility of future generations to satisfy their needs” [12]. The work also employs the idea of ecosystem approach as a strategy of integrated management of natural resources, which secures preservation and sustainable use of the resources in a justified way [23].

Intensive employment of arable land is considered as an economic use of land parcels in the ways, causing deterioration of soil quality (system plowing of erosion-dangerous area, violation of soil-protective requirements of arable farming, employment of degraded lands).

Alternative directions of use of degraded arable lands include:
-growing of energy crops;
-growing of perennial plants;
-sowing of perennial herbs for forage production;
-sowing of perennial herbs for honey production.

Financial efficiency of the projects implementation is examined under conditions of the Western region of Ukraine for four enterprises in Lviv region, where arable lands suffer from the different kinds of degradation, i.e. water erosion on slopes, wind erosion on the land parcels with the soils of light mechanical content (deflation), water-logging of lands.

To estimate investment projects, the following dynamic indicators are calculated, particularly net present value, profitability index and discounted payback period [27]:

$$NPV = \sum_{t=1}^{T} \frac{CF_t}{(1+d)^t} \qquad (1)$$

$$PI = \frac{\sum_{t=1}^{T} \frac{CF_t}{(1+d)^t}}{\sum_{t=1}^{T} \frac{I_{ut}}{(1+d)^t}} \qquad (2)$$

$$DPP = \frac{\sum_{t=1}^{T} \frac{I_{ut}}{(1+d)^t}}{\sum_{t=1}^{T} \frac{CF_t}{(1+d)^t}} \qquad (3)$$

where:
NPV – net present value, UAH;
PI – profitability index;
DPP – discounted payback period, years;
CF_t – cash flow in a year t, UAH;
d – discount rate per annum;
I_{ut} – investment expenditures in a year t, UAH;
t – serial number of each year;
T – period of the project implementation, years.

Financial efficiency of implementation of the projects was estimated under conditions of the western region of Ukraine (Lviv region), where one can widely observe such kinds of degradation of arable lands as water erosion on slopes, wind erosion on the land parcels with the soils of light mechanic content, acidification of soils and waterlogging of lands.

Aggregate and order of the technological processes, which are necessary to be performed in the process of implementation of each project, are defined on the base of a detailed study of scientific works, regulatory documents and reference books in the mentioned field.

Production expenditures are determined by materials expenses, expenses for labor payment, depreciation costs and general production expenditures. Expenditures for payment and material expenses for fuel are calculated on the base of acting norms of production, time, and fuel consumption in agriculture of Ukraine [20]. Amount of other material expenditures is calculated on the base of acting market prices. General production expenditures are taken in the size of 30% of the amount of annual labor payment. Depreciation costs are calculated by production method. Income is determined at minimum values of the indicators of yield capacity and sale prices for each kind of products.

A rate of discounting of money flows is calculated by the method of cumulative construction by adding compensations for different risks to a risk-free basic rate (Table 1).

Table 1. Calculation of discounting rate

Rate and compensation	Value, %
Risk-free basic rate	4.2
Compensation for risks, particular for the branch	1.0
Compensation for differences in liquidity of investment	3.0
Compensation for the necessity of investment management and competent management of assets	1.0
Compensation for inflation processes	3.0
Total	12.2

Source: the author's personal calculations

A risk-free basic rate is defined as an average rate for currency deposits of ten commercial banks of Ukraine. Compensation for a branch risk is determined on the base of the norms of the Fund of State Property of Ukraine [1]. Compensation for risks of investment liquidity is set on the ground of the fact, that investments into purchase and development of a land parcel are relatively liquid within the qualification group of the estimated object, while having less liquidity, as comparing to bank deposits [5]. Value of compensation for the necessity of investment management considers available or absent competent management. Concerning a high rate of growth of the prices for goods and services, a correction for inflation processes has been made.

RESULTS AND DISCUSSIONS

Project 1. Growing of energy crops

The project is intended for a farming enterprise under administration of Rozvadiv village council in Mykolaiiv district, Lviv region, which employs 34.6 ha of arable lands with water-logged soils.

The project takes energy willow as its object, which is unpretentious to soil conditions, enriches soil with minerals, microelements and nutrients of natural origin, has a high yield capacity on well irrigated lands. Willow is also used as an anti-erosion means for anchoring of soil and as a natural filter for its purification. Degree of land exhaustion by willow is 3-5 times lower than by cereals. Besides, almost 60-80% of nutrients come back into the land with fallen leaves [10] [21].

Time horizon of the project is 28 years. It is planned to get yield of willow every three years, i.e. nine times during the period of the plantation existence. Expected yield capacity of energy willow is taken as 60 ton/ha in the first and ninth cycles, 70 ton/ha in the second and eighth ones, and 80 t/ha in other cycles.

Project 2. Growing of perennial plants

The project is intended for a farming enterprise under administration of Poharysko village council in Zhovkva district, Lviv region, which employs 12.0 ha of arable lands with deflated soils.

Hazelnut tree has been chosen as an object for the project. Comparing to other perennial plants, it is unpretentious to the quality of soil (but acidic, salinized and waterlogged ones) and microclimatic characteristics of territory.

Root system of nut crops has high anti-erosion properties, supplying conditions for the soil protection from degradation. Placing of a nut orchard on 3-6° slopes enables easy maintenance of the soil and simplifies shipping of nuts. Establishing an orchard on 7-20° slopes, it is necessary to keep to the requirements of anti-erosion protection. The project also considers a great demand for nuts at the domestic and foreign markets [14] [19].

A minimum time horizon of the project is 75 years. Every 25 years, i.e. three times during the period of the plantation existence, it is planned to make surgery with total cutting of a tree. A crop starts to bear fruits on the fifth years. Performing the total complex of measures concerning maintenance of the hazelnut plantation it is possible to obtain 5 kg of nuts from each tree starting from the 5th to the 10th year of fruit-bearing, 8 kg – from the 10th to the 20th year and 6 kg – from the 20th to the 25th [11].

Project 3. Sowing of perennial herbs for forage production

The project is intended for a farming enterprise under administration of Remezitsi village council in Zolochiv district, Lviv region, which employs 16.2 ha of arable lands with eroded soils.

Herbage and hay of perennial herbs are characterized with high feeding qualities. Nutritive value of 1 kg of hay constitutes approximately 0.52 feeding unit. Cubes and granules are not of less nutritive value than oats [3]. It can secure the branch of animal breeding with cheap and appropriate feeding base. At the same time, perennial herbs improve soil fertility, protect it from wind and water erosion, positively influence soil cultivation. According to the data of scientific and research institutions, after three-year growing of perennial herbs, amount of humus increases by 0.3-0.4%, a share of nitrogen in the soil by 150-200, sometimes 300 kg/ha. A share of calcium and other substances, contributing to intensification of structural soil aggregates, also increases [25].

Time horizon of the project is 8 years. It is recommended to sow multi-component legume and cereals herb mixtures: meadow clover, esparcet horned, meadow carmine, red chaff, with the sowing norms of 5 kg/ha, 8 kg/ha, 5 kg/ha and 9 kg/ha respectively. Such herb mixture is more resistant to unfavourable conditions, creates a dense turf, structuring the soil, and secures obtaining of forage with balanced nutrients. To reduce surface flow of melted and rainwaters, the soil is recommended to be cultivated across the slope or by contour. To support high productivity and durability of grass stand, it is necessary to apply mineral and organic fertilizers. Starting from the second year, it is recommended to make overgrazing on the places of grass stand destruction with the norm of 5-10% of the total area of cropping.

Preparation of hay should be done in the first year, making two mowing’s in a season. Under performance of a complex of crop-engineering and agro-ameliorative works, cultivated hayfields can supply 10.0-13.0 ton/ha of dry weight of grass [18].

Project 4. Sowing of perennial herbs for honey production

The project is intended for a farming enterprise under administration of Nadychi village council in Zhovkva district, Lviv region, which employs 6.7 ha of arable lands with eroded soils.

Sowing bee plants with different period of flourishing and different productivity, it is possible to create a honey-producing conveyer, which will secure bee-families with honey yield during the whole season.

White sweet-clover is taken as a perennial and bee plant for the project. It is also good for vegetative reclamation. The plant is unpretentious to soil fertility. It grows well on light sandy, not deep carbonate, rocky soils and black alkali, on hilly area and washed-out slopes of ravines, where it is necessary to introduce anti-erosion measures. Sweet-clover also enriches the soil with organic substances and improves its structure [15] [17].

Time horizon of the project is 5 years. Sweet-clover starts to flourish on the second year after sowing. Thus, it is rationally to sow it along with phacelia, i.e. an annual bee plant in order to yield nectar in the first year. Sweet-clover does not need specific agro-technical measures. However, under application of mineral fertilizers, the plants grow higher, increasing their honey yield. To regulate the period of honey yielding, vegetation is mowed twice a season. It is planned to pump honey three times a year. Maintenance of one hectare of sweet-clover plants needs two bee-families [6]. It is expected to gather 250-350 kg of honey from one hectare of phacelia, and 300-500 kg of honey from one hectare of sweet-clover.

Efficiency of the projects is measured at minimum indicators of production expenditures, expenses for labor payment, yield capacity and sale prices for products (Table 2).

Table 2. Main criteria of projects evaluation

Project	Index		
	Net Present Value, thousand UAH/hectare	Profi-tability Index	Payback Period, years
Project 1	35.11	1.08	5.9
Project 2	1460.83	21.8	4.6
Project 3	25.67	1.65	2.3
Project 4	36.79	9.8	1

Source: calculated by the author.

Analysing the obtained results, one should mark that each project is profitable for capital investments. Index of the net present value proves that revenues from investments are enough to meet the expenditures and to increase income within each project. In all variants, profitability index is above one, i.e. profitability rate of all projects exceeds the common rate of discounting, i.e. 12.2%. Evaluation of the project according to payback period of investments confirms that the most attractive is the variant of use of degraded arable lands for honey production, because in the first year of the project implementation, amount of income equals the amount of investments into the project.

To stimulate farmers to diversify their production, it is necessary to introduce a grant-project form of development for territorial communities [16]. Advantages of such approach are revealed in its multifunction (solution of some primary tasks), collectivity (consideration of the interests of the community majority), an opportunity to attract different sources of financing (funds of local, regional and state budgets, funds of private domestic and foreign investors, money of international organizations and funds) by means of transparent and open selection.

CONCLUSIONS

To sum up, introduction of alternative directions of use for degraded arable lands, which expect combination of environmental measures and ecologically focused commercial activity, will secure solution of both ecological and social-economic problems of a region.

The authors of the work have studied four variants of alternative use of degraded arable lands with different economic intention, but similar ecological target, i.e. to protect soil from degradation, first from erosion.

Although estimation of the investment projects is a little subjective one (for example, it does not concern conjuncture of the market, logistics), the authors of the research consider the projects are attractive for implementation within the policy of integrated management of rural territories. Planning development of the territories it is important to take alternative directions of use for degraded arable lands as one of possible ways to solve the tasks concerning stimulation of development of small and medium business on rural area, support for alternative power engineering, development of ecological network and protection of biological diversity.

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ELECTRONIC AGRICULTURAL MAPS FORMATION ON THE BASIS OF GIS AND EARTH REMOTE SENSING

Nazar STUPEN[1], Mykhailo STUPEN[2], Oksana STUPEN[2]

[1]Lviv Polytechnic National University, Ukraine, 6 Karpinskogo Street, Lviv, Lviv region, 79000, Ukraine, Phone: +38 032 258 26 98; E-mail: nazstupen@gmail.com
[2]Lviv National Agrarian University, Ukraine, 1, V. Velykoho str., Lviv Region, 80381, Ukraine, Phone: +38 032 22 42 961; E-mails: zemdek@ukr.net, oksanashufryn@ukr.net

Corresponding author: romomas@ukr.net

Abstract

The article is dedicated to the introduction of mapping methodology of the use of agricultural lands based on GIS and Earth remote sensing from space. In the article, the theoretical and methodical positions and features of complex agricultural mapping are formulated, the method of geo-information mapping of agricultural land holdings and land uses with the use of data of Earth remote sensing from space is developed. It is proved that the technological scheme of creation of electronic agricultural maps represents a complete cycle of creating maps and includes the following stages: the preparatory stage, the stage of fieldwork, the stage of map creation. Particular attention is paid to the stage of map formation, in which the content and database of created maps are developed. It is established that work on map layout may be performed after the steps of forming layers, processing of map symbols libraries, development, and filling of databases, and also the formation of layers of thematic elements. The content of agricultural maps is a collection of agricultural complexes, objects associated with them for agricultural development of the territory of the agricultural business, and thematic elements, used to create a complex agricultural map. An approximate content of thematic elements of the agricultural complex map, consisting of agricultural complexes and agricultural infrastructure is defined on the basis of the development of theoretical foundations. A complete list of the semantics of layers of a complex agricultural map is presented.

Key words: *geo-information, technologies, agricultural land use, complex agricultural map, semantic database.*

INTRODUCTION

Agricultural land is the most valuable resource for Ukraine. The condition and methods of using agricultural lands are very rapidly changing; therefore, the creation of a mapping database of agricultural land-use becomes more relevant. Mainly, electronic land-use maps are created using a variety of sources, including cartographic, statistical, data of Earth remote sensing and other source data.

To increase productivity, quality and stable development of agricultural production in Ukraine is possible only on the basis of modern technologies. A successful solution to this problem requires agricultural mapping, which is the main tool for displaying the state of agricultural infrastructure and the results of agricultural inventory. That is why the paper presents a methodology and technology for the creation of complex electronic agricultural maps using GIS-technologies and Earth remote sensing from space.

Methods of geo-information mapping of data of Earth remote sensing from space are reflected in the works of many Ukrainian and foreign scientists: T.V. Vereshchaka, Yu.F. Knyzhnykov, S.S. Kokhan, Yu.O. Moskalenko, A.A. Aliabiev, O.V. Barladin, A.S. Belward, Dr. Kuldeep Pareta and others. The methodology of geo-information cartography is fully developed by M.N. Mers, Yu.O. Karpinsky, S.M. Polchyna, I.S. Kruhlov, R.I. Sossa, J.D.Vitec, M.S. Reed and others. The theory and methods of agricultural mapping are considered in the works: O.M. Berliant, Yu.S. Bilych, E.L. Bondarenko, T.I. Kozachenko, D.M. Kurlovych. Regarding the mapping of land at the level of administrative-territorial units, we note the works of V. V. Razov, I.P. Kovalchuk, S.N. Serbeniuk, L.A. Shuaib, I.P. Williamson.

The activity of the above-mentioned scientists of Ukraine and the world shows the important role of the maps of natural resources as information support in solving problems in the field of economic planning and rational use of territories. However, the issue of integrated mapping of agricultural land uses still remains unexplored.

The state of cartography of agriculture in Ukraine demonstrates the lack of integrated agricultural maps that reflect the interconnection of agricultural land uses and objects with natural and socio-economic conditions. In addition, agricultural maps of analytical type are insufficiently presented reflecting the qualitative and quantitative indicators of agriculture in Ukraine. Thus, the development of the content and technology of creating agricultural maps becomes especially relevant to the tasks of thematic mapping. Solving this problem requires the development of a modern scientific and practical basis for optimal compilation and operational updating of cartographic works, as well as the creation of up-to-date databases for management by agro-industrial complex.

MATERIALS AND METHODS

The study is based on data provided by the Ministry of Agrarian Policy and Food of Ukraine, in particular, planning-cartographic materials, including agricultural maps, geographical coordinates of objects of agriculture and other.

Comprehensive study of the technology of creating agricultural maps involves the use of satellite data various spatial resolution and cartographic materials of the appropriate scale. This approach allows us to trace the characteristic flood processes at various levels of coverage – global, regional or local. Data of Earth remote sensing and geo-information systems (GIS) are the basis for the creation of integrated electronic agricultural maps. The method of creating such maps usually includes the following 4 steps: preparatory; fieldwork; data processing; map creation.

RESULTS AND DISCUSSIONS

The importance of geo-information mapping of land resources and administrative areas is conditioned by several reasons: 1. The need for obtaining a comprehensive information on the current land resources and administrative area, the nature of use, existing problems of land use; 2. lack of modern diversified information on the state and features of soils, natural resources and administrative districts complication of its obtaining; 3. dynamic changes that occur in the structure of land resources, their use at contemporary phase of social relations development [6]; 4. the necessity of information and analytical support (in the form of a complex atlas) of the rational use of lands protection against the degradation processes [6].

These problems are particularly important for most of the administrative districts of the state, in which the dominant type of land use is agro-industrial activity[9].

Currently, there is the problem of the mapping of land resources in Ukraine, primarily the territories of administrative districts, rural councils, agro-business, and different types of management and ownership forms. Most (more than 70%) of all cartographic materials of different scale were created 15-25 years ago and they are outdated [13].

Creation of complex agricultural maps is impossible without using GIS-technologies. Particularly, the application of GIS-package "Digitals Professional" and other software provides new opportunities for reflection of quantitative and qualitative information on the properties of soils and land and resource potential, the efficiency of its economic use, etc. The availability of specific programs and modules enables the introduction, analysis and visualization of diverse geospatial information on the state of soil lands, decoding aero and space images in order to study the structure of land use and its dynamics, create interactive models for the development of exogenous processes and soil contamination, generalize and visualize statistical data, manage geospatial data and geo-database, make adjustments and improve its electronic map model [7].

The preparatory stage for the creation of a complex electronic agricultural map: the development of a map program is being conducted, its purpose is being formulated, and the collection of input data used to create agricultural maps is being done. After these actions, preparations are made for geo-information mapping, which requires the selection of software for laboratory work in the creation of a map, as well as the choice of mathematical basis (scale, projection, layout). In Fig. 1 the technological scheme of the preparatory stage during the creation of a complex agricultural map is demonstrated.

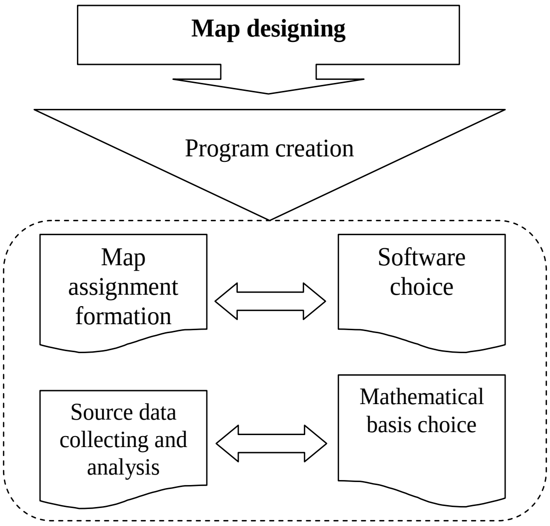

Fig. 1. Scheme of conducting the preparatory stage of creation of a complex electronic agricultural map
Source: author's development.

The stage of the field work is carried out by coordination, filling out a field survey journal, photographing of objects on the locality, linking of the results of the field survey to the map (Fig. 2).
Coordination of objects on the locality is the getting of geographic coordinates in the selected coordinate system using the GPS (Global Positioning System) technologies that, when scheduled, have an accuracy of 0.005 m + 1 mm / km, and at an altitude of 0.010 m + 2 mm / km at good weather conditions. This corresponds to the precision of the used topographic basis at a scale of 1: 100,000, while the selected system of coordinates USK-2000 is built into the set of coordinate systems of the device.
The following information: number of points; data; the state of the field; coordinates of the shot point; the number of the field photo; description of the object is provided in the field journal. To perform the linking of a field survey data to the map, the field journal is done in electronic format using software Microsoft Excel. The data table is filled in the same order as in the field journal. Next, the data table, using the software "Digitals Professional", is loaded into the computer and as to coordinates of points in the table, points are created on the map (in the system of coordinates USK-2000). The obtained result will have the Digitals Professional format with extension (* gbd). For the convenience of comparing field data with other data, the extinct result is exported to a file format (* in4), which makes it possible to use them in other GIS, in particular, "Digitals", "Geo-project", GIS, "Map", etc. [8]. The Digitals Professional program provides the ability to use various vector formats for export and import (* dxf, * mid / mif, * srr, * dgn, * txf, * tif, * bmp, * jpg) [2].
The technological scheme of the implementation of the stage of field work to create a complex agricultural map is presented in Fig. 2. The production stage includes a significant list of works for the creation of maps using GIS-programs. The work is carried out in GIS Digitals Professional and Geo-project. The scheme of implementation of the production stage is presented in Fig. 2.

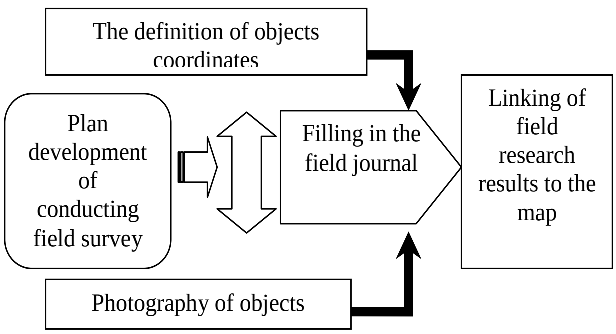

Fig. 2. Technological scheme of creation of complex electronic agricultural map at the stage of field works
Source: formed by the author.

The stage of map formation includes a full range of works for its creation, which is carried out by GIS programs. These works are convenient to form in the GIS MapInfo

Professional and Geo-project. The technological scheme of the stage of map creation is shown in Fig. 3. A digital topographic map is created using the AutoCAD Map 3D 2011 program, which is a platform for creating and managing map data. In our case, for its use, it is necessary to convert the shape file (*.shp) into a format for further processing. To do this, the Mapinfo Professional program is used with the help of the FME Quick Translator tool; when converted, all graphical and attribute data of the topographic map are saved.

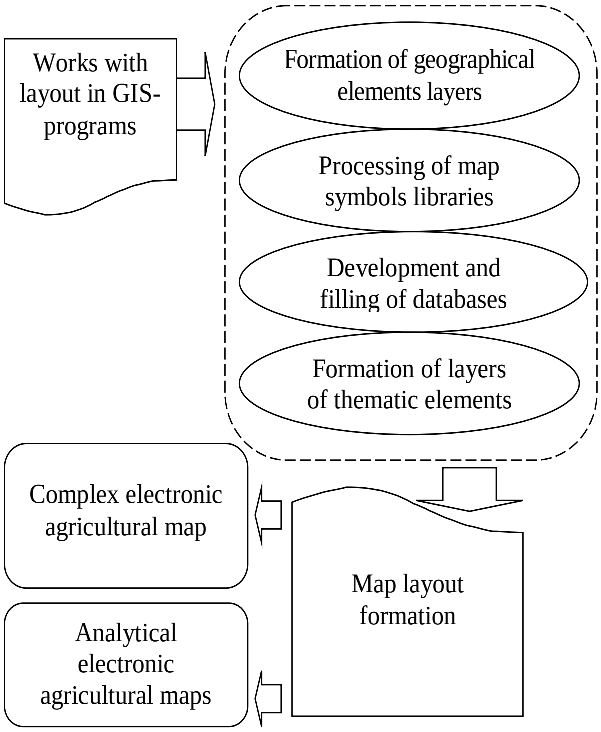

Fig.3. Technological scheme of the stage of map development in GIS programs.
Source: formed by the author on the basis of data [1].

When forming the legend of geographic objects and complexes, a standardized library of map symbols applied to create topographic maps with a scale of 1: 100,000 is used. When forming legends of thematic content, the ESRI library of map symbols, implemented in the ArcGIS 10.1 program, is used [11].

The development of the content of a complex electronic agricultural map is the main process of mapping. The content of the map is a system of vector layers of the forming map. The complex electronic agricultural map consists of two groups of layers: geographic and thematic. Thematic layers of a complex agricultural map are the main element that includes three large groups of complexes and objects: agricultural holdings, economic indicators of agriculture and agricultural infrastructure. The agricultural activity is closely linked to the geographical environment, and, accordingly, its reflection on agricultural maps is fully grounded.

It should be noted that the development of agricultural maps begins with the creation of a geographical basis to provide the necessary accuracy of the spatial localization of the map elements, as well as for orientation and identification of the features of the placement of elements and complexes that will be reflected on the map [2, 3, 11]. In this case, it is possible to identify the connections between cartographic complexes and objects with the geographical environment. In this regard, the geographical basis of agricultural maps includes the following elements: administrative boundaries, hydrography, settlements, road network.

Technologies for creating a complex agricultural map using the data of Earth remote sensing from space are some common geographic elements derived from the automatic classification of space images. These elements will be used in the map to be created as constantly updating information of the topographic map of the studied territory. And those elements that can not be obtained from data of Earth remote sensing from space (due to the insufficient number of space images) will be got from the results of the conversion of elements of the topographic map. The set of thematic elements used to create a complex agricultural map is obtained from a variety of data. So, the subjects of agricultural activity are the main object of the automatic classification of space images, and information on agricultural infrastructure will be obtained as a result of the analysis of sectoral and departmental data (Fig. 4).

One of the main stages of creating a complex electronic agricultural map, which is being developed in GIS programs, is the replenishment of the database. The database of a complex electronic map includes a

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system of layers, each containing a table with geospatial and attributive data.
It can be applied when compiling the atlas of agriculture of the territory, and it can also be used to study the territory for the purpose of sustainable development of the region. The semantics of the layers of a complex agricultural map is presented in Table 1.

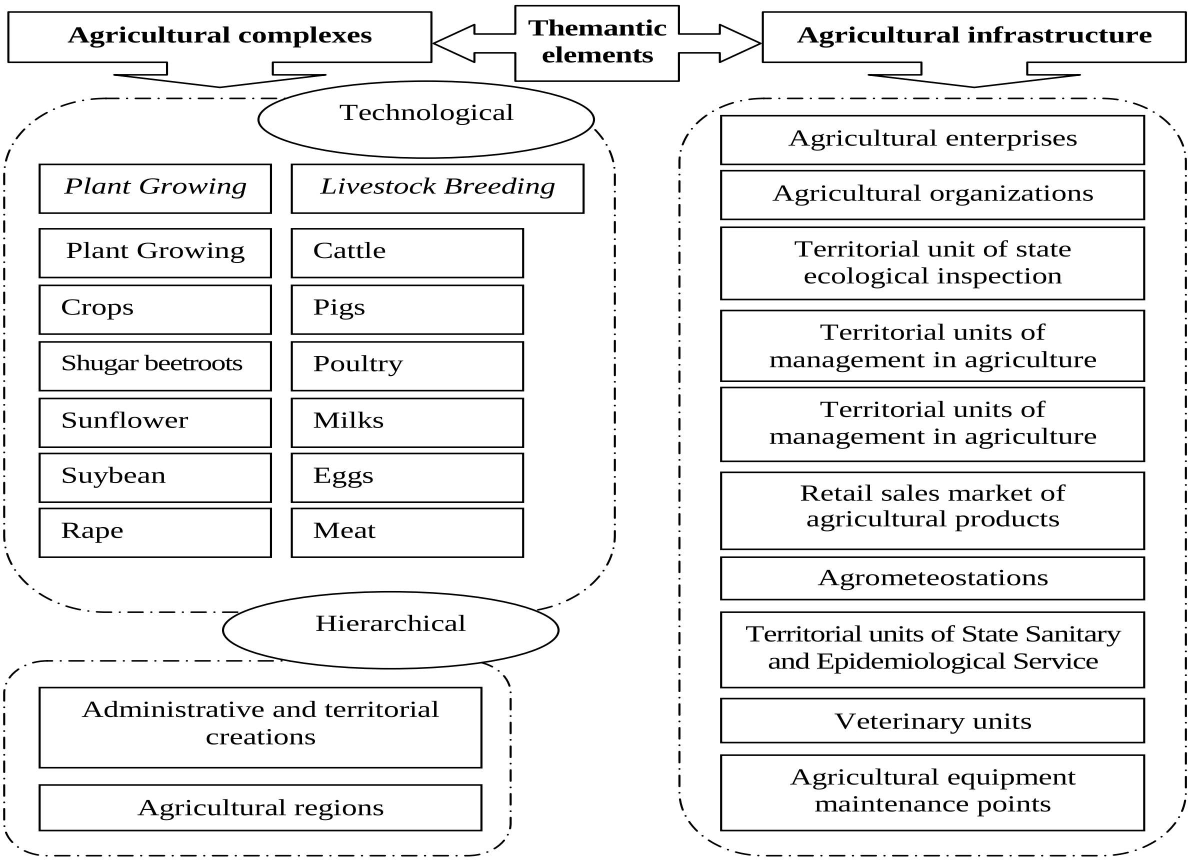

Fig. 4 Approximate content of thematic elements of the complex agricultural map
Source: formed by the author on the basis of data [5, 12].

Table 1. Semantics of layers of a complex agricultural map

The name of the layer	Information characteristics
Plant Growing	Layer name, proper name, location, coordinates, area, state
Hydrography	The name of the layer, proper name, location, coordinates, area, state
Relief	Layer name, object name, location, absolute height, origin, character of the breed
Settlements	Layer name, object name, proper name, coordinates, area, population, state
Road Network	Layer name, object name, object type, proper name, location, length, width, state
Boundaries	Layer name, object name, territorial units, length
Agricultural lands	Layer name, object name, proper name, location, coordinates, area, state
Objects of agricultural infrastructure	Layer name, object name, proper name, location, coordinates, destination, state
Livestock Farming	Layer name, object name, time, number of livestock farms, number of animals

Source: formed by the author on the basis of data [13].

As it can be seen from Table 1, a complex agricultural map will consist of the following layers: plant growing, hydrography, relief, settlements, road network, borders, agricultural land, agricultural infrastructure objects, livestock farming.
Geospatial data for the creation of the complex agricultural maps is information that identifies the geographic location and properties of objects on the locality. Attributable data include the object identifier, any descriptive information of the database, images, etc. [4, 10]. Analysis of these data makes it possible to create new analytical agricultural maps.

CONCLUSIONS

In this way the technological scheme of the creation of agricultural maps is a complete cycle of creating maps and consists of successive stages of work: preparatory stage, stage of fieldwork, the stage of laboratory work, the creation of maps. Much attention is paid to the stage of the laboratory work, where it is necessary to develop the content and database of the maps to be created. The content of agricultural maps represents a set of vector layers, the display of agricultural complexes, objects and features for the development of agriculture in the investigated territory. The semantic database of agricultural maps can be used in the management of the agricultural activity of the researched area.

The results of the research in the perspective can be applied in the development of methodological documents for the mastering agricultural land-use and web-oriented technologies for creating agricultural maps in related industries. The development of scientific researches is aimed at improving the content of agricultural maps of complex and analytical types and extending the use of the developed technology for the creation of such maps in agriculture in Ukraine.

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METHODOLOGICAL APPROACHES ON THE EFFECTIVE LAND RESOURCES USE IN THE REGIONS OF UKRAINE

Roman STUPEN, Zoriana RYZHOK

Lviv National Agrarian University, Ukraine, 1, V. Velykoho str., Lviv Region, 80381, Ukraine, Phones: +38 067 33 27 875, +38 093 94 32 302; E-mails: romomas@ukr.net, zoryana.rizhock@gmail.com

Corresponding author: zoryana.rizhock@gmail.com

Abstract

Key problems of the unstable development of regional economic systems and the weakening of the sustainable economic growth in the regions are revealed at the present stage of the national economy functioning and the economic reforms implementation in Ukraine. The methodological approach to the sustainable social and economic development of the region as to the effective land resources use is proposed. The mechanisms of land resources effective use in accordance with the policy of sustainable social and economic development of the region are substantiated. The main directions of the regions problems solution on the way to ensuring efficient market-oriented and ecologically balanced regional development of agricultural land use are determined.

Key words: *land resources use, social and economic development of the region, regional economics, land organization*

INTRODUCTION

Under the transformation of the national economy of Ukraine, the transition to market relations conditions, land resources, as the main national wealth, are the basis of the regional economy formation for solving the food problem in the shortest terms, creating a competitive national agro-industrial complex in the European and world agro-food markets. Their use in the structure of regional economy requires the urgent problems solution of economic and ecological effectiveness aimed at the growth of the economic potential of the region because the land in agricultural production is an active element, which justifies its economic value. The issues of the security level, the land fund structure, as well as the land effective use, mainly influence the formation of state regional economy. These issues are still uncertain because the increase in profits from land use is the priority criterion. Ursu andCofas [15], Sargo [8], Bozkurt [1] and such Ukrainian scientists as Budziak [2], Horlachuk [4], Danylyshyn [3], Novakovskyi [7], Sokhnych [9], Stupen [11], Tretiak [14], Khvesyk [5] and others made significant contributions to the study of rational land resources use and their protection. However, they considered the land as the main means of production, instrument, and object and, particularly, the labor product. It is insufficient under economy decentralization conditions. Land resources should be regarded as to their economic functions, namely, as the material basis of people's welfare and productive forces of the society, the base for the reproduction of labor, material and technical, natural factors of the economic growth in the region.

MATERIALS AND METHODS

A monographic method during the learning Ukrainian and foreign scholars' scientific publications on the effective land resources use issues is used. The systematic method of the economic researches is applied for studying the peculiarities of land relations development in the regions of the country. The method of statistical analysis is applied during the studying information the use and the state of the lands according to agricultural lands types in the regions. In the implementation of the theoretical generalizations and formulations of the conclusions, the abstract and logical method is used in order to improve the methodological approach to the sustainable social and economic development of the region for the effective land resources use.

RESULTS AND DISCUSSIONS

The issues of regional policy of our country are of special consideration among the most important problems of social and economic development of society. In the context of a market economy, the land is the primary factor of production, the foundation of the Ukrainian economy, the main resource for improving the current economic situation by attracting land capital as a commodity to the effective circulation and improving land relations in all spheres of the regional economic complex.

In Ukraine, it is not paid enough attention to the issue of regional development both at the national and regional levels. In fact, there were no mechanisms in the state to stimulate regional development that would contribute to the development of regions. The adoption of the Law of Ukraine “On Stimulating the Development of Regions” gave a certain impetus to the launch of strategic planning of regional development – a complex of measures aimed at achieving sustainable development of regions by combining economic, social and environmental interests at national and regional levels, maximizing the efficient use of regional potential in the interests of their inhabitants and the state as a whole [6].

The rational lands use and protection as to their main purpose, the creation of the most favorable conditions for high productivity of agricultural lands, the increase of production volume and obtaining the maximum production quantity per area unit at the lowest cost of labor and funds are the primary directives as an outcome of the formation of the economy of the region. The land organization, as the mechanism, plays an important role aimed at meeting the society’s needs in food and industry needs – in raw materials, taking into consideration soil and climatic conditions of the region.

The main criterion for the effective use of land resources is the productivity of the land, which is determined by the yielding capacity of crops and depends on the soil and climatic conditions, productive forces development level at ensuring the optimal conformity of land use structure with the natural and economic conditions of the regions.

In the context of land resources efficient use, the region should be understood as an integral territorial system of natural and resource potential in the sphere of the sustainable regional development, as based on interests of regional needs but not on the economy of the country as to the natural and agricultural zoning using data of the state land cadastre and conducting land organization.

We propose to consider the region as a set of land resources, the spatial location of a certain land number that determines the specificity of the region as a territorial creation because the land with its resources characterizes the specific territory to a full extent. Regional policy implies the development of the use and land protection programs, documentation on the land organization in the field of land protection as well as carrying out natural and agricultural, ecological and economic, anti-erosion and other types of lands zoning.

Ukraine has a sufficiently powerful of agricultural land resources. The efficiency, profitability, competitiveness of the regional economy, their rational and environmentally sound use, lands protection for the whole society depend on the proper use of such resources [4].

The intensity of lands use is diverse both in time and according to administrative and territorial units. In agriculture, it is necessary to define zonal and regional specialization clearly, which would correspond to the peculiarities of the natural and economic production conditions on the territory of the region, district, city, settlement, village, some individuals’ lands and lands of different purpose and economic use.

The most compelling evidence is that the land fund of Ukraine is 60,354.9 thousand hectares (Table 1), of which 41,507.9 thousand hectares (68.77 %) are occupied by agricultural lands, of which 32,541.3 thousand hectares are arable land [10]. Odesa region (5.52 %) occupies the first place as to the area and Chernivtsi region (1.34 %) – the last one among the regions, which affects the specialization of production. One citizen in Ukraine has 0.76 hectares of arable land, while in Europe this indicator is 0.25 hectares [12].

Table 1. Land area as to the types of agricultural lands and regions in 2016 (thousand hectares)

Region	Total land area		Place among regions of Ukraine as to areas	Agricultural lands		Place among regions of Ukraine as to the existence of agricultural lands	Arable lands		The level of arable lands security, ha per 1 person
	thousand hectares	%		thousand hectares	%		thousand hectares	%	
The Autonomous Republic of Crimea	2,608.1	4.32	13	1,792.5	2.97	13	1,271.5	1.45	-
Vinnytsia	2,649.2	4.39	12	2,014,2	3.34	9	1,725.5	1.97	1.08
Volyn	2,014.4	3.34	20	1,047.6	1.74	20	672.6	0.77	0.65
Dnipropetrovsk	3,192.3	5.29	2	2,513.0	4.16	2	2,127.4	2.42	0.65
Donetsk	2,651.7	4.39	11	2,041.1	3.38	7	1,652.7	1.88	0.39
Zhytomyr	2,982.7	4.94	5	1,510.1	2.50	17	1,112.7	1.27	0.89
Transcarpathian	1,275.3	2.11	24	451.0	0.75	25	200.2	0.23	0.16
Zaporizhia	2,718.3	4.50	9	2,241.7	3.71	4	1,903.6	2.17	1.09
Ivano-Frankivsk	1,392.7	2.31	22	630.5	1.04	23	397.2	0.45	0.29
Kyiiv	2,812.1	4.66	8	1,664.2	2.76	15	1,355.5	1.54	0.78
Kirovohrad	2,458.8	4.07	14	2,032.2	3.37	8	1,764.6	2.01	1.81
Luhansk	2,668.3	4.42	10	1,908.6	3.16	12	1,276.6	1.45	0.58
Lviv	2,183.1	3.62	18	1,261.5	2.09	19	794.1	0.90	0.31
Mykolaiiv	2,458.5	4.07	15	2,006.0	3.32	10	1,699.2	1.94	1.47
Odesa	3,331.4	5.52	1	2,591.8	4.29	1	2,075.5	2.36	0.87
Poltava	2,875.0	4.76	6	2,165.5	3.59	5	1,774.7	2.02	1.23
Rivne	2,005.1	3.32	21	926.2	1.53	22	656.8	0.75	0.57
Sumy	2,383.2	3.95	16	1,698.0	2.81	14	1,226.3	1.40	1.10
Ternopil	1,382.4	2.29	23	1,046.2	1.73	21	856.4	0.98	0.80
Kharkiv	3,141.8	5.21	4	2,411.5	4.00	3	1,933.2	2.20	0.71
Kherson	2,846.1	4.72	7	1,969.4	3.26	11	1,777.9	2.03	1.67
Khmelnytsk	2,062.9	3.42	19	1,566.2	2.59	16	1,252.7	1.43	0.97
Cherkasy	2,091.6	3.47	17	1,451.0	2.40	18	1,272.0	1.45	1.02
Chernivtsi	809.6	1.34	25	469.7	0.78	24	330.8	0.38	0.36
Chernihiv	3,190.3	5.29	3	2,067.5	3.43	6	1,419.2	1.62	1.36
Ukraine	*60,354.9*	*100*		*41,507.9*	*68.77*		*32,541.3*	*37.08*	*0.76*

Source: Own calculation on the basis of data [10]

At the stage of the transition to the market economy the issue of the increase of economic potential level, the use productivity, land resources preservation and reproduction, the introduction of the regulatory agricultural lands circulation are inseparably connected to the perspectives of the social and economic development of the region if there is an effective land resources use (Fig. 1).

In addition, the main obstacles to problems solution of the regions on the way to providing efficient market-oriented and environmentally-balanced regional development of the use of agricultural lands are the following ones:

• the absence of the clear and transparent mechanism of the central support to local government bodies for the solution of problems in the field of land relations;

• the absence of the system approach to the regional policy of the effective and environmentally-safe agricultural lands use, the uncertainty of the strategic perspectives of the land relations development program for the long-term perspective;

• the imperfection of the regulatory and legal base of the state regulation of ecologically oriented land use development;

• problems of territorial organization of land use of agricultural enterprises and legal and land management mechanisms of lease relations regulation;

• the necessity of a balanced state land policy as to land management, multi-purpose cadastre, forecasting, zoning of lands according to their categories and types of land use, planning and regulation of rural territories development in the region;

• the loss of additional reimbursement of funds to the local budget due to the absence of the market system of land relations, low land tax and rental payment, reduction of investment attractiveness of land use.

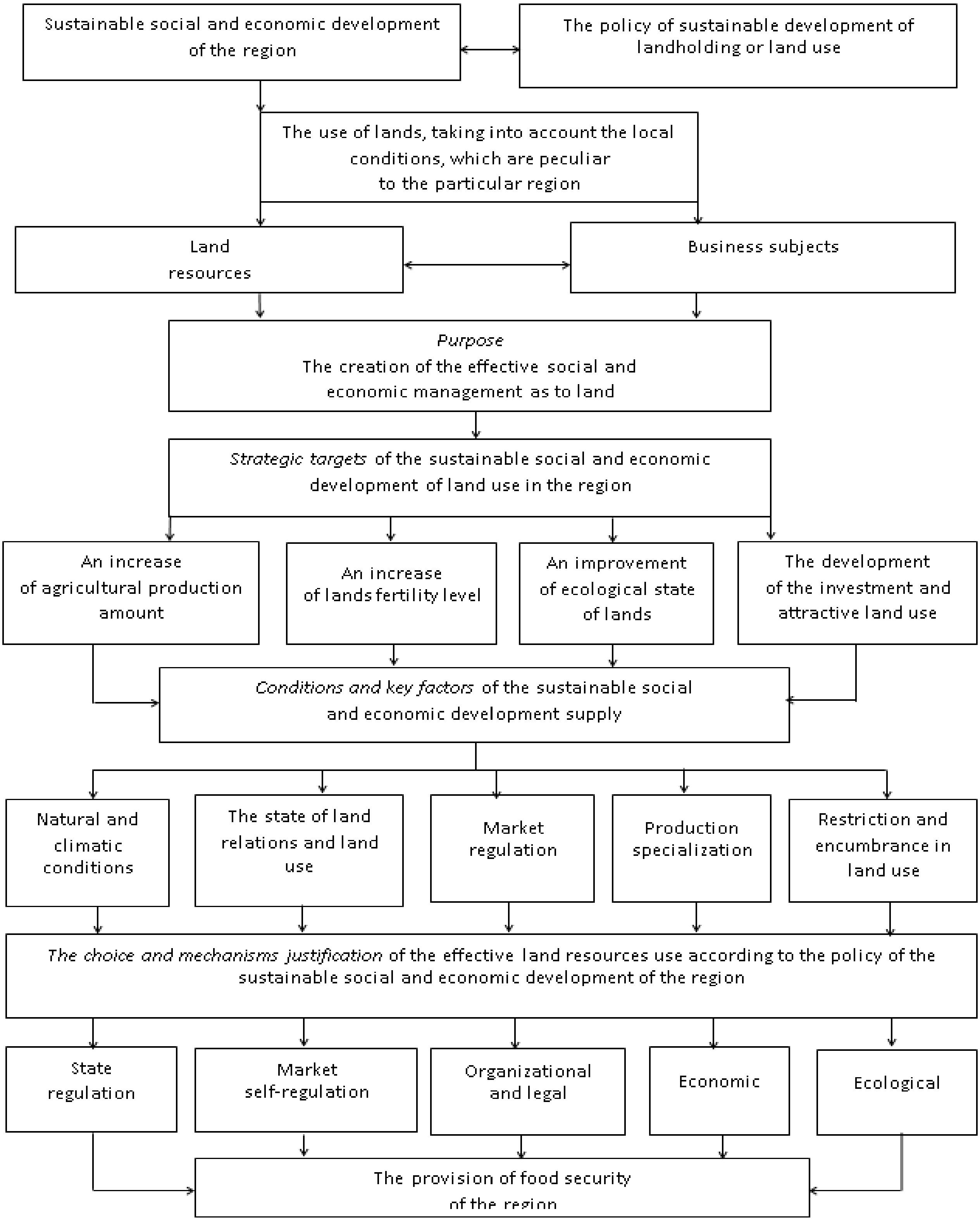

Fig. 1. Methodological approach to the sustainable social and economic development of the region at the efficient land resources use.
Source: it is done by the author

Unfortunately, in agriculture, there are still processes of reducing the efficiency of land use, deteriorating qualitative characteristics of land resources and increasing transaction costs, which ensure the implementation and protection of land ownership rights [13].

A priority condition for the increase of land capital in the social and economic growth and sustainable development of the region is the formation of mechanisms of state regulation of land resources in order to increase national wealth and welfare of the society while improving the efficiency of the use of territorial potential.

CONCLUSIONS

Therefore, in Ukraine it is necessary to create mechanisms of the state regional policy of land resources use and protection in order to increase the efficiency of land use economics with an orientation towards encouraging regions to self-development, taking into account the transformational market transformations of the national economic space.

The priority directions of regional development are the substantiation of the methodological provisions for improving the efficiency of rational land resources use, the implementation of the territorial organization of ecologically-oriented land use.

Obviously, social and economic development of the region is the maximum attraction of the land potential of the regions, which is the material condition of production, the object of social and social relations.

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APPROACH TO THE CURRENT STATE OF KNOWLEDGE ON DODDERS (*CUSCUTA L. CONVOLVULACEAE*) FROM A TAXONOMIC, MORPHOLOGICAL AND PHYSIOLOGICAL POINT OF VIEW

Maria TĂNASE

"Lucian Blaga" University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environmental Protection, 7 Dr.Ion Ratiu Street, Sibiu, Romania, Email: maritanase@yahoo.com

Corresponding author: maritanase@yahoo.com

Abstract

This paper aims at representing a synthesis of studies, researches and experiments of bibliographic and original scientific papers that provide information on the level of current knowledge regarding cuscuta; as well as a starting point for further research. The genus Cuscuta L. (dodder) is one of the most significant groups of holoparasite-anthophytes, mostly economically, because infestation with some of its species can lead to significant production losses in a wide variety of crops, both quantitatively and qualitatively. The dodder has long been considered a curiosity by botanists and evolutionary biologists because it has particularly interesting and even enigmatic features when examined with great care and interest. Cuscuta offers many curiosities and features that explain the plant's adaptation to parasitism: an enormous fertility of up to 10,000 seeds per plant; a long subsistence in the search for host plants; a long-lasting and staggered germinative faculty, due to the phenomenon of skin inhibition; a lack of cotyledon (though still considered to belong to the Dicotiledonatae class); the presence of chlorophyll in all organs of the plant, with the exception of the root (and nonetheless the inability to photosynthesize, unless under conditions of a carbon dioxide-enriched atmosphere); lack of a meristem and root sculpture, which results in a solely ascending migration of assimilates; the resistance of living haustoria in the host plant while the parasite's stem is dead, thus enabling the parasitic plant to regenerate and become perennial; the ability to transmit diseases such as viruses and mycoplasmas; etc. The purpose of this paper is to highlight the current state of knowledge on cuscuta species, in terms of taxonomy, ecology, agriculture, economy and management, by applying concepts that prove significant to biodiversity conservation and the agronomic value of landscape.

Key words: *Cuscuta L., holoparasite, taxonomy, morphology, physiology*

INTRODUCTION

The topic of the paper subscribes to a field that seeks to develop agricultural scientific knowledge; a field of vital importance for the future, especially regarding the increase of agricultural production. The paper aims to highlight the current state of research on dodder species from a taxonomic, ecological, agricultural, economic and applied management point of view, as well as to underline important notions concerning biodiversity conservation, the agronomic value and the aesthetics of the landscape. The paper has, by its specificity, several major objectives and components: documentation, information, analysis, scientific research, evaluation, as well as implementation of the integrated management system of the protection of prato-ecosystems, given that in Romania cuscuta has been spreading substantially, thus influencing the quality, quantity and production price, as a consequence of poor agricultural practices.

MATERIALS AND METHODS

The methods used to reach the goals were various, depending on the proposed activities. The analysis of the infected fodder crops and the damage caused by cuscuta was carried out by means of some expeditions in the area that is under scrutiny, carried out during the time frame May-October, for the detection and collection of the dodder. Biological material was used to determine the different stages of development, from the first stages to the fructification phase. In order to determine the host and the sowing species, a recent bibliography with current scientific nomenclature was used; and confirmation regarding the correctness of the determinations was made with the help of the Romanian researcher Mihai Costea, Associate Professor and Curator of Herbarium at the Wilfrid Laurier University Department of Biology in Waterloo, Ontario, Canada; a researcher mainly specialized on taxonomy. The identified species were then introduced into the WLU (Wilfrid Laurier University, Waterloo, Ontario, Canada), and the specimens are designated M. Tanase s.n. ("sin numero") and stored as vouchers in the herbarium of the University.

To analyze the plant materials, the flowers were rehydrated and then dissected, and the images can be visualized in the "Digital Atlas of Cuscuta" (http://www.wlu.ca/page.php?grp_id=2147&p=9022). [21].

RESULTS AND DISCUSSIONS

Bibliographic information on dodders around the world is abundant and varied: In 1937 Dean [25] reported a total of 464 publications, and from the 1950s to the '70s dodders were the subject of over 1,000 publications [33]. This demonstrates that parasite anthophytes have increased the curiosity of researchers, thus becoming the subject of numerous studies. In our country I. Prodan and Tr. Săvulescu were the first ones to establish the existence of the main species of cuscuta; whereas [9], [10], managed to identify the species existing at that time on the territory of Romania; and E. Rădulescu and V. Bulinaru , followed by Hălălău, Paun and Şarpe (1980) synthesized morphological and systematic knowledge on cuscuta, as well as its prevention and control in cultures [92].

Over time, research has diversified and numerous studies have verified the physiological mechanisms and tropisms of autotrophic plants in terms of whether they are sewn on dodders or not; what is their mineral composition, the (high) content in potassium and phosphorus and (low) content in calcium: [82], [2], [73]; [83]. It is now well known that dodders, considered holoparasitic plants completely devoid of chlorophyll, do in fact have small amounts of chlorophyll and are thus capable of photosynthesis [29]; [60]; [61]; [109]; [4], [5]; [51];, [62]. Moreover, there is a transfer of trophic substances from the host to the parasite [69]; [70]; [59]; [81]; [51]; [101]; [102].

The absorption mechanisms at the level of the haustorial apparatus are highlighted by the use of the electronic microscope [26], [27], [6]; [100]; [102]; [103]; [104] and by means of radioactive tracers [32]; [33] for determined the nature of photosynthetic products, the parasitic synthesis power; identified the substances that the parasite takes from the host plant and what substances are transferred to the parasitic plant.

These parasites were used to create biological bridges between botanically very different hosts; as well as to study the transmission of viruses and mycoplasmas [30]. Newer studies on the morphological diversity of species, a morphometric analysis of floral characters and a molecular study using plastids and nuclear DNA sequences are supported by recent researchers of cuscuta, who have made biogeographic reconstructions of the genre and its phylogeny [18]; [17]; [106].

Taxonomy. The history of these interesting parasitic plants can be traced back to antiquity [64]; [54]. Costea and Tardif [19] examined the etymology and the first names of cuscuta, as well as aspects unexplored in the early history of the concept of parasitism. The etymology of the name has been declared to be either of Greek origin [23] Arabic, or as unifying different languages and cultures such as Aramaic, Hebrew, Arabic, Persian, and Greek [20].

Although it is devoid of cotyledon, botanists nowadays consider it a dicotyledon: according to some, it represents the only genus of the Cuscutaceae family [39]; according to others – based on modern phylogenetic studies, a genus of the Convolvulaceae family [65]; [66]; [89].

Although they are very difficult to identify, given that the main variables used to identifying species usually rely on microscopic differences of the plant's flowers, [90]; [3]; [21] revealed the real thing, as compared to mere lines and drawings, as Yuncker did in his iconography [107]; the former thus using a depth-creating methodology, with new morphological details, three-dimensional pieces, textures, thickness, visible on microscope photographs.

The taxonomy provided by Yuncker proved to be extremely ironclad, but eight decades after the monograph of Truman G. Yuncker (1932) the cuscuta species is yet again under scrutiny [107]; [90]; [20]; [17]; [91]. The phylogeny, character evolution and biogeography of dodder (Cuscuta, Convolvulaceae) can be deduced from plastid encoding and nuclear sequences (García et al., 2014). Cuscuta includes, according to the newest research, over 200 species (Table 1) around the world (Mihai Costea), grouped into four subgenera: Monogynella, Cuscuta, Pachystigma and Grammica, with a broad geographical distribution [15].

Table 1. Number of identified Cuscuta species*

Choisy (1841)	39 spp.
Engelmann (1859)	77 spp.
Yuncker (1932)	165 pp.
The new species identified and published after 1932 (to be added to the initial 165 above)	
Truman G. Yuncker (1934-1965)	18 spp.
Armando Hunzinker (1944-1947)	10 spp.
Naomi Feinbrun (1965, 1970)	2 spp.
Miquel A. García (1999-2001)	3 spp.
Mihai Costea (2010)	10 spp.
Total	**> 200 species**

Source: *Mihai Costea, Atlas Digital [21]

Cuscuta's morphology and biology. The root, with a normal geotropism, has a limited elongation of up to 1-3 centimeters, but a considerable increase in thickness; it also has neither meristem or scrub [37]; [95], it is not characterized by any mitotic division or cell elongation [86], and it seems that the only role of this organ is to supply the plant with water [13]; [86]. The root has an ephemeral existence of only 20-25 days, degenerating rapidly, approximately 7 days after germination; the process of necrosis thus being much faster than that of apical growth. Therefore, in the absence of a host plant, the dodder plant dies after about a month of life.

The stem is the most developed organ, being able to reach up to a few meters in length. It is called filament and it is characterized by a very rapid growth process. Also, it is filiform, almost cylindrical, always twisted around the host plant, with the number and speed of lateral branches (shoots) varying a lot from one species to the other. The stem acts as a reserve of substances (water, phosphates, starch) that the parasite accumulates at high temperatures, forming a reserve for future fruit development, even after the necrosis of the host plant [87]; [88]; [102].

The dodder is devoid of green leaves, their role being taken by foliar nematodes in the form of scales, which are found by the branching nodes. The lack of real leaves and their replacement by rudimentary ones is evidence of a degeneration due to parasitism. The scales are small in size (a few millimeters), sessile and often partly co-grown with the lateral branches that are born next to them.

After settling itself as a parasite, simultaneously to its growth and branching, the dodder performs volubility movements not only when it turns around the host plant but also when it moves from one plant to another [9]. During this movement no haustoria are formed. It is only when the plant slows down its growth rhythm and moves from broad and lax movements to making tight spirals around the organ around which it is rotating, that the haustoria are formed. Haustoria have between 10 and 30 sucking extensions, as small protuberances that have an area similar to an adhesion disk on the contact surface of the plant [79].

In order to perforate tissues, haustoria make use of mechanical and chemical means: lithic enzymes (cytoses, amyloses) and hormones (cytokinin) [48]. Haustoria are genuine absorption organs, capable of extracting 100% of the soluble organic compounds from broad beans (Vicia faba) [98]. The incompatibility of anthophytes with101any host plants is not well known at the molecular level [76]; [91], but it has been observed that extracts from resistant plants cause an inhibition of dodder enzymes – enzymes that destroy the cell wall. It has been shown that dodders have a selective system that allows them to dissolve the walls of the host cells without destroying their own walls. However, this system does not function when cuscuta grows on itself; case in which it only uses mechanical pressure [99].

Opinions on whether haustoria are in fact modified roots differ among scientists: some say they are roots [54] because they have meristems [32] and they can survive the winter in host plants, thus becoming perennial [97]. Others consider that the haustoria are not roots because they do not appear at the base of the seeds as roots [24], [1]); and the cytochinins that inhibit root formation stimulate the formation of haustoria [67]; [75]; [57]; [58].

The first flowers appear about 4-6 weeks after germination, in a number of 5-20 flowers, presented as inflorescences of the types racem or cyme, and adapted for both cross-pollination – given that they attract a large number of pollinating insects [107]; [63] and for self-pollination, when the flowers are formed on covered filaments, which cannot be visited by insects. Flowers (Fig.1) are hermaphrodite, generally pentamere, 1.5-5 mm long, of either shorter or longer peduncles. The calyx is gamopetalous, tubular, membranous or fleshy, with obtuse or acute lobes, erectile or slightly reflective, often glued to the corolla, with wide edges. The corolla is gamopetaly, tubular, having triangular lobes at its tip, ovate or lanceolate, erectile, with either obtuse or acute tips. At the base of the corolla tube there are scales, stiffenings of the stamens, as membrane scales, than can be whole or divided, with finely denticulate edges or fringes. Cuscuta is the only genus in the Convolvulaceae family and the Solanales order, in which these structures have reached a high degree of elaboration and diversification [78]. The stamens are of equal numbers to the corolla lobes, being co-grown with the corolla tube. The ovary is bilocular, consisting of 2-4 ovules; whereas the two styles can be free-standing or united; the stigmas can be capitate, ovoid or prolonged.

The fruit is a conical, globular or flattened capsule, irregularly dehiscent or indehiscent, with 2-4 small seeds [19]; [74].

Fig. 1. Dodder's flowers (original)

Seeds are small, 0.4-4 mm in diameter and 1-2.2 mm in length, depending on the species, ovoid, globular or elongated, yellowish-brown, rusty, grayish or greenish, glabrous, with a reticular surface. Depending on the size of the seeds, dodder species are often grouped into two categories: large dodders, whose diameter is greater than 1.3 mm, and small ones with a diameter equal to or less than 1.3 mm. While these terms are sometimes used, they do not enable an identification of species [79]. The seed color ranges from gray to brown, depending on the thickness of the cuticle, the surface is cross-linked due to the peeling of the outer membrane of the cuticle [79]. The seed embryo can be twisted, spiral shaped or double-spiral shaped and the seed is devoid of cotyledons, which is a defining characteristic of the cuscuta genus. This can be explained by the fact that the main concern of the plant is to look for a host, and not to photosynthesize [22]. The morphological variations of the seeds of the different cuscuta species deserve to be taken into account, not only because they provide a better understanding of the development of secondary cell wall sculpture (which range from striate to micro-crosslinked or fine-folded), but also because they provide a taxon identification key based on seed characters [52].

Pre-parasitic life. Germination occurs in April-May, influenced by latency [63] and when optimum conditions of heat and humidity are achieved in the soil (15-20^{0}C for small seed dodders ex. *C. trifolii*, *C. epithymum* and 20-30^{0}C for those with large seeds such as *C. campestris*) and is also possible from May to October only for those seeds in the superficial soil layer, that are not deeper than 10 cm in the soil [79]. The tegumentary repose, which characterizes dodder seeds, is determined by the water impermeability of the seminal skin [94]. In nature, the discontinuation of the tegumentary repose is not well-known, it is known however that it can be interrupted by the passage of seeds through the animal and poultry tube, these being vectors in spreading the parasite, either directly or via manure. Also, winter frosts, various bacteria or fungi can interrupt the tegumentary repose of dodder seeds, which are known to remain in the soil, retaining their germination capacity for up to 10 years [79] or even longer, between 10 and 40 years for seeds preserved under low humidity conditions [36].

An interesting aspect of germination ecology is the presence of the water-resistant seminal tegument, that is, physical hibernation [38], which can be interrupted by mechanical scarification [44], [45]. This determines the germination of seeds of many cuscuta species, including C. epithymum [35], [93], but not in a high percentage (maximum 23%) [93], Gaertner's explanation being that they also have a physiological hibernation [38]. Other authors support the idea that hibernation is only physical, not physiological, and give examples of parasitic species in which germination is controlled by temperature changes, not by other factors (chemical indices of the host plant): C. Campestris [6] și C. australis (Jayasuriya et al., 2008). In our experiments, we tested seed germination under laboratory conditions, seeds in which the tegument repose was discontinued by sinking them into concentrated sulfuric acid (96%; d=1.83) for different amounts of time [92]. The seeds germinated after about 7 days; the best germination being registered with the seeds kept in sulfuric acid for 15, 20 and 25 minutes. A time frame of less than 15 minutes proved insufficient to destroy the impermeability of the skin; and those seeds left in acid for more than 25 minutes did not germinate because of the destruction of the viable elements of the embryo [92].

Establishing parasitic contact and parasitic development. Circumnutation enables the contact between the stem of the parasite and the host plant, the dodder wrapping itself spirally around the host between 4-8 times, a process followed by the thickening of the contact surface (also called irritable region) and the emission of haustoria, which then sink into the tissues of the plant. After about a week, time frame that is necessary to the establishment of vascular connections between the parasite and the host, the growth of the parasite is accelerated, and the terminal shoots then form visible knots and interlocks, after which the stem resumes its circumnutating movements to spiral around another host. From now on, the invasion of the parasite on the host is carried out rapidly, each cuscuta species can parasitize a large number of plant species, especially the dicotyledonous species [25]. Simultaneously with the formation of the first haustoria, the root as well as the base of the stem become necrotic and die. This moment defines the start of parasitism, since from now on the dodder nourishes solely via its host plant. The duration the parasite needs to go through all the phases that have been mentioned, namely from the beginning of seed germination to the final set-up, is 20-30 days. If the filament cannot encounter any favorable host, it continues to live an independent life from its seed reserves, but for no longer than a month.

Ontogeny and the nature of vasculary interconnection between parasite and host. The physical conjunction between parasite and host plant is called „haustorium"; and is produced by a xylem-xylem attachment [14]. When it comes to parasitic angiosperms, the water and nutrition transfer from hosts to parasites is facilitated by a high degree of osmolarity [42] and a low water potential (due to the high perspiration rate [54]; [34]; [71], by means of keeping stomata open in order to encourage perspiration and thus facilitate the extraction of nutrients from the host [14].

A haustorium contains a large amount of suckers (10-30), which present themselves as protuberances in the contact location between a haustorium and the tissue of the host plant. Every single of these protuberances starts looking like a concave disk that adheres through its margins to the host's epidermis (adhesion disk) [108], from which the haustoria emerge. The junction between a haustorium cell and the ligneous vessels is mainly realized by a simple contact, meaning that the extremities of haustorium cells penetrate the interior of xylem [108], but when the same cells come into contact with the phloem of the host plant, its extremities start a digitiform ramification, surrounding the vessel without penetrating its interior [84]; [85]; [26], [27], [53]).

The perennity of *Cuscuta*. Cuscuta species habitating in temperate climate zones are usually regarded as annual plants, of which the entire population dies at the end of the vehetative period [96]; [19], but there are assumtions that haustoria survive thrughout the unfavorable season in the tissues of the perennial host plants, thus surviving the winter and showing a perennial character [63]. Even more, it was proven that those individuals belonging to the species of *C. Epithymum*, deriving from winter-surviving haustoria, are capable to grow and infect host plants at the beginning of season, several weeks before those individuals deriving from germinated seeds [98]; and the vegetative part of the plant is twice as well developed and forms more abundant flowers throughout the same vegetative period [49], [50]; [63].

Cuscuta photosyntesis. Like all evolved plants, Cuscuta has four organs: roots, stems, leaves and flowers, although the root and leaves are very diminished. Since under normal environmental conditions, cuscutas are not capable of photosynthesis by themselves, they need to parasitize other plants in order to finalize their life cycle, so cuscuta can be defined as an obligate holoparasitic plant living on the stem of the host plant. It was believed that as a totally parasitic plant, the cuscuta would be incapable of photosynthesis and entirely lacking chlorophyll, and that the absent photosynthesis is a consequence of its parasitic nature [74]. However, there is proof that other than the root of the plant, all organs are slightly chlorophyllide and "equipped" with stomata [64]; [107]; [7]. The presence of the chlorophylles **a** and **b** in many cuscuta species is a fact [60]; [61]; [55]; [56], whereas the value of the ratio chlorophylle **a**/chlorophylle **b** is between 2.2 and 3.5; value that is analoguous to that of autothrophic plants [41]; [80]; [12]; [6]. Moreover, [33] prooved that in a CO_2-enriched atmosphere, the photosynthetic intensity of cuscuta is very enlarged, despite its small concentration of chlorophylle, thus being able to ensure at least a part of those substances that are necessary to its growth [11]; [8].

Fer [33] showed that when it comes to dodders, the migration of assimilates is exclusively carried out acropetally; an observation that is also supported by Haupt and Newmann [40]; and the absence of a descendent migration seems to be determined by the absence of a radicular meristem [64]; [37]; [95]; [68]. Based on the exclusively acropet migration of assmilates, numerous studies in which cuscutas have been used as virus vectors, support the existing analogy between the direction of virus transmission and the migration direction of assimilates [16]; [43]; [47]; [72]. The absence of a descendent migration also explains the ephemeral life of the root, which exhausts its reserves and dies unless it gets assimilates.

The nature of substances collected by cuscuta from its host plants represents a controversial issue: Poma and Ciferri [69], as well as [105] emphasize that the greatest part of the metabolites collected by the parasite is formed by carbohydrates. Kerstetter and Hull [51] signal that the marked carbohydrates constitute the majority (70%) of soluble assimilates; Suthoff (quoted by Jacob [33] mentions that the parasitic collections mainly transport sucrose, whereas [33] proves that 95-96% of collected substances are represented by carbohydrates, the most representative one among them being sucrose, followed by glucose and fructose. Additionally, the transportation of a significant quantity of marked assimilates from host plant to cuscuta is also underlined in various studies [51], [46], [100], [104], whereas according to the results of [81], the parasitic collection mainly consists of nitrogenous substances.

CONCLUSIONS

The genus Cuscuta L. (dodder) is a significant groups of holoparasite-anthophytes, long time considered a curiosity by botanists, with many curiosities and features: an enormous fertility, a long subsistence in the search for host plants; a long-lasting and staggered germinative faculty, a lack of cotyledon, the presence of chlorophyll in all organs of the plant, with the exception of the root, he inability to photosynthesize, unless under conditions of a carbon dioxide-enriched atmosphere; lack of a meristem and root sculpture, which results in a solely ascending migration of assimilates; the resistance of living haustoria in the host plant while the parasite's stem is dead, thus enabling the parasitic plant to regenerate and become perennial; the ability to transmit diseases such as viruses and mycoplasmas etc.

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CUSCUTA EPITHYMUM L. (CONVOLVULACEAE), THE MOST WIDESPREAD SPECIES IN SOUTHERN TRANSYLVANIA, ROMANIA

Maria TANASE

"Lucian Blaga" University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environmental Protection, Sibiu, Romania, Email: maritanase@yahoo.com

Corresponding author: maritanase@yahoo.com

Abstract

Dodder species affect several thousand hectares in Romania, cutting crops,that is why they became a major economic concern, especially for lucerne, clover, potato, pasture, meadow crops [3]. *The impact ranges from moderate loss to severe reduction in plant growth and in some cases, even the death of the host plant, and the severity of the infestation depends largely on the stage of development of the host plants at the initial fixation of the steam [20]. Cuscuta epithymum L. is the most widespread species in the entire analysis, on the territory of the counties Sibiu and Brasov, as well as the parasite on most host plant species. Dodder is a particularly dangerous and harmful quarantine plant, it produces a general disruption of metabolism in the plants they parasite, from which it absorbs organic and inorganic nutrients, weakens and prevents the growth and development of host plants, which leads to their death.*
.

Key words**:** *Cuscuta epithymum, holoparasitic anthophytes, host plants, polyphagous*

INTRODUCTION

Dodders are counted among the most dangerous quarantine parasitic weeds, not only in Romania, but also in the majority of countries in the warm and temperate climate zones worldwide [33], [34]. They are therefore spread in the southern and central parts of Europe, in South Asia, Northern Africa, the warm and temperate zones of North America and South America, as well as in Australia. Due to their non-abidance to the rules of phytosanitary quarantine, dodders have been spreading on even more surfaces; the seed reserves in the ground thus increasing from year to year. The current distribution of cuscuta in the dymanic landscape can be determined by means of a persistant seed bank [19]. Such species are considered to be harmful and invasive weeds according to the legisiation of most countries, having commercial significance with regards to the import/export of seeds/vegetal material that can be susceptible of containing cuscuta seeds; hence their quarantine status [10]; [6].
Cuscuta spp. are obligate holoparasitic anthophytes, dependent on suitable hosts for nutrients [20], water and physical support. Although the names of numerous species suggest that they would be specialized on certain host plants, according to personal observations, that are also confirmed by Meulebrouck [19] (for *Cuscuta epithymum*), cuscuta species are polyphagous; and specialty literature indicates that a high number of cuscuta species can grow on a large variety of host plants, even if they prefer certain ones [1].

MATERIALS AND METHODS

The objective of the work is to send expeditions on the territory of Sibiu AND Brasov county, between May and October each year, for the detection and collection of the dodder. On the occasion of the trips, various cultures, pastures and meadows were tracked, railroad tracks and even the tram line, the roadside, uncultivated land, etc. For each sample, it was noted: the locality, the crop (the host plant species), the degree of attack, the phenotype of the dodder and the date.
Samples were harvested and kept under appropriate conditions. The biological material analyzed was in various stages of development, from the first stages to the

fructification phase. In order to determine the host plants and the sowing species, a recent bibliography with current scientific nomenclature has been used.
I mention that other Cuscuta species have been noted in the analyzed area, in all species the identification was confirmed by the Romanian researcher Mihai Costea Curator of Herbarium of the Wilfrid Laurier University Biology Department in Waterloo, Ontario, Canada [9]. Specimens sent by us are marked M. Tanase s.n. ("sin numero") and stored as vouchers in the herbarium of the university.

RESULTS AND DISCUSSIONS

Information and documentation to identify areas for the spread of dodder began in 2011 and continued in the years to 2016, in terms of identifying areas of distribution, but also the presence of sowing in fodder perennial crops and grasslands in the area, crops and localities.

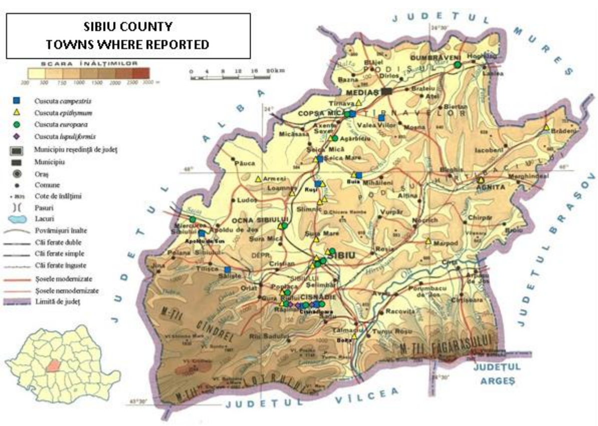

Fig. 1., Sibiu County, locality where reported *Cuscuta*, by us (http://pe-harta.ro/Sibiu/ - processed)

The analyzed area is actually the agricultural territory belonging to Sibiu and Brasov counties, where field trials were conducted to collect information and plant material, measurements, and reveals.
The crops were analyzed from a phytosanitary point of view, following the presence of the dodder, we have collected statistical data refer spreading, numerical density at the surface unit, host plant, damage produced. Based on the data, we mapped the localities where the dodder and the list of host plants were identified.

Table 1. *Cuscuta spp.* in Sibiu County, identified by us

Nr. crt.	LOCALITY	*C. campestris*	*C. epithymum*	*C. europaea*	*C. lupuliformis*
1.	AGÂRBICIU		♠	■	
2.	AGNITA		♠		
3.	APOLDU DE SUS	▼			
4.	ARMENI		♠		
5.	BOIȚA		♠		
6.	BRĂDENI		♠		
7.	BUIA	▼	♠		
8.	CISNĂDIE	▼		■	◙
9.	CISNĂDIOARA	▼		■	◙
10.	COPȘA MICĂ	▼		■	
11.	CRISTIAN				
12.	DUMBRAVA SIBIULUI		♠		
13.	DUMBRĂVENI			■	
14.	HAMBA		♠		
15.	MARPOD		♠		
16	LOAMNEȘ		♠		
17.	MIERCUREA SIBIULUI			■	
18	OCNA SIBIULUI		♠	■	
19.	POPLACA		♠	■	
20.	RĂȘINARI		♠	■	◙
21.	RUȘI	▼	♠		
22.	SĂLIȘTE	▼			
23.	SIBIU		♠	■	
24.	SLIMNIC		♠		
25.	ȘEICA MARE	▼	♠		
26.	ȘURA MARE		♠		
27.	TÂRNAVA		♠		
28.	TURNIȘOR			■	
29.	VIILE SIBIULUI	▼	♠	■	

Source: Original.

Fig. 2. Brasov County, locality where reported Cuscuta, by us (http://pe-harta.ro/Brasov/processed)

Table 2. *Cuscuta spp.* in Braşov County identified by us

Nr. crt.	**LOCALITY**	***C. campestris***	***C. epithymum***	***C. europaea***
1.	RÂŞNOV			■
2.	BRAŞOV			■
3.	CAŢA			■
4.	VIŞTEA DE SUS		♠	
5.	BRAŞOV	▼		
6.	BRAŞOV			■
7.	STUPINI BV.			■
8.	STUPINI		♠	
9.	CAŢA		♠	
10.	UCEA		♠	
11.	VIŞTEA			
12.	DRAGUŞ şi OLTEŢ		♠	
13.	MESCHENDORF			■
14.	BUNEŞTI		♠	
15.	VLĂDENI	▼		
16	CRISTIAN			■
17.	VULCAN			■
18	MAIERUŞ		♠	
19.	HĂLCHIU		♠	
20.	CODLEA			■
21.	MÂNDRA		♠	
22.	BRAŞOV	▼		
23.	MĂGURELE		♠	
24.	ŞERCAIA		♠	
25.	VOILA		♠	
26.	SÂMBATA DE JOS		♠	

Source: Original.

Dodders are counted among the most dangerous quarantine parasitic weeds, not only in Romania, but also in the majority of countries in the warm and temperate climate zones worldwide [33]; [34]. They are therefore spread in the southern and central parts of Europe, in South Asia, Northern Africa, the warm and temperate zones of North America and South America, as well as in Australia. Due to their non-abidance to the rules of phytosanitary quarantine, dodders have been spreading on even more surfaces; the seed reserves in the ground thus increasing from year to year.

The current distribution of cuscuta in the dymanic landscape can be determined by means of a persistant seed bank [19]. Such species are considered to be harmful and invasive weeds according to the legisiation of most countries, having commercial significance with regards to the import/export of seeds/vegetal material that can be susceptible of containing cuscuta seeds; hence their quarantine status [10]; [6].

Table 3. Host plants for *Cuscuta epithymum* identified by us

Nr. crt.	**Host plants species**	**Botanic family**
1.	*Agropyron repens*	*Poaceae*
2.	*Avena sativa*	*Poaceae*
3.	*Centhaurea nigrescens*	*Asteraceae*
4.	*Chrysanthemum leucanthemum*	Asteraceae
5.	*Coronilla varia*	Fabaceae
6.	*Cruciata glabra*	*Rubiaceae*
7.	*Cytisus nigricans*	*Fabaceae*
8.	*Dactylis glomerata*	*Poaceae*
9.	*Euphorbia cyparisias*	*Euphorbiaceae*
10.	*Fagopyrum convolvulus*	*Polygonaceae*
11.	*Festuca rubra*	*Poaceae*
12.	*Festuca rupicola*	*Poaceae*
13.	*Galium rubioides*	*Rubiaceae*
14.	*Gallium palustre*	*Rubiaceae*
15.	*Gallium vernum*	*Rubiaceae*
16.	*Hypericum perforatum*	*Hypericaceae*
17.	*Leontodon autumnalis*	*Asteraceae*
18.	*Linaria vulgaris*	*Scrophulariaceae*
19.	*Lotus corniculatus*	*Fabaceae*
20.	*Mentha arvensis*	*Lamiaceae*
21.	*Onobrychis viciifolia*	*Fabaceae*
22.	*Pimpinella saxifraga*	Apiaceae
23.	*Plantago lanceolata*	*Plantaginaceae*
24.	*Rhinanthus serotinus*	*Scrophulariaceae*
25.	*Sonchus arvensis*	*Asteraceae*
26.	*Taraxacum officinale*	*Asteraceae*
27.	*Tenerium chamaedrys*	*Lamiaceae*
28.	*Vicia cracca*	*Fabaceae*

Source: Original.

Leguminous plants (Fabaceae) are more frequently chosen as host plants, maybe also due to the fact that they are capable of fixating atmospheric azote, thus being more nutritious [30].

Except for the preferred cultures of perennial leguminous fodders, cuscuta also parasitizes numerous vegetable plants [26], textile plants, industrial plants and ruderal species. Also, it can survive on wood essences, such as willow, acacia, poplar and blackberry [23]. In literature there is also reference to the parasitism of the species of pine and birch trees (*Pinus sylvestris* and *Betula pandula*) by *C. epithymum*, but only the trees' seedlings [19].

Cuscuta facilitates the transmission of certain viruses onto trifolieae, the viral chlorosis of the sugar beet, potato viruses but also diseases such as microplasmoses [5]; [21]; [8]; Credi, 1992; [14]; [22]. The most important types of ecosystems affected by cuscuta species are the pratological ecosystems, but a high number of other species also function as host plants for dodders; fact which influences the biodiversity of ecosystems, thus having repercussions upon human society and animal health. Agricultural crop losses are substantial, from both a quantitative and a qualitative point of view [11]; [31], the fatty acids in fodders representing an important parameter regarding their quality [31]; [15]; [16].

There have been relatively few studies on the impact of natural plant communities, but in general it goes without saying that biodiversity is reduced in those zones attacked by cuscuta [13]; [18]; [17]; [24]; [25]. Certainly, one needs to take into consideration the fact that most parasitic species have negative consequences on agriculture, influencing the output quantity, quality and price [27]; [29].

CONCLUSIONS

Cuscuta spp. are obligate holoparasitic anthophytes, dependent on suitable hosts for nutrients, water and physical support. Although the names of numerous species suggest that they would be specialized on certain host plants, according to personal observations [31], that are also confirmed by Meulebrouck, 2009 (for *C. Epithymum*), *Cuscuta* species are polyphagous (Table 3); and specialty literature indicates that a high number of cuscuta species can grow on a large variety of host plants, even if they prefer certain ones [1].

In Romania in recent years have multiplied considerably the number of hectares of non worked agricultural land. It has been multiplied by a huge number of annual and perennial weeds, producing significant damage to crops, due to the fact that they are a permanent source of weeds, but also a source of pests and diseases difficult to control.

Although it parasitizes a large number of plants [6], significant are mainly the damages done to perennial leguminous fodder crops: alfalfa, clover, sainfoin, fingers-and-thumbs, as well as mixes of croplands and natural grasslands [3]; [12]. Due to its non-abidance to the rules of phytosanitary quarantine, dodders have been spreading on even more surfaces; the seed reserves in the ground thus increasing on a yearly basis. In addition to the damages caused to the cultures of perennial leguminous fodders, dodders can also be often found in grasslands and meadows [7]; [32], [28], having a negative impact on the decorative and touristic aspect of the landscape due to their invasion [4]; [2], Bardgett et al., 2006).

The most widespread of the 4 species of dodder identified are: *Cuscuta epithymum*, in 13 localities - Brasov county and 20 localities - Sibiu county, in the analyzed area.

According to the results of our research, there is no leguminous fodder that is not attacked by cuscuta clusters [31].

Also, we have noticed its presence on grasses, although according to the specialty literature on cuscuta, grasses are theoretically not parasitized by cuscuta.

However, during our field inspections on grasslands, cuscuta was detected on the following species, belonging to the Poaceae family: *Agropyron repens, Briza media, Dactylis glomerata, Festuca pratensis, Festuca rubra, Festuca rupicola*, but also on *Triticum aestivum*, as a ruderal plant [31]. we mention that many host plants of C are detected by us and are not quoted in the literature

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LAND RESOURCES MANAGEMENT IN UKRAINE UNDER THE CONDITIONS OF THE LOCAL GOVERNMENT REFORMING

Ruslana TARATULA[1], Nazar STUPEN[2]

[1]Lviv National Agrarian, Faculty of Land Management, St. Vladimir the Great, 1, Dubliany, Ukraine. Phone+380679001076, Email: ruslana.78@ukr.net
[2]Lviv Polytechnic National University, Ukraine, 6, Karpinskogo str., Lviv, Lviv region, 79000, Ukraine, Phone: +380673706682, E-mail: nazstupen@gmail.com

Corresponding author: ruslana.78@ukr.net

Abstract

The article considers theoretical aspects of the mechanisms of land resources management in Ukraine. The work determines main characteristics of land resources management and outlines the notion of land resources management of territorial communities under conditions of power decentralization. In the context, land resources management is currently viewed as important theoretical and methodological problem at different levels of power. The research concerns the main reasons for impossibility of established territorial communities to have lands at their disposal. Implementation of the state land policy expects from the bodies of state power working in the field of land relations, focused on rational use and protection of land, security of food safety of the country and creation of ecologically safe conditions for running of economic activity and living of people. Transition of lands to the control of amalgamated territorial communities is a common European practice of decentralization of rights and responsibilities. In terms of decentralization, the principal goal of the land reform is to secure sustainable social and economic development of the territories due to efficient management in the field of land use. Among the primary steps are the following, particularly the necessity to regulate the order concerning setting the boundaries of the area of amalgamated territorial communities and simplification of the procedure of development and approval of the documents concerning land organization in terms of determination of boundaries of administrative and territorial units. In Ukraine, there is no a legally approved general strategy of land resources and land relations development. Nevertheless, people have great expectations that they soon get the needed legislative documents, supporting adequate solution of the problems in the field of land relations, improving degree of trust of business people and society to the system of land relations.

Key words: *land resources, land resources management, territory, territorial community, decentralization*

INTRODUCTION

Land resources are not just a component of environment, a territory, where some people live and which supply administrative division of the country. Land resources are first economic resources, particularly agricultural lands, forests, mineral deposits [2].

Land resources management dates back to the ancient times, and thus, appearance and development of the science about processes of land resources management has an old history. However, the study is a relatively “young” branch and its development should be considered in the general context of social and economic management [3].

Unfortunately, in Ukraine, land is a factor of well-being and growth and, as a natural resource, is still underestimated. Under conditions of power decentralization in Ukraine, the issues of land use are of particular importance. It is connected with land resources management at the current stage of land reform, which is being implemented in the country under almost uncontrolled establishment of land relations in the land sphere, contradictions of land laws. There is a threat of losses of land territories as social and cultural, ecological, economic and political wealth [10].

Decentralization is called a number one reform in Ukraine. Its main goal is to give authorities and resources to people for an optimal control of their personal development. The first stage of the reform, i.e. a financial one, has passed very quickly and successful. Budgets of communities have been considerably increased. However, the communities will be able to create and perform real strategic programs of development only after obtaining control for the main resource, i.e. land.

Nowadays, tasks of transition of the authorities concerning land resources management have come into effect [9].

MATERIALS AND METHODS

The present paper is examining the following basic scientific methods and approaches: dialectical approach, the system approach.

Using general scientific and economic methods of investigation, the work makes analysis of acting legislative acts, monographic publications, manuals, city programs of use and protection of lands, city-planning and land-surveying documents. The research also studies directions and mechanisms to improve the system of land resources management under conditions of power decentralization.

In the scientific literature, there is a notion of "mechanism of state regulation". However, its essence is interpreted rather contradictory, which is confirmed by the analysis of works of such domestic and foreign specialists, as Horlachuk (2002), Dankevych (2017), Kostyshyn (2015), Malookyi (2016) [2, 4, 5, 8].

A great contribution to the development of some aspects of state regulation of land resources is made by Dorosh (2004), Kulinich (2016), Tretiak (2006) and others [3, 6, 13].

RESULTS AND DISCUSSIONS

The problem of land resources management has always been an actual issue, because land is a basis for any production.

However, while in non-agricultural field, land is of passive, secondary importance, in agriculture and forest husbandry, it is the principal production means. The fact confirms the great importance of land.

Land has some peculiarities, which differ it from other production means. They are 1) land is a product of nature; 2) space restriction; 3) permanent location; 4) appropriate agricultural use of land results in improvement of its fertility and productivity, etc. [5].

Important issues include implementation of the state land policy, its efficiency, expertise, appropriate management of land resources and their solution.

Nowadays, citizens of Ukraine have got millions of hectares of productive lands into ownership for extension of their private farms, organization of farming enterprises. Great area has been used for residential building, horticulture and vegetable growing, etc.

Increase of the number of business entities on land has initiated increase of land relations participants and intensified environmental problems. In its turn, it requires development of a new and improvement of the existing set of legislative documents concerning property forms, payment for land, mortgage, land protection, etc. It is now obvious that methods of land resources management, which have been established in the period of state ownership of land and are still used, do not meet modern requirements of market economy and do not satisfy needs of business subjects on land [5].

The notion of land resources management is formalized to the degree, which can supply its accurate and rather broad definition. Moreover, any definition of management relates to the notions, which are not generally formalized (system, goal, tasks, functions, etc.) [11].

The goal of management is a pre-determined result (conditions of an object). All instruments and methods of regulation of social-economic development and improvement of environmental conditions are focused to reach the goal. The intention to reach a goal always forces social-economic and ecological activity [13].

March 31, 2016, the Parliament registered a new project of law "About introduction of changes to some legal acts of Ukraine concerning expansion of authorities of local government bodies of land resources management and intensification of the state control for use and protection of land". It was followed by approval of the law of Ukraine "About voluntary amalgamation of territorial communities" and establishment of 159 amalgamated communities at the end of the year [7].

That Law regulates relations, which are established in the process of voluntary amalgamation of territorial communities of villages, settlements and towns, as well as voluntary joining to the amalgamated territorial communities.

Adjacent territorial communities of villages, settlements and towns can be subjects for voluntary amalgamation of territorial communities.

An amalgamated territorial community with a town as an administrative center is called a town territorial community, with a settlement as its center – is a settlement territorial community and with a village, as a center – is a village territorial community [12].

Intensification of the position of territorial community with an authorized right to dispose the lands, which are within the settled territory and outside it, is one of the main tasks of the decentralization reform.

The issue of power decentralization is outlined in the Concept of reforming of local government and territorial organization of power in Ukraine, approved by the Resolution of the Cabinet of Ministers of Ukraine №333 of April 1, 2014 [1].

The Concept of reforming of local government and territorial organization of power in Ukraine says that one of the urgent problems of local government development is to wake up an interest of local government to solution of the problems in the field of land relations.

Nowadays, the issue of land relations is controlled by the bodies of local government only within settled places, i.e. approximately 4% of the territory of Ukraine, and 96% of land resources are at the disposal of executive bodies. That system should be changed, giving the principal share of land resources to the control of the bodies of local government, capable territorial communities, and another share should stay state-owned. Particularly 84% of land resources should be transferred to territorial communities, and 16% - to the Cabinet of Ministers of Ukraine (lands of the bed of territorial sea; lands under large and small rivers; exclusion area; lands of natural reserved fund; lands of defense). Important position of the state is first in security of control for rational use of land resources.

The reform of territorial organization of power in Ukraine is an extremely important task, which, in spite of its complexity, should be performed in the nearest future. Application of the proposed approaches in the process of formation of administrative and territorial units of a basic level under improvement of land laws will simplify the corresponding administrative procedures and minimize the number of potential conflicts in the process of territories management and development of territorial communities [7].

The urgent task of land reform is to transfer state land to communities. Having obtained the appropriate rights, the communities will arrange, make inventory and sell the lease right for land at an open auction. Consequently, the communities will get a powerful financial resource for their development.

Thus, in the short term it is necessary:

To develop and introduce a strategy for interaction with the parliament in making of appropriate decisions concerning intensification of authorities of ATC in terms of disposal of land resources within their jurisdiction.

To help communities to make inventory of 100% land.

To define complex planning documents, which include architectural and land information at the level of community and the region.

To secure transition of land parcels of communal and state property to lease or sale through the mechanism of transparent online auctions [10].

Unfortunately, nowadays communities are in terrible conditions. The reason is in the imperfect system of management at the level of local government, which prevents engagement of a huge potential of population. Besides, it is very difficult to overcome the stereotypes, which have been established in the Soviet period. Many decades, people were persuaded that they did not need to think, they were said what to do. Under current conditions, another idea is required, i.e.

nobody will solve the problems of community, which are in its responsibility. However, such social thinking needs adequate conditions.

A bright example is demonstrated by modern Poland. The experience, accumulated by the neighbor concerning decentralization of state management, regionalism and local government is of great importance for Ukraine. It enables observation of the dynamics of democratic transformations and determination of peculiarities for improvement of power authorities' activity.

For instance, sources of budget filling of a Polish municipality and Ukrainian village council, for discharge of their responsibilities, are similar, including taxes for land and income tax from citizens. However, in a municipality there are approximately 5-7 thousand of people, while in 46% of village councils, there less than a thousand. Having analyzed the situation, the authors of the work cone to the conclusion that, within the present territorial organization, it is practically impossible to make calculation and records of the efficiency of budget cost utilization. The present budget system exists not for a citizen, who needs services, but for the infrastructure. Besides, there is no a clear distinguishing between state and communal property. Land reform is not completed and thus, the second source of budget filling cannot be fully engaged [9].

A law concerning voluntary joining of communities came into force on March 18, 2017 and the newspaper of the Supreme Council "Holos Ukraiiny" published the Law of Ukraine "About introduction of changes to some legislative acts of Ukraine (concerning voluntary joining of territorial communities)" (project of the law № 4772). Thus, the Law is officially in force.

The Law simplifies the procedure of voluntary amalgamation of territorial communities, gives right for communities to join the existing one at a simplified procedure. It will support establishment of capable communities according to the approved Prospective plans without violating the Methods of such communities' formation. The changes are represented by the parameters, which are to be reached for a community to become a capable one. Such community should be established around a center, determined by a Prospective plan of formation of the territories of the region communities. It should include at least half of the number of residents, expected by the Prospective plan. The each next territorial community joins the community at simplified procedures. The joint territorial communities can also elect delegates to the council of the amalgamated community, while head of the amalgamated community is not elected. Thus, the council of a new-established community will include representatives of all territories.

Transfer of land to the disposal of amalgamated territorial communities is a common European practice of rights and responsibilities decentralization.

In terms of decentralization, the principal goal of the land reform is to secure sustainable social and economic development of the territories through efficient management in the field of land use.

The primary steps expect the necessary regulation of the order to determine boundaries of the territory of amalgamated territorial communities and simplification of the procedure of development and approval of the document concerning land organization, particularly determination of boundaries of administrative-territorial units [4].

The next step is to adopt the Resolution of the Cabinet of Ministers of Ukraine of June 7, 2017 № 413 "Strategy of improvement of the mechanism of management in the field of use and protection of agricultural lands of state property and disposal of them".

The general part says that nowadays there is an urgent need to determine an efficient mechanism of management in the field of use and protection of agricultural lands of state property, prevention of excessive use, reduction of social tension in the field.

Ukraine possesses a considerable land-resource potential. As of January 1, 2017, land fund of Ukraine constituted 60,3 million hectare, or approximately 6 % of the territory of Europe.

Agricultural lands constitute almost 19% of the general European ones, including arable land – almost 27%. Indicator of the area of agricultural lands, in calculation per one person, is the highest among the European countries and makes 0.9 hectare, including 0.7 hectare of arable land (the average indicator of European countries constitutes 0.44 and 0.25 hectare respectively).

In total, the area of agricultural lands takes 42.7 million hectare, or 70% of the total area of Ukraine, and area of arable land – 32.5 million hectare, or 78.4% of all agricultural lands, 13.1% pastures, 5.8% hay fields, 2.1% perennials, 0.6% grassland (Fig. 1).

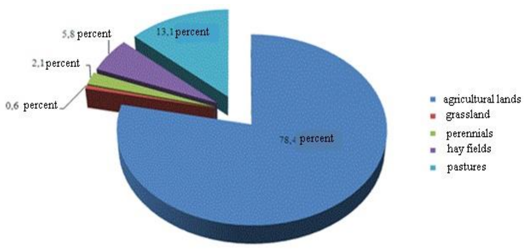

Fig. 1. Structure of agricultural lands
Source: [10]

Area of black land soil in Ukraine occupies from 15.6 million to 17.4 million hectares, or approximately 8% of the world reserves. Of them of agricultural lands by the form of property: 74.8% private, 25.1% state, 0.1% communal; of them arable land: 84.3% private, 15.6% state, 0.1% communal (Fig. 2).

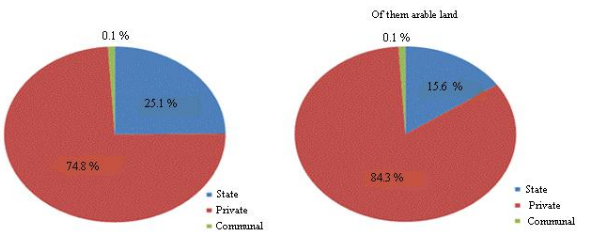

Fig. 2. Distribution of agricultural lands by the form of property
Source: [10]

In the structure of land resources of the country and land use, one can observe substantial disproportion, which can make threat for environment and living conditions in case of their intensification, as well as reduce efficiency of economic activity and sustainable development of the national economy in total.

In Ukraine, 92% of the territory are engaged in economic activity. Employment degree is extremely high and constitutes 54% (in the developed countries of Europe it constitutes nearly 35%). Actual forests cover only 16% of the territory of Ukraine that is insufficient for ecological balance (the average indicator of European countries is 25-30%) (Fig. 3).

Excessive employment of lands (above 54% of the land fund of Ukraine), including the land on slopes, has caused deterioration of ecologically balanced correlation of agricultural lands, forest and water objects. It has made a negative impact on stability of agro-landscapes and caused a considerable anthropological load on ecological sphere.

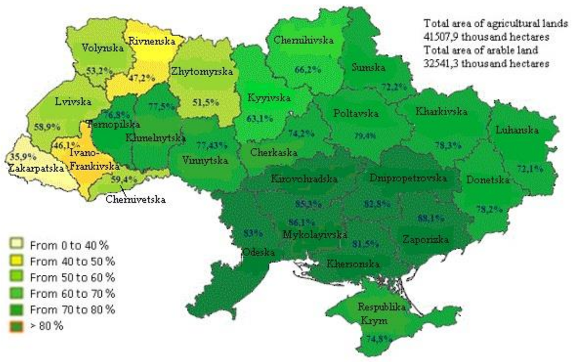

Fig. 3. Employment of agricultural lands in the regions of Ukraine
Note: data on the Resolution of the Cabinet of Ministers of Ukraine of June 7, 2017. Kyiv.

The issue of implementation of the state land policy, its efficiency, expertise, appropriate management of land resources is f urgent importance.

Implementation of the state policy expects that bodies of state power carry activity in the field of land relations, focused on rational use and protection of lands, security of food safety of the country and creation of ecologically safe conditions for running of economic activity and living of citizens. Quality of the state land policy is determined with consideration of the criteria (requirements) of appropriate state management of land resources, which are described in the Recommendations of Food and Agriculture Organization of the UNO (FAO).

According to the recommendations of the European economic Commission of the UNO on the issues of land resources management, appropriate state management of land resources requires performance of the measures concerning:

- legally approved definition of the essence of land, forms and character of property, forms of use and rights for land, restrictions and obligations, which should be registered;
-commercial use of the system of land resources management according to a long-term financial model, a system of legal normative regulation and administrative management, as well as orientation of the system of land resources management for satisfaction of consumers demand;
- security of transparent activity of the system of land resources management, a reliable, free, low-cost access to land information for all subjects of the market;
-performance of continuous monitoring, estimation and control for efficiency, integrity and transparency of the system of land resources management with consideration of the indicators, depicting expenditures of funds and time for performance of each transaction with land, as well as the degree of needs satisfaction.

Results of analysis of the present situation in Ukraine supply the conclusion that nowadays those measures are not completely performed.

However, the expected results from Implementation of the Strategy will secure:

-functional efficiency and transparent system of management in the field of use and protection of agricultural lands of state property with consideration of decisions and recommendations of the 35th session of the Committee about the global food safety and development of rural regions by improving of the system of land use;
-rational use of agricultural lands of state property with consideration of the interests of society, territorial communities and the state;
-optimization of the structure and area of the lands of state property and system of land use;
-updating of the data of the State land cadaster;
-performance of the conservation of degraded, low-productive and technologically polluted lands and recultivation of deteriorated lands;
-improvement of the mechanism of management in the field of use and protection of land, keeping and reproduction of soil fertility;
-stop of economic use of ecologically dangerous, economically inefficient land parcels and their grassing or foresting;
-reduction of the level of corruption and minimization of social tension in the field of land relations;
-increase of efficiency of the state land policy, accelerated implementation of the land reform [10].

CONCLUSIONS

Considering everything mentioned above, one can make a conclusion, that the state land policy is at the stage of formation and does not completely correspond the European and world criteria and requirements concerning appropriate land resources management.

In Ukraine, there is no legally approved general strategy of development of land resources and land relations. However, there are great expectations that we soon get the wished legislative documents, which will contribute to solution of the problems in the field of land relations, improve the trust of business people and society to the system of land relations.

Nevertheless, there is a positive fact that nowadays, on the territory of Ukraine, more than three thousand villages have amalgamated and 665 territorial communities have been established. The reform is in the progress.

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SOCIO-ECONOMIC ANALYSIS OF FACTORS THAT INFLUENCE THE ADAPTIVE CAPACITY OF MAIZE FARMERS TO CLIMATE CHANGE IN SOUTHWEST NIGERIA

Olaniran Anthony THOMPSON[1], Oluyede Adeleke ATURAMU[2]

[1]The Federal University of Technology, Department of Agricultural and Resource Economics, P. M. B. 704, Akure, Nigeria. +2348036288434, Email: oathompson@futa.edu.ng,
[2]College of Education, Ikere, Nigeria

Corresponding author: oathompson@futa.edu.ng

Abstract

The study assessed the climactic variables effect on maize farmers in South-western Nigeria. Especially, the maize farmers' socio-economic characteristics in both the guinea savannah and rainforest Agricultural Ecological Zones (AEZs) were assessed. The adaptive capacity and socio-economic variables that impact on the adaptive capacity of the maize farmers were determined in both zones. A multi-stage sampling was used for the study. Ekiti and Oyo state were purposively selected for the study because they are the highest producers of maize in the region, 360 maize farmers were interviewed for the study. The methods of data analysis includes descriptive statistics, 5-point Likert-type scale, Livelihood Diversification Index (LDI) and Logit Regression Model (LRM). The descriptive statistics result revealed that farmers in the rainforest zone were older than their counterparts in the guinea savannah with the mean age of 50.9 years and 49.2 years respectively. The study revealed that maize farmers' in the guinea savannah ecological zone perceived climate change as high intensity of sun with the grand mean values (X) of 3.88. Also, logistic regression estimation found age square, level of education, farming experience, income, access to credit, farm size and land ownership as significant policy variables of livelihood diversification (Adaptive capacity) among maize farmers in the study area. Therefore, from the findings of the study, it was suggested that government at all levels and Non-Governmental Organizations (NGOs) should enhance the adaptive capacity of the maize farmers' in the study area by providing credit facilites to them at single-digit interest rate.

Key words: *maize farmers, adaptive capacity, Logit Regression Model, agricultural ecological zones*

INTRODUCTION

The unprecedented increase in human activities as a result of industrialization has being acknowledged as one of the major causes of global warming. This has led to unpredictability of weather and is affecting the agricultural yield significantly. Also, it has being established that there is nexus between weather variables and agricultural yield according to the Intergovernmental Panel on Climate Change (IPCC), (2010) [12].
Agriculture in the form of crop production, livestock breeding, fishery and forestry contributes reasonably to the economy of Nigeria at local, state and national level. The sector employs the majority of the Nigerian population **(**Ayoade, 2012**)** [4]. Most rural dwellers are involved in agricultural activities. This can be in form of input marketing, production, value addition, transportation and output marketing.
Therefore, high percentage of the labour force (70%) in Nigeria is engage in agricultural related activities. According to Olukoya, (2007) [23], the sector contribution to Gross Domestic Products (GDP) in 2006 was about 25%. The economy of Nigeria is dominated by agriculture and natural resources extraction which drives the national economic development.
The findings of Deressa and Ringer, (2009) [7] revealed that agricultural sector in most Sub Sahara Africa (SSA) productivity is low and is as a result of small scale production that is predominant in the sector. Several factors such as lack of access to credit, improved inputs, lack of infrastructures and deforestation among others accounted for the low productivity in the continent agricultural sector. These factors impact negatively on the

adaptive capacity of the farmers and increase their vulnerability index. Hence the high exposure of farmers to production, marketing and climate change risk.

In Nigeria, maize is of critical importance to food and income generation. Maize is a major and important cereal being cultivated in all the agricultural zones in Nigeria because of better varieties. It serves as the main staple food for millions of Nigerians (Oyewo, 2016) [28]. Maize is consumed in various forms in Nigeria, especially in the southwest, southeast and south-south of the country. Maize could be boiled and eat or processed to pap and porridge.

Maize is industrially important chiefly for the production of starch and alcohol. The starch can be used for cooking and salad dressing (Onuk *et al., 2015)* [26]. Maize is a major ingredient in infant and livestock feed industries. It is also fermented to produce dextrins, sugars, and syrup (Sowumi and Akintola, 2014) [30]. The maize subsector provides employment for many farmers. Many farmers are into maize production because of its economy value and due to its usage in the industries (National Bureau of Statistics (NBS), 2016) [17]. The importance of maize cannot be overestimated (Ojo, 2016) [20]. Its importance cut across different spheres of human life.

Nigerian government at all levels are making efforts to ensure increase in agricultural productivity, however, the effects of climate change is pronounced in this sector. Since temperature, light, and rainfall which are weather variables are the main determinant of crop yields. Again, climate change which is the variations in relative humidity, sunshine, and particularly temperature and rainfall, can have severe adverse effects on agricultural practices and the outputs of both cash and food crops as well as on animal production potential (Omotosho, 2009) [25]. Consequently, it is important to assess the maize farmers' perception and the socio-economic factors that influence their adaptive capacity to climate change in Nigeria. This is to enhance the formulation of efficient and effective policies that will reduce the negative impact of climate change risks on maize farmers' productivity in Nigeria.

MATERIALS AND METHODS

Study Area

The study was conducted in Ekiti and Oyo States in the Southwestern Nigeria. There are 49 Local Government Areas (LGAs) in the two states. Ekiti has 16 LGAs and Oyo has 33 LGAs (Adejuwon and Odekunle, 2006) [1]. All the States are within the tropical rainforest, they have bi-modal rainfall distribution but with less intensity. There is a distinct dry and rainy seasons in the region. All the States have an average annual rainfall and temperature of 1490mm and 26.3^{o}C respectively (Omotosho, 2009) [25]. The states have a high density of human population of 5,869,902 (NPC, 2007) [18] and most of the people are farmers. The states are a major source of timber in the region. In the humid rain forest of the states are found economic cash crops such as oil palm, (*Elaeis guineensis*), cocoa (*Theobroma cacao*), Rubber (*Hevea brasiliensis*) banana/plantain (*Musa* spp.) and cola nut (*Cola nitida*). Also found are some principal staple food crops and fruits. (Oyekale, 2014) [27]

Fig. 1. Map of South-western Region of Nigeria
Source: NPC, 2007.

The states are peopled predominantly by Yorubas who speak various dialects of the Yoruba language and the life patterns of the people represent an embodiment of culture, ranging from the local foodstuff to the mode of dressing, dancing, wood crafts, such as, carved house posts and decorated doors (Omonijo *et al.*, 2014) [24]. Figure 1 shows the map of south-western Nigeria.

Sample and Sampling Techniques

The sampling technique used for the study was multi-stage. Two states namely Ekiti and Oyo were purposively selected for the study because they are the highest producers of maize in the region (NBS, 2016) [17]. In each state, four Local Government Areas (LGAs) that are major producers of maize were purposively selected for the study. In each LGA, three (3) communities that are major producers of maize were purposively selected through the assistance of the Fadama II and Agricultural Development Programme (ADP) extension agents in each State. Furthermore, in each community, 10 maize farmers' were randomly selected. Therefore, 360 maize farmers were interviewed for the study. Structured questionnaire was used to collect data from each LGA. Taking cognizance of the Agro-Ecological Zones (AEZs) in the states and determining the perception of the farmers with regards to what they perceive as climate change. Also, identifying the significant variables that influence the farmers' adaptive capacity in the study area.

Nature and Sources of Data

Data used in this study were collected from one source, namely primary. Data were obtained through administering structured questionnaire on the maize farmers who were visited. The dataset collected include: maize farmers' socio-economic characteristics, membership of associations, access to credit and extension services, perceptions of climate change, other source of income apart from maize farming.

Data Analysis and Model Specification

Descriptive statistics, Livelihood Diversification Index (LDI) and logit regression model were used to analysis the data collected. Descriptive statistics such as frequency distribution, mean, mode, simple proportions, 5-point Likert-type scale, bar chart and graph were used to examine the socio-economic characteristics of maize farmers in the study area. To determine the maize farmers' perception of climate change in the study area, 5-point Likert-type scale was used. Respondents were asked to respond to statements relating to intensity of sun over time, degree of temperature over time, rainfall frequency, frequency of floods and droughts, using Strongly Agreed (SA), Agreed (A), Undecided (U), Disagreed (D), Strongly Disagreed (SD). The responses were scored as 5,4,3,2 and1for SA, A, U, D and SD respectively.

The mean from each statement was obtained and used to classify the responses on each statement into SA (>4.50), A (3.50-4.49), U (2.50-3.49), D (1.50-2.49) and SD (<1.50). The grand means for all the statements were calculated to be able to place all the responses on a continuum that enabled a conclusion to be drawn on what the perception of the respondents were with regard to climate change in each AEZ. Livelihood Diversification Index (LDI) using Herfindahl index of diversification was used (Kimenju and Tschirley, 2009) [15] to determine the adaptive capacity of the respondents, which is calculated as

$$D_k = 1- \sum_{i=1}^{N}\left(s_{i,k}\right)^2 \text{ -------- } (1)$$

where,

D_k is the diversification index, i is the specific livelihood activity, N is the total number of activities being considered, k is the particular household and $S_{i,k}$ is the share of i^{th} activity to the total household income for k^{th} household.

Logit Regression Model (LRM) was used to determine the factors that influence the livelihood diversification of maize farmers in both the guinea savannah and rainforest AEZs.

The model is stated thus:

$$L_i = P_i/ \text{Ln } 1\text{-}P_i = \beta_0+ \beta_1 X_1+ \beta_2 X_2+ \beta_3 X_3+ \beta_4 X_4+ \beta_5 X_5+ \beta_6 X_6\text{----}\beta_{14} X_{14} + U_i \text{ ----- } (2)$$

where P_i = if diversified (diversified1 and not diversified 0)

The dependent variable is livelihood diversification index

The independent variables were:

X_1 = Age (in Years)

X_2 = Age Square (in Years)

X_3 = Sex (1 = male, 0 = Female)

X_4 = Marital status (1 = Married, 0 = Otherwise)
X_5 = Level of Education (Years of formal Schooling)
X_6 = Farming Experience (in Years)
X_7 = Farm income (Naira)
X_8 = Non-Farm Income (in Naira)
X_9 = Household size (No)
X_{10} = Membership of Association (1 = Yes, 0 = No)
X_{11} = Access to Credit (Amount in Naira)
X_{12} = Access to Extension Support (No of Contacts)
X_{13} = Farm Size (in Hectares)
X_{14} = Land Ownership (1= Yes, 0 = Lease)
U_i = Error term
Where β_0 = Intercept or constant
b_1 = Vector of parameter estimates.

RESULTS AND DISCUSSIONS

From table 1, 85% of the respondents in the guinea savannah were male and 66.8% were male in the rainforest AEZ. The high variation in the ratio of male to female maize farmers' can be attributed to the fact that men always have greater access to land as a productive resource than women. Since there is great disparity between female and male in the size of landholdings, the mode of women participation in maize farming in the two AEZs will definitely vary with the land-owning status of households (Onuk *et al.*, 2015) [26]. The study revealed that more women (33.2%) were involved in maize farming in the rainforest AEZ compare to in 15.0% guinea savannah AEZ. This actually butresses the fact that men in the rainforest AEZ will likely give more attention to cash crops such as cocoa and allow their women to be involved in maize farming. The men in rainforest AEZ will definitely like to take advantage of the regular and steady rainfall to plant cash crops and other viable economy crops that actually require regular water such as plantain.

The Table reveals further that majority of the respondents in both guinea savannah AEZ (87.8%) and rainforest AEZ (79.4%) are in their active economic age bracket. The mean productive age of 49.2 years in guinea savannah and 50.9 years in the rainforest buttress this. The result is in tandem with Olayemi (2015) [22] who opined that for farmers to be productive in farm chores, they must be young and active in order to contribute meaningful labour input into all the stages of production for efficient output realization which in turn results in consumptive and income opportunities with proportional household welfare. However, the percentage of those in active age in the guinea savannah was more than that of the rainforest AEZ. This is likely going to be, because most youths in the guinea savannah were involved in the cultivation of maize compared to their counterparts in the rainforest. Since rainforest AEZ is mainly known for cash crops such as cocoa, there is likelihood for most farmers in the AEZ to devote most of their time and energy to cash crops production (Burkard, 2007) [6].

The number of years put in by the sampled farmers as shown in table 1 reveal that the mean farming experience of the respondents in the guinea savannah zone was 18.9 years with 6-10 years being the modal distribution. In the rainforest AEZ, the mean farming experience was 16.6 years with 6-10 years being the modal distribution. This implies that maize farming is not a new enterprise in the two AEZs; experience gained on farm first hand is better than theory read in schools or from seminars and workshops (Thompson and Amos, 2010) [31]. In the two zones, an overwhelming majority (>90.0%) of the farmers have farming experience of six years or above. The overall average farming experience of over 17.8 years imply that most farmers in both AEZs have adequate farming experience in maize production. Therefore, the respondents were not novices in maize farming.

91.7% of the respondents in the guinea savannah were married and 83.3% in the rainforest were also married as shown in Table 1. Hence, there is tendency for most of the maize farmers in both AEZs to rely on family labour to augment seemingly fizzled-out hired labour thereby reducing the cost of labour. This finding supports Ogunwande's (2014) [19] claim that marriage increased the number of households' members, making more labour available for farming.

Table 1. Socio-economic Characteristics of Rural Farmers' in the Study Area

Socio-economic Characteristics	Southern Guinea Savannah Ecological Zone		Rain Forest Ecological Zone		Pooled	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Sex						
Male	153	85	120	66.8	273	75.8
Female	27	15	60	33.2	87	24.2
Total	**180**	**100**	**180**	**100**	**360**	**100**
Age in years						
≤ 20	4	2.2	7	3.9	11	3.1
21-30	20	11.2	10	5.6	30	8.3
31-40	17	9.4	11	6.1	28	7.8
41-50	53	29.4	62	34.4	115	31.9
51-60	68	37.8	60	33.3	128	35.6
≥ 61	18	10	30	16.7	48	13.3
Total	**180**	**100**	**180**	**100**	**360**	**100**
Farming Experience in years	6	3.3	17	9.4	23	6.4
≤ 5	60	33.3	62	34.4	122	33.9
6 – 10 years	22	12.2	28	15.6	50	13.9
11 – 15 years	33	18.3	26	14.4	59	16.4
16 – 20 years	59	32.9	47	26.2	106	29.4
> 20 years						
Total	**180**	**100**	**180**	**100**	**360**	**100**
Marital Status						
Single	3	1.7	10	5.6	13	3.6
Married	165	91.7	150	83.3	315	87.6
Divorced	4	2.2	3	1.7	7	1.9
Widowed	8	4.4	17	9.4	25	6.9
Total	**180**	**100**	**180**	**100**	**360**	**100**
Education Attained						
No formal Education	25	13.9	31	17.2	56	15.6
Adult Education	6	3.3	21	11.7	27	7.5
Primary School Education	29	16.1	59	32.8	88	24.4
Secondary School Education	59	32.8	45	25.0	104	28.9
Tertiary Education	61	33.9	24	13.3	85	23.6
Total	**180**	**100**	**180**	**100**	**360**	**100**
Mean Age	**49.2**	**50.9**	**50.1**			
Mean Farming Experience	**18.9**	**16.6**	**17.8**			

Source: Computed from Field Survey, 2017

In other words, marriage increases a household's productive labour and in turn boosts farm activities. Furthermore, the spouses would likely assist in the marketing of maize output. The offspring of such maize farmers could also assist in the production process thereby reducing labour wage and ultimately production cost.

As shown in the Table, reasonable percentage (50%) of the respondents in the rainforest AEZ were not educated since the percentage of those who had no formal education and primary school education is half and those who had adult education, secondary school and tertiary education were also 50%. Since education is important for sound decision making in all human endeavours, these results suggest that extension workers need to do more to sensitize farmers on the need to be educated in the AEZ. Since more than half of the farmers in the guinea savannah could read and write, introduction of new technologies and its adoption may not be a challenge compared to their counterparts in the rainforest AEZ. From the Table, farmers in the guinea savannah AEZ appear to be more literate than their counter parts in the rainforest AEZ. It provides reading ability, consciousness and awareness, which enable good decisions to be made. Therefore, the higher the level of a farmer's education, the better his decision making ability, especially in the adoption of new technologies and other innovations.

From Fig.2., 33.3% of the respondents in the guinea savannah AEZ belong to at least one farmers' organization. However, in the rainforest AEZ, 52.8% of the respondents claimed membership of farmers' organizations. The result revealed that high percentage of the respondents in the guinea savannah were not members of any farmer organization. The implication here is that only a few farmers would have access to credit facilities through cooperative organizations compared to their counterparts in the rainforest AEZ. According to Amos, (2014) [2] membership of association is of immense benefits to members, it gives opportunity for bulk purchase of inputs at discounted rates and helps members secure credit facilities as at when due. In addition, lending agencies will prefer to give credit to a cooperative body rathern than to an individual.

Fig. 2. Rural Farmers' Membership of Farmers' Organization in the Study Area
GS = Guinea Savannah
RF = Rainforest

The implication is that only a few farmers in the guinea savannah would have access to credit facilities (Develtere and Pollet, 2012) [8]. Moreover, there will be limited forums to reach out to farmers that do not belong to an association since most developmental organizations and extension agents distribute inputs to the farmers at a subsidized price through farmer organizations (Bagchee, 2004) [5].

In the guinea savannah AEZ, 30.0% of the respondents had less than 1ha, 46.7% had between 1 and 5ha, 10.0% had between 6 and 10ha and 13.3% had more than 10ha. In the rainforest AEZ, 47.8% had less than 1 hectare, 43.9% had between 1 and 5ha, 2.2% had between 6 and 10ha and 6.1% had above 10ha. The mean farm size of 4.4ha in the guinea savannah and 2.3ha in the rainforest AEZs revealed that the maize farmers' in both AEZs were into small scale farming (Kang, 2011) [14]. The average household size of about 7 people in both zones is relatively large enough considering the average farm size of 4.4ha and 2.3ha which perhaps will necessitate the use of family labour by most of the respondents for maize production. Also, from the Table, the rainforest AEZ mean farm size of 2.3ha compared to 4.4ha of the guinea savannah may likely due to the fact that the heavy rainfall also predisposes soil to leaching; while the big trees and rugged topography make land clearing more difficult and expensive, hence the subsistence nature of maize farming in the rainforest AEZ (Sowunmi and Akintola, 2010) [30]. Again, the major difference in the average farm size may be due to the pressure of urbanization on availability of farm land; urban settlement being more prominent in the rainforest zone than in the guinea savannah zone (Amujoyegbe and Alabi, 2012) [3].

Figure 3 reveals that 18.3% of the respondents in the guinea savannah AEZ, had access to credit facilities and 40% of the respondents in the rainforest AEZ had access to credit facilities. According to Fasoranti (2006) [10], poor access to credit facilities coupled with non-membership of cooperative societies by farmers may account for the poor financial base of farmers and hence their inability to employ modern farm implements, resulting in poor productivity by the farmers.

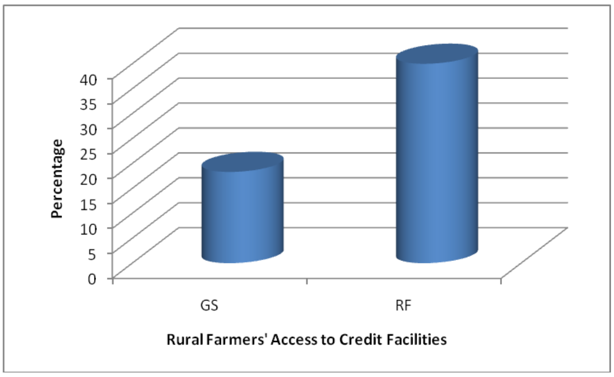

Fig. 3.Rural Farmers' Access to Credit Facilities in the Study Area
GS = Guinea Savannah
RF = Rainforest

As shown in Figure 4, 17.8% of respondents in the guinea savannah AEZ had access to extension agents at least twice a month while 82.2% had access to extension agents less than twice a month. In the rainforest AEZ, 30.6% of the respondents had access to extension agents at leat twice in a month and 69.4% had access to extension agents less than twice in a month. Therefore, in both zones 75.8% of maize farmers had limited access to extension education that can enhance their productivity. Therefore, few maize farmers' in the study area had access to information and new production techniques. Since the extension agents serve as intermediary between the government and the farmers. Through whom the government distributes improved varieties of inputs to the farmers (Jiggins, 2007) [13].

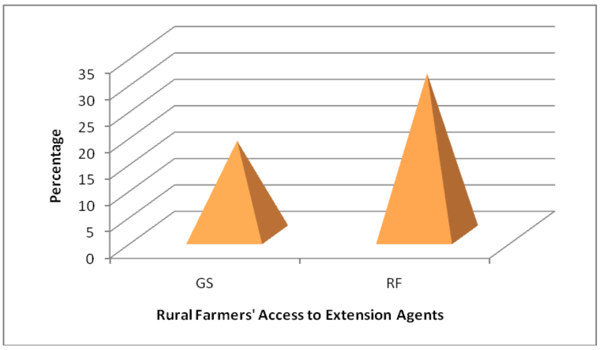

Fig. 4. Rural Farmers' Access to Extension Agent in the Study Area
GS = Guinea Savannah
RF = Rainforest

The responses of the rural farmers' in the guinea savannah ecological zone to the perception statement of what they understand by climate change revealed in table 2 that they had positive perception towards high intensity of sun, high degree of temperature, frequent rainfall (i.e. Unpredictable) and unusual drought statements with the grand mean values (X) of 3.88, 3.88, 3.52 and 4.18 respectively indicating agreed to all the above statement. The zone is characterized by low rainfall and long dry period compared to rain forest ecological zone. This probably accounts for the reason why the rural farmers in this zone perceived climate change as, high intensity of sun, high degree of temperature and unusual drought.

Table 2. Rural Farmers' Perception of Climate Change in Guinea Savannah

S/N	**Perception Statements**	**Responses**						
		SA *f/(%)*	**A** *f/(%)*	**U** *f/(%)*	**D** *f/(%)*	**SD** *f/(%)*	**Mean Rating X**	**Remark**
1	High intensity of sun	81 (45.0)	57 (31.7)	0 (0)	24 (13.3)	18 (10.0)	3.88	**A**
2	High degree of temperature	66 (36.7)	51 (28.3)	42 (23.3)	18 (10.0)	3 (1.7)	3.88	**A**
3	Frequent rainfall (Unpredictable)	60 (33.3)	45 (25.0)	21 (11.7)	39 (21.7)	15 (8.3)	3.52	**A**
4	Incessant flood	3 (1.7)	9 (5)	45 (25)	75 (41.7)	48 (26.6)	2.13	**D**
5	Unusual drought	90 (50)	63 (35)	- -	24 (13.3)	3 (1.7)	4.18	**A**

Source: Field Survey, 2017

Also, Table 3 reveals the responses of the rural farmers' in the Rainforest AEZ to the perception statements of what they perceived as climate change. The rural farmers had positive perception towards the third (Frequent rainfall (i.e. Unpredictable)) and forth (i.e. Incessant flood) statements with the grand mean values (X) of 3.76 and 3.78 indicating agreed to the above statements, undecided about the second (i.e. High degree of temperature) statement and negative perception towards the first (i.e. High intensity of sun) and fifth (i.e. Unusual drought) statement with the grand mean value (X) of 2.45 and 2.13 indicating disagreed to the above statement. This zone is characterized with frequent rainfall and has an average annual rainfall and temperature of 1489mm and 26.5ºC respectively (Omotosho, 2009) [25]. Therefore, it is not surprising that farmers from this zone perceived climate change as frequent rainfall and have no basis to perceive it as unusual drought.

Table 3. Rural Farmers' Perception of Climate Change in Rain Forest Ecological Zone

S/N	Perception Statements	Responses						
		SA *f/(%)*	**A** *f/(%)*	**U** *f/(%)*	**D** *f/(%)*	**SD** *f/(%)*	**Mean Rating X**	**Remark**
1	High intensity of sun	9 (5)	21 (11.7)	38 (21.1)	52 (28.9)	60 (33.3)	2.45	**D**
2	High degree of temperature	15 (8.3)	12 (6.7)	60 (33.3)	36 (20)	57 (31.7)	3.42	**U**
3	Frequent rainfall (Unpredictable)	54 (30)	63 (35)	6 (3.3)	33 (18.3)	24 (13.3)	3.76	**A**
4	Incessant flood	36 (20)	63 (35)	24 (13.3)	30 (16.7)	27 (15)	3.78	**A**
5	Unusual drought	6 (3.3)	21 (11.7)	36 (20)	87 (48.3)	30 (16.7)	2.13	**D**

Source: Field Survey, 2017.

Table 4 shows the adaptive capacity of the maize farmers' in both the Guinea savannah and Rainforest AEZ. The measure of income diversification that takes into account the variations in the income shares which is the Herfindahl index concentration was used in this section to measure the adaptive capacity of the maize farmers' in the study area. From the Table, 19.4% of the respondents in the guinea savannah AEZ 80% income was from maize farming. While the remaining 20% income is from other sources (i.e. diversified). That is why they are considered very low adaptive capacity according to Koshti, (2014) [16].

In the same AEZ, 12.8% of the respondents 60% income is from rural farming and the remaining 40% is from other sources, so their adaptive capacity is low. The Table revealed that in guinea savannah, 18.9% of the respondents income from maize farming accounted for the 40% of their total income, the remaining 60% is from other sources. Such adaptive capacity was considered as moderate, since other sources of income will reduce the effects of climate change risks on maize production. 23.3% of the respondents in the AEZ agreed that above 80% of their income was from other sources and that is why they are regarded as very high adaptive capacity according to Koshti, (2014) [16].

Again, the Table revealed the adaptive capacity of the maize farmers' in the Rainforest AEZ. From the Table 14.4% of the respondents 80% income is from maize farming and 20% is from other sources. Also, from the AEZ, 11.1% of the respondents agreed that 60% of their income is from maize farming and 40% is from other sources. In the same AEZ, 13.9% of the respondents said that 40% of their income is from maize farming and the remaining 60% is from other sources. 48.4% of the respondents in the rainforest AEZ agreed that less than 20% of their income is from maize farming and above 80% is from other sources. The income diversification pattern as revealed in table 4 shows that maize farmers from the rainforest AEZ have other sources of income (i.e. income diversification) compare to their counterpart from the Guinea savannah. Since there is likelihood that of most of the respondents in the rainforest AEZ are into production of other arable crops and cash crops like cocoa. The AEZ is suitable for such crops compare to the guinea savannah. Therefore, they have their income diversified even from farming activities (Ellis, 2000) [9]

.Adaptive Capacity (i.e. Livelihood Diversification) of the Rural Farm Households in Both Guinea Savannah and Rainforest in South-western Nigeria.

Table 4. Adaptive Capacity of the Rural Farming Households in the Study Area

	Guinea Savannah AEZ			Rainforest AEZ	
Category	**Index**	**Frequency**	**Relative frequency Percent**	**Frequency**	**Relative frequency Percent**
Very Low Adaptive Capacity	0.20	35	19.4	26	14.4
Low Adaptive Capacity	0.40	23	12.8	20	11.1
Moderate Adaptive Capacity	0.60	34	18.9	25	13.9
High Adaptive Capacity	0.80	46	25.6	22	12.2
Very High Adaptive Capacity	>0.80	42	23.3	87	48.4
	Total	**180**	**100**	**180**	**100**

Source: Computed from field Survey, 2017

The results of logit regression model were used to determine the factors influencing the adaptive capacity (livelihood diversification) of maize farmers in the study area. In the guinea savannah, seven out of thirteen postulated independent variables were significant. These are age square, level of education, farm experience, farm income, access to credit, farm size and land ownership. Likewise, in the rainforest AEZ, four out of thirteen postulated independent variables were significant at 5%. These are age, age square, level of education and farm income. Table 5 indicates that in the rainforest AEZ, age was significant at 5%. In the AEZ, the age of the respondents influenced the livelihood diversification. It is possible for a farmer in his/her active age to be involved in many agro-enterprise ventures. Such a farmer can plant two or more crops at the same time. Also, in many cases, such a farmer can get engaged in non-farm activities such as carpentry and barbing.

The age square of the maize farmers in both the guinea savannah and rainforest AEZ negatively affects their livelihood diversification. This suggests that elderly maize farmers in both AEZs may not be willing to diversify from maize farming. A farmer, who is used to cultivating maize over the years, may be difficult to convince to cultivate other crops or pick up other jobs like barbing and carpentry. Younger maize farmers in the same AEZs may be willing to take up cultivation of other crops or venture into non-farming activities to increase his/her portfolio of income. Also, level of education was significant at 5% level in both AEZs. The coefficient was negative, implying that the higher the level of education, the lower the level of livelihood diversification of the maize farmers' in the study area. Education is an important factor influencing the level of livelihood diversification *(*Okere and Shittu, 2013) [21]. Educated farmers tend to have a sustainable livelihood, thus having a less diversified income portfolio.

The explanation of this is that respondents with formal education (especially those educated up to tertiary level) are engaged in well-paid salary jobs than those without formal education. They are less likely to combine two or more jobs (multiple job holding). This is because education enhances the potential of respondents and makes them grab available opportunities with little or no stress. Furthermore, in both AEZs, the regression analysis shows that farm income was significant at 5%. The coefficient was negative implying that farm income negatively affects the adaptive capacity (i.e. livelihood diversification). As farm income from maize farming increases, maize farmers in either zone would not see any need to diversify income especially from non-farming activities. As the income from maize farming increases, farmers would tend to give more attention to their farm than getting engaged in other activities, since they would be sure that reasonable income will come from their maize farming.

In the guinea savannah, farming experience of maize farmers was significant at 5% and the coefficient was negative, implying that as farmers' years of experience increases, such farmer will be less diversified. Specialization in planting of certain crops as a result of experience reduces the chances of farmers diversifying his/her portfolio (Idowu *et al.*, 2015) [11]**.** Also, access to credit influences the maize farmers' adaptive capacity positively in the guinea savannah and it was significant. Therefore, access to credit in the AEZ is a critical factor that will influence diversification. Farmers can combine other agribusiness such as selling farm inputs if they have access to credit. It will be possible for them to increase their adaptive capacity by diversifying their livelihood, reducing their dependence on maize production.

Table 5. Estimates of Parameters of Logit Regression Model of Factors Influencing Livelihood Diversification among Maize Farming Households in the Study Area

Variables	**Agricultural-Ecological Zones**			
	Guinea Savannah		**Rainforest**	
	Coefficient	**Standard Error**	**Coefficient**	**Standard Error**
Age (in years)	-0.158	-0.557	-0.574**	-0.218
Age Square (in years)	-4.207**	1.604	-3.702**	1.412
Sex	10.448	2474.3	4.702	1113.4
Marital Status	23.790	7306.8	12.608	2557.9
Education (Years of Formal Schooling)	-4.055**	1.774	-1.460***	0.639
Farming Experience (in years)	-3.836**	1.140	-12.5	13.75
Farm Income (in Naira)	-0.005**	0.002	-0.002**	0.000
Household Size (Nos)	-0.299	0.443	-0.009	0.005
Membership of Association	3.478	3.058	2.295	2.018
Access to Credit	3.890***	0.169	3.052*	2.683
Access to Extension Support	10.468	3215.0	9.002	2765.1
Farm Size (in Ha)	15.563***	0.675	0.125	0.075
Land Ownership	3.572***	0.639	0.368	0.304
R^2		92.9		90.3
Adjusted R^2		89.7		88.1

Source: Computed from Field Survey, 2015
***1%, **5%, *10%

Also, in the guinea savannah, the size of the farm and land ownership affected the adaptive capacity of the maize farmers positively and they were both significant. If the farmers had access to large hectares of land and they were the owner of such land, then it would be possible for them to plant other crops that required longer periods of gestation. So farm size and ownership of land are critical variables that can be used to influence the livelihood diversification of maize farmers in the AEZ. In the guinea savannah, large farm size and land holding ability will increase the adaptive capacity of the maize farmers. This is in tandem with the finding of Amos (2014) [2] on the positive correlation between land holding size and farmers' efficiency because land ownership influences the type of crops to be planted (i.e. cash crops or arable crops) (Sadiq *et al*., 2013) [29]. So maize farmers' adaptive capacity will be enhanced if they have access to larger farm size and if they owned such land.

CONCLUSIONS

From the study, maize farming was male dominated farming enterprise in the study area. Frequent unpredictable rainfall and incessant flooding was perceived to be the pronounced climate change phenomenon by the maize farmers' in the rainforest AEZ. Likewise, from the study, maize farmers in the rainforest AEZ had a high adaptive capacity compare to their counterpart in the guinea savannah AEZ. It was therefore recommended that extension agents should be supported by both government and NGOs to visit the maize farmers regularly and orientate them about climate change and how to mitigate its effects on their productivity. Again, maize farmers' adaptive capacity in the study should be enhanced by government at all levels by providing credit facilities to them at a single-digit interest rate.

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POTASSIUM REGIME OF IRRIGATED CHERNOZEMS IN VARIOUS AGROTECHNICAL BACKGROUNDS

Oksana TSURKAN[1], Svetlana BURYKINA[2], Galina SUKHORUKOVA[1], Yaroslav BILANCHYN[1], Alla PIATKOVA[1], Tamara LEAH[3]

[1]Odesa "I. I. Mechnikov" National University, Frantcuz'kiy blvd,. 48/50, Odessa, Ukraine, 65058. E-mails: otsurkan75@gmail.com; grunt.ggf@onu.edu.ua; avpyatkova2011@gmail.com;
[2]Odessa State Agricultural Experimental Station of the National Academy of Agrarian Sciences of Ukraine, 24 Mayakskoe Street, smt. Khlebodarskoe, Belyaevsky district, Odessa region, Ukraine, 67667. E-mail: burykina@ukr.net
[3]"N.Dimo" Institute of Pedology, Agrochemistry and Soil Protection, 100 Ialoveni Str., Chisinau, Moldova, 2070. E-mail: tamaraleah09@gmail.com.

Corresponding author: tamaraleah09@gmail.com

Abstract

The study analyses the changes of the fractional composition of potassium of the main soils of southern Ukraine – ordinary chernozem and southern chernozem under influence of irrigation and fertilization systems. The research was conducted in two stationary experiments, laid on chernozem ordinary (11-year of crop rotation) and on chernozem south (3-year multifactorial experiment). It is established that under the influence of irrigation in ordinary chernozem the sum of groups of potentially available potassium in a layer of 0-30 cm increases by 40.3 and 57.5% in comparison with rainfed conditions. The content of exchangeable potassium in chernozem usually varies considerably depending on the soil moisture (r = -0.80). The norm of fertilizers – manure 200 t/ha + $N_{200}P_{200}K_{60}$, introduced under the basic cultivation of the first crop rotation, in the aftermath after 11^{th} year provides a positive balance of exchangeable potassium in ordinary chernozem even with a decrease in the initial content in 2.1 times. In the southern chernozem, the total amount of potentially available potassium is much lower than in chernozem ordinary: 19.0% in the layer 0-30 cm and from 45.5 to 52.6% with a depth of 120 cm. The distribution of the depth and direction of irrigation and fertilizer systems are similar to those of ordinary chernozem.

Key words: ordinary chernozem, southern chernozem, irrigation, fertilizers, potassium regime

INTRODUCTION

Potassium belongs to the group of main elements that determine the geochemical features of the landscape, the conditions for the migration of other elements. Among the elements of mineral nutrition consumed by plants in the largest quantities, potassium holds one of the first places. Under the conditions of high potassium presence, the following qualities of the agricultural products improves: content of sugar in fruits and vegetables, starch – in potatoes, fat – in the oilseeds, the filling in grains of cereal crops, the strength of fibres in the barns.

The potassium in the soil increases the water-retaining capacity of cells, affects the plant's resistance to drought and crops' infestation of diseases [15]. This element contributes to the increased winter and frost resistance of winter wheat, as well as the frost resistance of spring crops [11]. In ordinary and southern chernozems of heavy granulometric composition, the gross content of potassium is quite high and ranges from 2.1 to 2.4% [17], though its main share constitutes a potential reserve of an exchangeable equilibrium. The gross availability of the element to plants depends on many factors, the main among which is the moisture regime and scientifically grounded use of fertilizers.

In the period of intensive use of chemicals in agriculture, most of Ukraine's soils had a high degree of supply with exchangeable potassium. Since 1991, the level use of mineral fertilizers has decreased: in 1991-

1995 biennium average was 73 kg (active substance - a.s.) of NPK, in 1996-2000 – 19 kg a.s. of NPK. Since 2001, a gradual increase has been observed and currently 43 kg a.s. NPK has been achieved, including only 8 kg of K_2O per hectare of sown area [6]. As we can see, the level of potassium fertilizers is very low. Some authors [7] consider that the important determinant of this phenomenon resides in the belief of many researchers, farmers, and specialists of the Ministry of Agrarian Policy and Food of Ukraine that most of the soils of the Forest-Steppe and Steppe areas, especially the heavy granulometric composition, are well-supplied with the potassium available to plants. However, the data collected during the recent agro-chemical survey reveals that the area of soils with low and average content of exchangeable potassium and the growth of its balance deficit from (-56.4) kg/ha in 2001 to (-64.2) has increased as for 2009 [12].

With the increase in the level of agricultural technology, spreading the use of techniques aimed at the accumulation and preservation of soil moisture, and the optimization of nitrogen - phosphorous nutrition, the agrochemical and economic effect of the use of potassium fertilizers on the ordinary and southern chernozems (the zone of the Steppe) has increased significantly. The role of potassium in irrigation and the application of high doses of nitrogen-phosphorus fertilizers in intensive crop rotation is especially evident [8].

Primarily, the plants assimilate the most mobile forms in the process of nutrition which is potassium of the soil solution. Then they consume exchangeable forms and during the development of the plant – unchangeably fixed forms, which must be taken into account when describing the fertility of soils with respect to potassium [13].

There is no consensus among the scientists about the effect of the long-term systematic introduction of fertilizers on the content of certain potassium fractions and their correlation in soils. For example, according to the studies of Nosko and Gladkyh on ordinary chernozems, it is established that when systematically applying medium and elevated potassium fertilizer rates, the content of mobile potassium increases by 23-37%, easily soluble and loosly-bond – by 30-35%, exchangeable – by 80-110% up to a depth of 100 cm [16]. According to their data, this process occurs even with a poor balance of potassium in crop rotation.

There also exist studies which confirm the same peculiarity in respect to the mobile element of the podzolic chernozems [3]. Data obtained on the chernozem drainage demonstrates that even for a positive balance of potassium, its accumulation occurs mainly in light - exchangeable forms. Alongside with this, as the content of potassium increases, its strongly bonded fractions also go up [14].

In contrast, Voronkov and Khramtsov argue that the systematic use of mineral fertilizers and straw as a source of organic matter did not significantly affect the accumulation of exchangeable forms of potassium in the recovered chernozem, which, in their opinion, is explained by the high dynamism of equilibrium between them [21]. The relative stability of the content of exchangeable potassium was observed in their experiments during 15-18 years with an annual carryover of 25-37 kg/ha.

In a stationary experiment on a dark-grey podzolic soil, fertilizer systems for the period from 2001 to 2012 provided an increase in the content even of the gross forms of potassium: mineral to a depth of 60 cm, organic and organic-mineral to 80 cm. In addition, they significantly changed the ratio of different forms of potassium to a depth of 60 cm; at a depth of up to 1 m, there was a sharp decrease in the exchangeable form almost to the indicators of the control variant.

According to the conclusions of Lopushnyak [10], an organic-mineral system with organic fertilizer saturation of 15 t/ha of crop rotation area has provided the highest rates of water-soluble, exchangeable and unchangeably fixed potassium in soil as compared to mineral and organic systems.

The influence of irrigation regimes on the state of the chernozem potassium stock was practically not studied, except for individual studies [18, 19, 23]. Some authors noted the effect of soil moisture on the mobility of potassium fractions and the evidence of its available form in soils of the steppe and dry-steppe zones [24], the Carpathians [22] and meadow-chernozem soils [9].

Thus, if the data on the effectiveness of long-term use of fertilizers in relation to the potassium regime of soils is quite contradictory, and in the conditions of irrigation is practically absent, it is necessary to systematize already received results and accumulate new types of soils, climatic zones and research methods for the establishment of certain regularities.

The aim of the study is to investigate the effect of long-term irrigation and fertilizer on the potassium regime of chernozems.

MATERIALS AND METHODS

Observations were conducted in two stationary experiments.

First, the irrigation regimes on different backgrounds of soil cultivation (ploughing to a depth of 25-27 cm to 40-50 cm) and organic-mineral fertilizer system within the Southern Bug Irrigation System were studied. The water from the South Bug river was used for irrigation. The chemical composition of hydrocarbon-calcium water with mineralization of 300-680 mg/dm^3 is as follows: among anions, hydrocarbon predominates (171.3-288.9 mg/dm^3) – an average of 54.1% of the sum of all anions; among cations – calcium (43.1-82.4 mg/dm^3), which is an average of 40.6% of their amount. The irrigation rate in the years of research from 1,200 to 3,500 m^3/ha. Irrigation rate 350-600 m^3/ha.

The soil ordinary chernozem is a shallow semi-humus lethargic on the loess (study field of the Ochakiv station). The average amount of humus in an arable layer of 0-30 cm – 4.81%, the content of which on the profile has gradually decreased. Among the absorbed bases, calcium prevailed (80.7-84.7%), the amount of sodium absorbed was negligible and amounted to 0.1% of absorption capacity. A characteristic feature of the soil is the high pH of the aqueous extract: the plough-treated horizon of 7.8-7.9, the under plough horizon and below – exceeded 8.2. Carbonation was noted from a depth of 40-50 cm.

Rotation of crops: corn for grains, winter wheat, corn for green feed, annual grasses, fodder beet, corn soda with silage, corn mix with perennial grasses. Agricultural procedures for crops cultivation is typical for this zone.

Variations of fertilizer systems: 1. 40 t/ha manure + $N_{60}P_{60}K_{15}$; 2. 100 t/ha manure + $N_{100}P_{100}K_{30}$; 3. 200 t/ha manure + $N_{200}P_{200}K_{60}$. Fertilizers were introduced once for rotation under the corn for basic cultivation. The repetition of the experiment is four times, the area of the plot is 0.15 hectares, the location is renamed. Potassium chernozem stock is presented depending on irrigation norms and fertilizer system, because there were no significant differences in ploughing variants.

The second multifactorial field experiment was laid on the territory of the Nizhnednistrovsk irrigation system at the fields of "Agrofirma Petrodolynskoe" in Odessa region. The type of crop rotation is grain and feed. Alternate crops: maize for silage, winter wheat, fodder beet. Agricultural procedures for crops cultivation is typical for this zone.

The source of irrigation in the Nizhnednistrovsk Irrigation System is the Dniester River. Total mineralization of water from March to October varies within 430-648 mg/dm^3. The dominant anion is a hydro-carbonate, the content of which varies from 195.2 to 274.5 mg/dm^3, and the averaged value is 52.3% of the sum of the content of all anions. Content of other anions: SO_4^{2-} – 75,2-171,8 mg/dm^3 or 27.6%; Cl^- – 32-76,7 mg/dm^3 or 19.8%; CO_3^{2-} – 0-9,0 mg/dm^3, or 0.4%. Irrigation rates: maize for silage – 300 m^3/ha – 5 irrigations; winter wheat – water storage – 400 m^3/ha and 3 plots of 300 m^3/ha; fodder beet – 300 m^3/ha – 11 irrigations.

The soil is southern low-humus heavy-bodied chernozem on loessed loam. Humus content in the arable layer is 3.4%. The capacity of the humus horizon does not exceed 60 cm and the humus content in its lower part is 1%. The composition of the absorbed bases is dominated by calcium, content of which in the arable layer is 26.5 mmol/100 g of soil, with the depth down to 23.3. The amount of saturated sodium is 1.4-1.2%. Carbonation is noted from a depth of 50-60 cm, but the field is aligned with this indicator only from 60-80 cm; the pH of the aqueous extract in the arable horizon ranges from 6.9 to 7.0.

The effectiveness of 19 variants of fertilizer systems was studies, the potassium fund was investigated on seven variants: 1. Control (without fertilizers); 2. Manure 40 t/ha – background; 3. Background + $P_{180}K_{180}$; 4. Background + $N_{180}P_{180}K_{180}$; 5. Background + $N_{180}K_{180}$; 6. Background + $N_{180}P_{180}$; 7. Background + $N_{300}P_{180}K_{300}$. The fertilizers were introduced once for rotation for corn silage. The area of the sown area is 550 m^2, the location is renamed, the repetition is 4 times. The exchangeable potassium was determined by the Maslova method [4], the fractional composition of potassium by the Dashevsky method in the modification of the Sokolovsky NSC ISSAR [1, 20].

RESULTS AND DISCUSSIONS

Under conditions of irrigation in ordinary chernozems, the sum of potassium groups in the layer of 0-30 cm increases by 40.3 and 57.5% (Table 1).

Table 1. The fractional composition of potassium in ordinary chernozems with irrigation

Variant	Depth of sampling, cm	Readily-soluble	Exchange-able	Hydro-lyzed	Unchanqe-ably fixed	Sum
		mg/100 g of soil				
Dryland	0-30	1.5	17.5	43.5	350.0	412.5
	30-50	1.0	16.5	49.0	495.0	561.5
	50-80	0.5	10.5	52.5	320.0	383.5
	80-120	0.5	10.5	39.5	300.0	350.5
	120-150	0.5	9.0	39.5	350.0	399.0
Irrigation 70-80 %	0-30	1.3	13.5	54.0	510.0	578.8
	30-50	1.0	16.5	49.0	475.0	541.5
	50-80	0.5	15.5	45.5	345.0	406.5
	80-120	0.5	8.5	43.5	415.0	467.5
Irrigation 80-90%	0-30	2.0	20.0	97.5	530.0	649.5
	30-50	0.8	13.5	51.0	477.0	542.3
	50-80	0.5	15.5	45.5	360.0	421.5
	80-120	0.5	21.0	45.5	375.0	442.0

Source: Own determination.

It is depending on the irrigation regime, in the horizon of 30-50 cm, changes in relation to the rainy conditions range from 3.3 to 9.9%, and in the layer 80-120 cm – higher than the control variant in 33.4 and 26.6.

At the same time, the changes in the content of the easily soluble and exchangeable forms are not significant, and the potential reserves increase to a large extent. Hence, an increase in the content of potassium that is easily hydrolysed, the more significant, the more intense irrigation. A similar trend is also applicable to the unchangeably fixed group.

According to Zhukov and Nikitina [24], it is due to the predominance of hydrosulphite minerals in the content of silty fraction, alkaline reaction of soil solution, saturation with divalent bases, high content of organic matter and periodic drying of soils.

According to Zhantalay [23], irrigation increases the content of hydrocarbons in the soil and the gross content of potassium, as well as the intensification of the processes of meltmorillonite's ilitization, where in the process it loses the ability to expand the lattice and turns into mixed-layer hydrosulfide - montmorillonite formation.

Study of fractional composition of potassium of southern chernozems under irrigation conditions within the limits of the Nizhnednistrovsky irrigation system showed that the sum of potassium groups in them is much lower than in ordinary chernozems – in the layer 0-30 cm at 19.0% and from 45.5 to 52.6 % with a depth of 120 cm (Table 2). Probably this is due to the gross reserves of potassium. The distribution on the profile is identical – there is a slight uniform decrease in potassium content with depth.

Compared with ordinary chernozems, in the southern chernozems, the proportion of light-hydrolytic potassium increases slightly and proportion of unchangeably fixed decreases accordingly. It is evident that the content of

In the most mobile (readily soluble) reliability of the changes is the lowest. With increase of the potassium bond strength with the soil environment, the reliability of its content in this group increases. The unchangeably fixed potassium is most closely related to the soil, which stipulates high reliability of this indicator. It should be noted that in all variants of the experiment in the layer of 30-40 cm the content of the unchangeably fixed potassium is sharply reduced, which can be explained by the high biological activity of the irrigated soil in the indicated layer.

the first three groups of potassium – readily soluble, exchangeable and hydrolysed – throughout the profile, with the background of all variants of the experiment, have very low reliability. This can be explained by the fact that the potassium of these three groups is characterized by mobility and is easily transformed from one to another depending on the environment.

Table 2. The fractional composition of potassium in the southern chernozem depending on the fertilizer system with the background irrigation (mg/100 g of soil, n=5).

Variant	*Depth of sampling, cm*	*Readily-soluble*			*Exchangeable*			*Hydrolyzed*			*Unchangeably fixed*			*Sum*
		$\bar{x}$	$S_{\bar{x}}$	*In % from sum*	$\bar{x}$	$S_{\bar{x}}$	*In % from sum*	$\bar{x}$	$S_{\bar{x}}$	*In % from sum*	$\bar{x}$	$S_{\bar{x}}$	*In % from sum*	
Control without fertilizers	0-30	0.51	0.05	0.15	9.44	0.17	2.82	49.70	0.52	14.87	274.60	10.98	82.15	334.25
	30-40	0.22	0.01	0.07	6.70	0.15	2.19	44.90	0.62	14.67	254.30	2.80	83.07	306.12
	40-50	0.17	0.02	0.07	5.05	0.30	1.99	43.80	1.41	17.24	205.00	5.15	80.70	254.02
	50-80	0.11	0.01	0.05	4.31	0.49	2.05	39.80	0.46	18.89	166.50	4.01	79.01	210.72
	80-120	0.10	0.01	0.06	3.73	0.29	2.25	36.11	0.35	21.73	126.20	4.86	75.96	166.14
Background 40 t/ha of manure	0-30	0.16	0.02	0.05	11.02	0.57	3.71	48.68	0.28	16.38	237.36	10.47	79.86	297.22
	30-40	0.08	0.01	0.03	6.38	0.35	2.36	44.19	0.54	16.38	219.19	4.00	81.23	269.84
	40-50	0.10	0.00	0.04	5.07	0.02	2.02	44.56	0.78	17.76	201.22	9.50	80.18	250.95
	50-80	0.10	0.01	0.04	4.89	0.11	2.11	40.16	0.33	17.32	186.66	8.28	80.52	231.81
	80-120	0.09	0.01	0.05	3.99	0.19	2.03	39.95	0.28	20.32	152.61	4.18	77.61	196.64
Background + $N_0P_{180}K_{180}$	0-30	0.48	0.01	0.17	12.01	0.53	4.38	52.37	0.84	19.08	209.60	18.70	76.37	274.46
	30-40	0.32	0.03	0.12	7.16	0.20	2.58	48.80	0.76	17.59	221.10	14.07	79.71	277.38
	40-50	0.09	0.01	0.03	12.01	0.53	4.26	48.80	0.76	17.33	220.74	13.57	78.38	281.64
	50-80	0.06	0.00	0.02	5.29	0.15	1.78	45.27	0.26	15.25	246.21	15.78	82.95	296.83
	80-120	0.17	0.02	0.08	4.01	0.19	1.90	39.51	0.77	18.75	167.08	18.76	79.27	210.77
Background + $N_{180}P_{180}K_{180}$	0-30	1.97	0.05	0.64	13.28	1.07	4.31	59.58	1.25	19.34	233.30	20.17	75.71	308.13
	30-40	0.22	0.01	0.07	5.95	0.28	1.98	46.17	0.78	15.34	248.62	3.24	82.61	300.96
	40-50	0.23	0.02	0.07	5.81	0.30	1.79	50.58	0.81	15.57	268.14	4.64	82.57	324.76
	50-80	0.18	0.01	0.07	4.25	0.12	1.74	44.18	0.46	18.09	195.57	1.55	80.09	244.18
	80-120	0.12	0.01	0.06	4.19	0.28	2.16	42.01	0.44	21.66	147.62	9.52	76.12	193.94
Background + $N_{180}P_0K_{180}$	0-30	0.27	0.03	0.09	7.95	0.52	2.79	51.33	1.29	17.99	225.74	6.19	79.13	285.29
	30-40	0.20	0.03	0.07	5.07	0.34	1.74	44.78	0.33	15.39	240.99	4.62	82.80	291.04
	40-50	0.13	0.02	0.05	5.95	0.19	2.08	48.23	0.50	16.88	231.37	5.97	80.99	285.68
	50-80	0.10	0.01	0.04	5.50	0.31	2.14	41.34	0.50	16.06	210.50	15.72	81.77	257.44
	80-120	0.21	0.02	0.10	4.49	0.35	2.23	38.01	0.31	18.87	158.76	4.43	78.80	201.47
Background + $N_{180}P_{180}K_0$	0-30	3.41	0.15	0.98	16.16	1.04	4.66	62.97	0.95	18.15	264.46	11.77	76.21	347.00
	30-40	0.39	0.02	0.12	6.36	0.14	1.88	54.73	1.09	16.20	276.38	5.84	81.80	337.86
	40-50	0.11	0.00	0.04	7.43	0.42	2.45	46.17	0.75	15.25	249.04	1.87	82.26	302.75
	50-80	0.13	0.01	0.06	4.44	0.13	2.02	40.75	1.09	18.57	174.07	5.88	79.34	219.39
	80-120	0.21	0.01	0.10	4.98	0.13	2.42	39.90	0.61	19.43	160.28	2.56	78.04	205.37
Background + $N_{300}P_{180}K_{300}$	0-30	0.34	0.04	0.13	10.05	0.15	3.77	49.66	0.90	18.61	206.78	10.82	77.50	266.83
	30-40	0.29	0.02	0.08	7.79	0.53	2.27	47.20	1.43	13.73	288.55	4.58	83.92	343.83
	40-50	0.16	0.01	0.05	6.05	0.22	2.01	43.55	0.35	14.50	250.50	9.72	83.43	300.26
	50-80	0.19	0.01	0.09	4.97	0.09	2.38	38.46	0.21	18.42	165.12	10.19	79.10	208.74
	80-120	0.22	0.01	0.11	4.81	0.06	2.42	39.29	0.21	19.77	154.40	4.30	77.70	198.72

Source: Own determination.

As our long-term studies have shown, the layer of chernozem ground of 30-40 cm with irrigation is sharply different from other horizons in all soil, to a certain extent and according to the mobile indicators.

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The application of fertilizers almost did not affect the content of readily soluble potassium, only on a background of balanced nutrition (background + $N_{180}P_{180}K_{180}$) its content in the arable layer increased by 3.9 times compared to absolute control.

This variant was distinguished by the most even distribution of potassium in groups in the arable horizon. Under the organic fertilizer system, the lowest content of readily soluble potassium (0.16 mg/100 g) was observed. It can be noted that the application of manure facilitates the transfer of potassium into more tightly connected forms.

The study found that the content of exchangeable potassium in chernozem usually varies significantly depending on the moisture content of soil samples. In the damp, there is a significant decrease compared to air-dry in all layers of soil, both in irrigated areas: from 1.7 to 2.9 times, and in areas without irrigation: 2.2-4.4 times (Figure 1, 2).

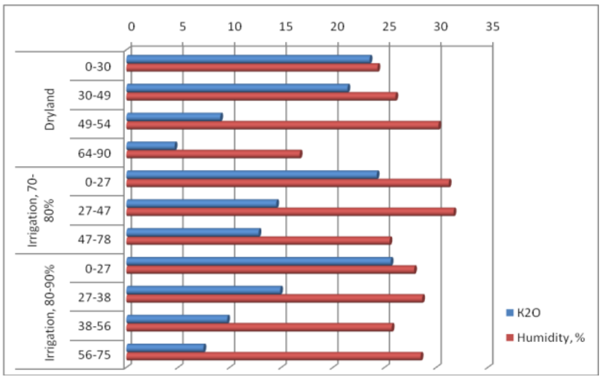

Fig.1. Effect of soil moisture level on the content of exchangeable potassium (mg/100 g soil) in ordinary chernozem (fresh soil samples)
Source: Own determination.

The high correlation value revealed the dependence of the content of exchangeable potassium on the soil moisture: r = - 0.80. The data is reliable at a Student's level of significance 0.01. Fewer fixation of potassium on wet soils compared with drying was noted in the experiments of Kucher [9].

The influence of the moisture condition of the samples on the variability of potassium forms in chernozem and grey forest soils in the Carpathian Highland region was noted by Warhol [22], but the direction of these changes was the opposite: wet samples showed a significant increase, compared to dry, exchangeable forms of potassium, while the amount of non-exchangeable – changed insignificantly.

As a rule, domestic and foreign soil scientists explain this by the nature of the mineralogical composition of the soil and their ability to retain and fix potassium during humidification and drying [2, 5].

The content of exchangeable potassium determines the degree of plant provision with this element of nutrition. We investigated changes in its content, depending on the soil and year of aftermath of the fertilizer systems.

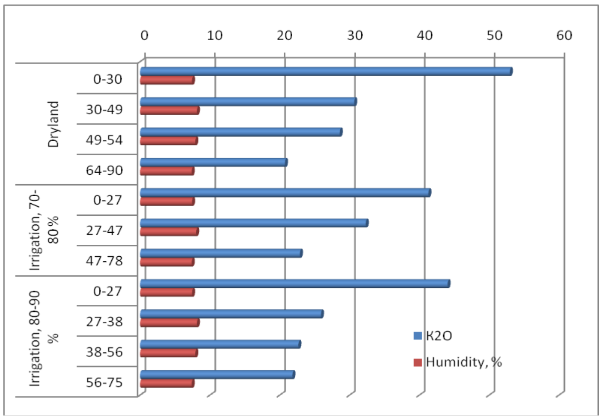

Fig.2. Effect of soil moisture level on the content of exchangeable potassium (mg/100 g soil) in ordinary chernozem (air-dry soil samples)
Source: Own determination.

Due to increase in the moisture content of irrigated soil in comparison with the non-irrigated, as well as the higher yield of agricultural crops, the content of exchangeable potassium under the influence of 11 years of irrigation decreased almost twice throughout the profile of ordinary chernozem to 120 cm (Table 3, 4).

Table 3. The content of exchangeable potassium in ordinary chernozem in the result of different fertilizer rates, mg/100 g of soil

Variant	*Depth of sampling, cm*	*Initial state*	*Year after fertilizers*				
			3rd	*4th*	*7th*	*8th*	*11th*
40 t/ha of manure + $N_{60}P_{60}K_{15}$	0-30	58.9	24.8	28.0	54.5	28.2	31.5
	30-50	36.7	16.9	20.2	29.7	18.7	23.7
	50-80	30.8	13.4	13.4	22.4	15.2	18.6
	80-120	29.4	9.6	7.5	13.1	11.4	13.0
100 t/ha of manure + $N_{100}P_{100}K_{30}$	0-30	57.7	24.3	35.8	26.3	26.6	39.2
	30-50	37.5	24.3	13.2	18.7	22.7	19.5
	50-80	32.5	16.7	9.4	9.1	17.2	16.2
	80-120	29.4	14.3	6.2	7.1	10.7	11.9
200 t/ha of manure + $N_{200}P_{200}K_{60}$	0-30	63.5	35.2	37.3	40.0	35.5	30.4
	30-50	38.7	35.7	18.9	17.8	21.7	25.3
	50-80	34.7	19.6	7.4	11.7	15.7	16.4
	80-120	29.4	14.5	6.2	7.4	11.0	9.3

Source: Own determination.

The reason for this phenomenon may be an increase in the biological activity of irrigated soil, as in this case, the content of N-NO_3 increases. And as known, N-NO_3 is an antagonist of exchangeable potassium, and according to our calculations, the content of N-NO_3 and K_2O is closely correlated (r = -0.9; the data is reliable at the Student's level of significance 0.01).

In conditions of experiment, despite the different amount of introduced potassium fertilizers, the content of exchangeable potassium was almost unchanged in the variants of fertilizer systems. But at the time of the end of the rotation (the 11th year after the fertilizer) the content decreased compared to the initial one: on fertilizer system with a minimum norm of mineral fertilizers in 1,9 times, in average – in 1.5 times and with a maximum – in 2.1 times.

Table 4. The content of exchangeable potassium in southern chernozem in the result of different fertilization rates, mg/100 g of soil

Variant	*Depth of sampling, cm*	*The initial state, n = 18*	*Year after fertilizers*		
			1st	*2nd*	*3rd*
			corn for green feed	*winter wheat*	*fodder beets*
Control without fertilizers	0-30	14.8	9.8	8.5	1.6
	30-40	10.0	6.6	8.7	0.7
	40-50	9.8	5.4	1.6	1.3
	50-80	6.6	6.2	8.2	0.7
	80-120	6.7	6.5	6.0	0.6
Background 40 t/ha of manure	0-30	16.6	9.6	16.0	3.1
	30-40	11.8	6.8	10.2	1.4
	40-50	11.3	5.4	8.7	1.6
	50-80	9.2	3.7	7.4	1.2
	80-120	6.7	3.6	6.6	1.2
Background + $N_0P_{180}K_{180}$	0-30	12.3	12.1	32.2	1.4
	30-40	8.6	6.2	6.0	1.3
	40-50	8.1	4.1	3.9	0.8
	50-80	6.0	4.1	4.8	0.7
	80-120	5.3	3.0	6.1	0.6
Background + $N_{180}P_{180}K_{180}$	0-30	9.7	22.3	25.3	2.1
	30-40	5.5	11.4	6.1	2.0
	40-50	8.9	9.1	6.1	1.7
	50-80	6.6	10.3	5.3	1.7
	80-120	6.2	8.6	5.2	1.3
Background + $N_{180}P_0K_{180}$	0-30	12,2	24,7	34,0	1,7
	30-40	9,6	13,4	10,1	0,9
	40-50	9,6	12,2	8,2	0,8
	50-80	7,2	14,4	7,3	0,6
	80-120	5,4	12,0	6,2	0,6
Background + $N_{180}P_{180}K_0$	0-30	13,6	10,1	18,0	1,3
	30-40	9,2	5,4	12,7	0,8
	40-50	7,6	6,0	9,1	0,8
	50-80	8,4	5,3	6,6	0,7
	80-120	6,6	5,3	4,4	0,6
Background + $N_{300}P_{180}K_{300}$	0-30	12,0	9,0	26,1	3,4
	30-40	8,9	5,0	15,2	2,1
	40-50	8,9	3,5	21,5	1,1
	50-80	7,8	6,1	15,0	1,0
	80-120	6,4	5,1	12,6	1,0

Source: Own determination.

However, while on the background of the first two fertilizer standards in the crop rotation, a negative potassium balance is formed, its deficit-free balance (Table 5) - +533.3 kg/ha per rotation of crop rotation is created at the background of the maximum (manure 200 t/ha + $N_{200}P_{200}K_{60}$).

On the southern chernozems before the laying of the experiment, the soil content of exchangeable potassium was characterized as medium-sized (Table4). In the control version, without introducing the main fertilizer over the years, gradual reduction of exchangeable potassium to a low level of supply occurs.

Table 5. The balance of nutrients in crop rotation for ordinary chernozem

Variant	Indicators	Nutrition elements, kg/ha		
		N	P_2O_5	K_2O
manure 40 t/ha + $N_{60}P_{60}K_{15}$	Added with fertilizers	426	322	285
	Off set of crops and non-produc-tive losses	709,7	285,1	678,1
	Difference	**-283,7**	**+36,9**	**-393,1**
manure 100 t/ha + $N_{100}P_{100}K_{30}$	Added with fertilizers	790	530	660
	Off set of crops and non-produc-tive losses	749,9	300,3	710,3
	Difference	**+40,1**	**+229,7**	**-50,3**
manure 200 t/ha + $N_{200}P_{200}K_{60}$	Added with fertilizers	1430	910	1290
	Off set of crops and non-produc-tive losses	797,9	319,7	756,7
	Difference	**+632,1**	**+590,3**	**+533,3**

Source: Own determination.

The most favourable potassium regime was on the background of the introduction of organic-mineral fertilizers: manure 40 t/ha + $N_{180}P_{180}K_{180}$ and manure 40 t/ha + $N_{180}K_{180}$.

The dynamics of the content of exchangeable potassium in soil over the years to a certain extent characterizes the crops' need in potassium fertilization. Its lowest content was indicated in the autumn after the harvest of fodder beets, which is explained by the increased need of this crop in potassium.

At the same time, it is likely that potassium was actively used at the end of the vegetation of beets, which did not allow to restore the stocks of its exchange forms at the expense of more tightly connected. The corn for green feed and winter wheat do not use potassium from the soil in large quantities until the end of the growing season.

CONCLUSIONS

The research allowed to draw the following conclusions:

-Under the influence of irrigation in ordinary chernozems the content of potentially available potassium in the layer of 0-30 cm increases by 40.3% and 57.5% in comparison with rainfed conditions.

-The content of exchangeable potassium in ordinary chernozem varies considerably depending on the soil moisture content (r = -0.80). In moist ones there is a significant decrease compared to air-dry on all layers of soil. both in irrigated areas (from 1.7 to 2.9 times). and without irrigation (2.2-4.4 times).

-Fertilizer norm of manure 200 t/ha + $N_{200}P_{200}K_{60}$, introduced under the main cultivation of the first crop rotation in the aftermath of 11 years provides a positive balance of exchangeable potassium in ordinary chernozem even with a decrease of the initial content in 2.1 times.

-In the southern chernozem. the total amount of potentially available potassium is much lower than in ordinary chernozem: in 19.0% in a layer 0-30 cm and from 45.5 to 52.6% with a depth of 120 cm. The nature of the distribution of depth and direction of irrigation and fertilizer systems are similar to ordinary chernozems.

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THE INFLUENCE OF THE SEASONAL FACTOR ON THE EMPLOYMENT AND REMUNERATIONS IN THE AGRICULTURAL SECTOR IN BULGARIA

Milen VELEV

"Prof. Dr. Assen Zlatarov" University, Bourgas, Bulgaria, Email: milen.velev@gmail.com

Corresponding author: milen.velev@gmail.com

Abstract

The present study aims at assessing the impact of the factor of seasonality on employment and remunerations in agriculture in Bulgaria. Statistical models have been used to investigate the dynamics and seasonal fluctuations of employment and remunerations in the agricultural sector. The conclusion drawn is that the seasonal factor influences the dynamics of employment more strongly than the dynamics of remunerations.

Key words**:** *employment, remunerations, seasonal factor, Bulgaria, agricultural sector*

INTRODUCTION

The problems that concern the rate and dynamics of employment and remunerations as well as well as the range of factors, including the seasonal one, which affect them, are both theoretically and practically extremely important. The diversity of factors with their changes logically leads to a dynamic in a variety of processes and activities, which necessitates timely and thorough analysis [1]. The rate and dynamics of employment and the remunerations are affected by a great number of factors among which seasonal factor stands out. The seasonal factor has a particularly marked influence on employment and remunerations in the agricultural sector, tourism, trade, etc. The assessment of the exact quantitative effect of the influence of the seasonal factor on the employment and remunerations could help develop and implement a variety of measures to encourage employment and the remuneration policy in the different economic sectors in Bulgaria.

MATERIALS AND METHODS

The main purpose of the present study is to assess the influence of the seasonal factor on the number of persons employed and the average monthly gross wages in the economic activity “Agriculture, forestry and fishing“ in Bulgaria. The objective study and analysis are necessary so that measures can be taken in order to increase the positive influence and minimize the negative impact [2].

The main tasks the present paper will approach are as follows:

-To examine the dynamics of the employed and the average wage in the agricultural sector in Bulgaria;

-To investigate the seasonal fluctuations in the employment and remunerations;

-To identify the main trends related to the dynamics of employment and remunerations and the changes expected in the short term;

-To present the main conclusions drawn and the results obtained in investigating the development of the economic indicators over of time.

Modern market economy, and more specifically the labour market, can be seen as a system which is complex and self-regulating, functioning under the impact of two counterbalancing forces - demand and supply [3]. From this perspective, the equilibrium of the labour market when the supply of labour force equals the demand for it, determines the number of the employed and the average wage. The dynamics of employment and remunerations in agriculture are determined by dynamics and the seasonal nature of production in the sector. Additional impact is the fragmentation of the land as a result of the conducted Agrarian reform and aggravated demographic structure in the Bulgarian village [5]. When production decreases, part of the persons employed may get laid-off and in this way employment falls. The other possibility is related to a decrease in the remunerations of the persons employed during the lean season. In this paper we are going to investigate which of the two effects predominates in the agricultural sector in Bulgaria. The elements of the remunerations can be basically divided into two kinds – remunerations of permanent nature and impermanent (variable) remunerations. The permanent remunerations include the basic remuneration for the pay reference period and additional remunerations paid permanently together with the basic one and depending only on the period of time worked. (For example, an additional remuneration for acquired seniority and professional experience, an additional monthly remuneration for the educational and academic degree of "doctor" "doctor of science", related to the work performance of the worker or employee, etc.) From the point of view of the workers permanent remunerations provide a sense of security and an opportunity for long-term planning of the household budgets, but from the point of view of the employers these remunerations are a permanent expense which does not depend on the results achieved, and this could present a certain risk to the competitiveness and financial state of the organization under unfavourable circumstances [6]. The variable remunerations (remunerations of impermanent nature) are the remunerations which are not paid to the workers and employees regularly and their size is not fixed. Some of these remunerations are related to the specific nature and features of the work done, and in this case they are usually regulated by law or regulations, another legal act, or in a collective labour agreement (for example, the pay for night work, overtime, work on public holidays, in cases of internal substitution or secondary employment, etc.) Another part of the variable remunerations are linked to the results, achievements and the performance of workers and employees – for example, bonus schemes, based on pre-determined indicators, on overall performance assessment, one-time bonuses, etc. [6] The dynamics of the remuneration in the course of time depends on the variable remunerations in the first place.

The present study is interested in the following questions: Does the seasonal factor affect the dynamics of the employment and remunerations, and if it does, to what extent? What are the main trends related to the dynamics of employment and remunerations in the agricultural sector in Bulgaria and the changes expected in the short term?

With a view to achieving better targeting, the present study has the following limitations: The period for which information is presented is 2008I- 2018VI;

-The data used show the figures of the end-of-the-month employment in the economic activity "Agriculture, forestry and fishing"in Bulgaria and the gross average monthly wage in the sector;

-Official and publicly available information is used in the study.

The main methods that have been implemented are: factor analysis, comparative method, the expert judgment method, visual fit approach.

RESULTS AND DISCUSSIONS

The study goes on to examine the dynamics of employment in Bulgarian agriculture, using monthly data for the Bulgarian economy for the period 2008I- 2018VI, data from the National Statistical Institute (NSI) [4].

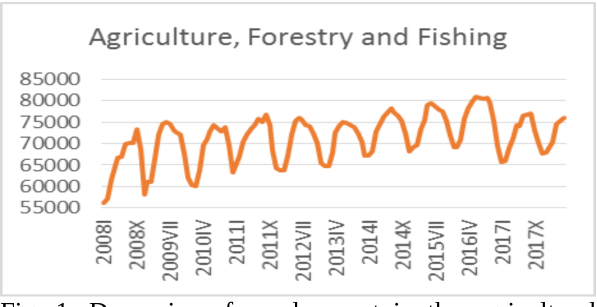

Fig. 1. Dynamics of employment in the agricultural sector in Bulgaria for the period 2008I- 2018VI. Source: National Statistical Institute.
* 2017-2018 – preliminary data.

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It is obvious from Figure 3 that the influence of the seasonal factor on employment is huge. At the beginning of the period that has been studied the number of the employed reached its lowest value (2008I – 56,110 people), and in 2016VI it was at its highest – 80,789 people employed.
Figure 2 shows the results of the seasonal decomposition of employment.

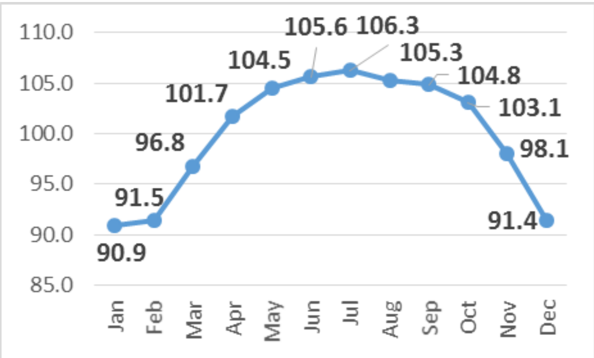

Fig. 2. Seasonal decomposition of employment in Bulgarian agriculture.
Source: National Statistical Institute, own calculation.

As figure 2 shows, the highest value of the seasonal indices was reached in July (106.3%), and the lowest – in January (90.9%). The deviation about the mean during each one of quarters is 15.4 percentage points (pp).
The most appropriate model for modelling the trend has been estimated for the adjusted time series (i.e. the time series with seasonal or random fluctuations removed). The different models have been compared as per the value of the coefficient of determination (explanatory part).

Table 1. Statistical evaluation of the different models describing employment variation in the sector of agriculture in Bulgaria.

Model Summary and Parameter Estimates

Dependent Variable:Trend-cycle for E from SEASON, MOD_1, MUL CEN 12

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Linear	,627	208,623	1	124	,000	67059,438	68,890		
Logarithmic	,737	348,102	1	124	,000	60202,244	2907,680		
Inverse	,354	67,857	1	124	,000	72200,316	-17824,234		
Quadratic	,743	177,996	2	123	,000	64591,800	184,560	-,911	
Cubic	,748	120,873	3	122	,000	65215,418	126,775	,222	-,006
Compound	,626	207,244	1	124	,000	67067,982	1,001		
Power	,754	379,850	1	124	,000	60729,949	,042		
S	,376	74,827	1	124	,000	11,187	-,261		
Growth	,626	207,244	1	124	,000	11,113	,001		
Exponential	,626	207,244	1	124	,000	67067,982	,001		
Logistic	,626	207,244	1	124	,000	1,491E-5	,999		

Source: Own calculation.

The obtained results show that the cubic and the quadratic models have the greatest values for the coefficient of determination (0.748 and 0.743 respectively). This coefficient is 0.627 for the linear model. The total variation which is explained by these models is significant as the F-statistic shows (the values of the significance levels are Sig. =0.00<0.05). The model chosen as the most adequate one is the cubic model (Fig. 2) because the difference between the values of the coefficient of determination for the cubic and linear models is equal to 0.121, i.e. bigger than 0.1. The following equation describes the cubic model:

$$E=65215.418+126.775t+0.222t^2-0.006t^3+\varepsilon,$$

where E is the number of the persons employed, $t=1,2,3,\ldots,126$ (the number of months, ε- the error term (Fig. 3).

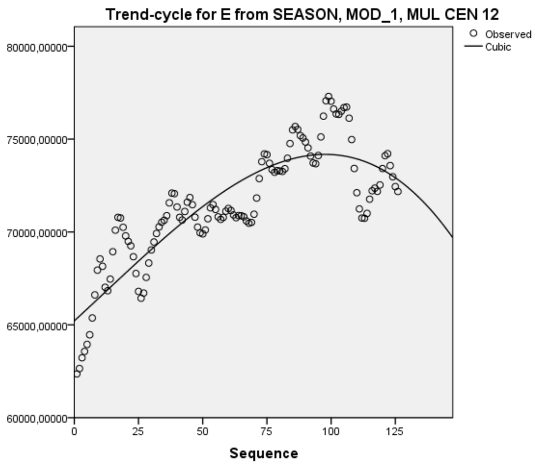

Fig.3. Dynamics of employment in the agricultural sector in Bulgaria with removed seasonal and random fluctuations (cubic regression model).
Source: Own calculation.

The dynamics of the average monthly wages in the agricultural sector and in the country as a whole are presented in Fig. 4, data from the National Statistical Institute (NSI) [6].
Figure 4 shows that the agricultural sector had the lowest average wage (329 BGN or 168 EUR) at the beginning of the period studied – 2008I, and at its end - 2018 VI it had the highest average wage (958 BGN or 490 EUR), i.e. there was a threefold pay rise. The graph clearly shows the seasonal fluctuations of the average remunerations. During the

period studied the average wage in the agricultural sector is always lower than the average wage for the country, with the difference between the two indicators going up.

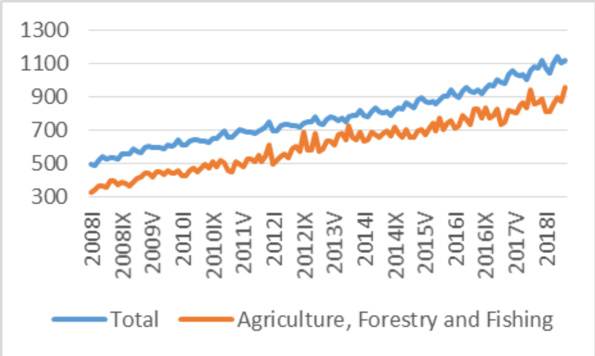

Fig. 4. Average monthly wages of workers in the agricultural sector and for the the whole of the country for the period 2008I- 2018VI.
Source: National Statistical Institute.
* 2017-2018 – preliminary data.

For instance, the difference between the average wages in agriculture and for the country in general was 170 BGN (87 EUR), in 2016 I this difference was 193 BGN (99 EUR), and in 2018I it is 262 BGN (134 EUR). On average, the remunerations in the agricultural sector are 166 BGN lower than the average remuneration for the country.

Figure 5 presents the difference between the average monthly wages for the country in general and the agricultural sector in particular for the period 2008I – 2018 VI.

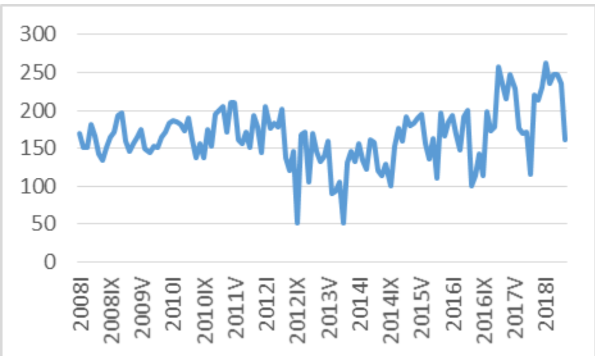

Fig. 5. Difference between the average monthly wages for the country in general and the agricultural sector in particular for the period 2008I – 2018VI (BGN).
Source: National Statistical Institute, own calculation.

Figure 6 shows the results of the seasonal decomposition of the average wage in agriculture.

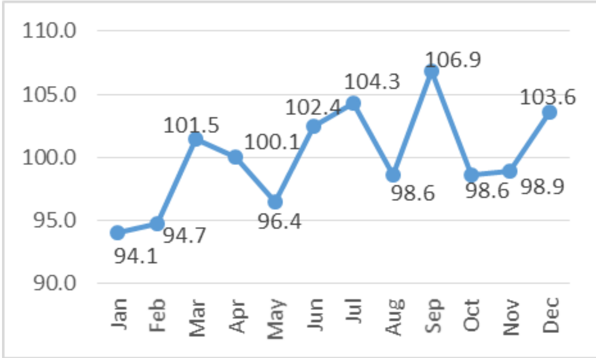

Fig. 6. Seasonal decomposition of average monthly remuneration in Bulgarian agricultural sector.
Source: National Statistical Institute, own calculation.

As can be seen in Figures 2 and 6, the seasonal factor affects the dynamics of employment and the remunerations in the agricultural sector in different ways.

But as Figure 4 shows the highest and the lowest values of the seasonal indices were reached in September (106.9%), July (104.3%), and in January (94.1%) respectively, very much similarly to the results for employment. The deviation about the mean during each one of the months is less compared to the results for employment - 12.8 percentage points.

The most appropriate model for modelling the trend has been estimated for the adjusted time series.

Table 2. Statistical estimation of the different models describing the variation of the average monthly remuneration in the agricultural sector in Bulgaria

Model Summary and Parameter Estimates

Dependent Variable:Trend-cycle for Wa from SEASON, MOD_4, MUL CEN 12

	Model Summary					Parameter Estimates			
Equation	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Linear	,991	13210,448	1	124	,000	349,867	4,228		
Logarithmic	,781	442,244	1	124	,000	53,863	146,133		
Inverse	,198	30,679	1	124	,000	646,367	-651,806		
Quadratic	,991	6795,327	2	123	,000	356,294	3,927	,002	
Cubic	,991	4670,349	3	122	,000	348,425	4,656	-,012	7,505E-5
Compound	,981	6498,341	1	124	,000	381,513	1,007		
Power	,856	738,602	1	124	,000	221,116	,258		
S	,250	41,372	1	124	,000	6,447	-1,233		
Growth	,981	6498,341	1	124	,000	5,944	,007		
Exponential	,981	6498,341	1	124	,000	381,513	,007		
Logistic	,981	6498,341	1	124	,000	,003	,993		

The linear, quadratic and cubic models are the most adequate models (0.991). All models are statistically significant and the linear model has been chosen as the most adequate one:

$$Wa=349.867+4.228t,$$

where Wa is the average monthly wage in the agricultural sector, t=1,2,3,…,126 (the

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number of months), ε-the error term (fig. 7). From the linear regression model obtained it follows that the remunerations in the agricultural sector grow by 4 BGN per month on average.

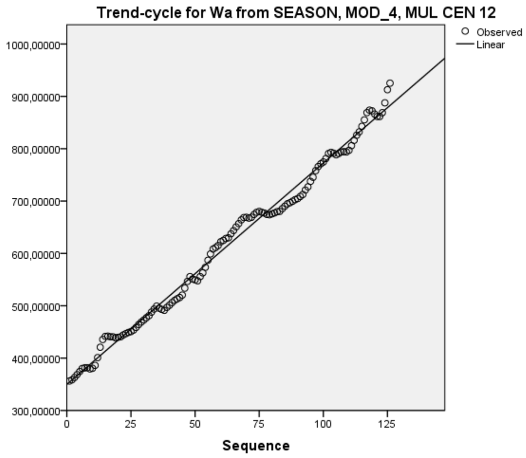

Fig. 7. Dynamics of the average monthly wage in the agricultural sector in Bulgaria with removed seasonal and random fluctuations (linear regression model).
Source: Own calculation.

The models thus obtained can serve as a basis for making a forecast for the number of workers in agriculture in Bulgaria as well as the average monthly remuneration in the sector during a succeeding period. The forecast has a time horizon of 12 months which is approximately 10% of the time series. (Table 4).

Table 4. Values of the average monthly earnings and the number of workers engaged in the agricultural sector in Bulgaria according to the forecast.

Month, year	Number of persons employed	Average monthly remuneration
JUL 2018	77,268	925
AUG 2018	76,450	878
SEP 2018	76,009	957
OCT 2018	74,600	887
NOV 2018	70,873	894
DEC 2018	65,965	940
JAN 2019	65,443	858
FEB 2019	65,759	868
MAR 2019	69,465	934
APR 2019	72,851	926
MAY 2019	74,675	896
JUN 2019	75,332	956

Source: Own calculation.

Therefore, if it is assumed that the patterns found will remain steady during the forecast period, then the average monthly wage in the agricultural sector in Bulgaria will continue to rise and will reach a value of 956 BGN. The number of the persons employed in June 2019 will reach 75,332 people. If the seasonal and random fluctuations are not taken into consideration, the trend is for the number of persons employed to decrease during the forecast period.

CONCLUSIONS

The analysis of the presented data leads to the following conclusions:

The dynamics of employment and remunerations in the agricultural sector in Bulgaria are affected in different ways by the seasonal factor.

There is a more pronounced impact of the seasonal factor on the dynamics of employment than on the dynamics of the average monthly remuneration.

If we assume that the patterns established in the study will remain steady during the forecast period, then the average monthly remuneration in the agricultural sector will continue to increase by 4 BGN per month, but will still be lower than the average monthly remuneration for the country.

The short-term emerging trend is for the number of persons employed in the agricultural sector to go down.

In conclusion, it can be noted that the seasonal factor exerts a huge influence on the dynamics of employment and remunerations in the agricultural sector in Bulgaria. In the short run the positive trend for an increase in the average remuneration and the trend for a decrease in the number of persons employed in the agricultural sector will most likely hold steady.

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IMPROVEMENT OF THE MECHANISM OF TECHNOLOGY TRANSFER WITHIN THE CONTEXT OF THE INNOVATIVE DEVELOPMENT OF THE AGROINDUSTRIAL COMPLEX OF RUSSIA

Mikhail Yakovlevich VESELOVSKY[1], Vladimir Gavrilovich SAVENKO[2], Inna Vladimirovna BITKINA[3], Natalia Lvovna KRASYUKOVA[4], Aleksandr Annayarovich STEPANOV[5]

[1]Technological University, 42, Gagarin Street, 141070, Korolev, Russia, Phone: +7 (495) 516-99-29, email: mveselovsky@bk.ru
[2]Russian University of Cooperation, 12/30, V. Voloshina Street, 141014, Mytischi, Russia, Phone: +7 (495) 640-57-11, email: savenko_vg@list.ru
[3]Financial University under the Government of the Russian Federation, 49, Leningradsky Avenue, 125993, Moscow, Russia, Phone: +7 (499) 943-98-55, email: inna.bitkina@inbox.ru
[4]Financial University under the Government of the Russian Federation, 49, Leningradsky Avenue, 125993, Moscow, Russia, Phone: +7 (499) 943-98-55, email: n-krasyukova@bk.ru
[5]University of the Ministry of Foreign Affairs of the Russian Federation (Odintsovo Branch), 3, Novo-Sportivnaya Street, 143007, Odintsovo, Russia, Phone: 8 (495) 661-71-22
email: aleksandr.a.stepanov@mail.ru

Corresponding author: mveselovsky@bk.ru

Abstract

The article reveals the problems of the development and improvement of the activity of entities of agricultural consulting in Russia in the period of the large-scale modernization of the agroindustrial complex. Special attention is paid to the problem of participation of the educational institutions subordinated to the Ministry of Agriculture in the consulting activity and to promoting the innovative activity of the participants in the innovative process. The current state of the institute of agricultural consulting, the main results of the activity in 2017 and the proposals for its development for the mid-term perspective are described. The priority directions and the strategy for the development of agricultural consulting are formulated in regard to the modernization of agricultural production, structural changes in its organization and the development of the system of agricultural consulting. The main directions of development of the institute of agricultural consulting, the main performed functions and the expected results are represented, as well as their impact on improving the quality of the informational and consulting support of agricultural production. The necessity of corrections of the conceptual essentials of the complex development of the institute of agricultural consulting is grounded including the ones organized with participation of educational institutions.

Key words**:** *innovative development, modernization of agro-industrial production, agricultural consulting*

INTRODUCTION

The objective of the present article is to show the possible ways of development of the system of agricultural consulting on the base of the research of the ways of development and functioning of the institute of informational and consulting support of agricultural production, changes in the structure of consumers of informational and consulting services and organizational changes in the system of agricultural consulting. Special attention is paid to the increase in the significance of the promotion of innovative products into agro-industrial production, as well as to the problems of attracting branch educational institutions to the participation in the consulting process.

The urgency of research is determined by the growing role of the institute of agricultural consulting in the modernization of the agro-industrial sector of the economy of Russia and the insufficient use of the potential of educational institutions subordinated to the Ministry of Agriculture of Russia in the development of this system.

MATERIALS AND METHODS

During the research, the authors studied the materials of the annual "Monitoring of consulting assistance to agricultural manufacturers and rural population in the Russian Federation" organized by the "Federal Center of Agricultural Consulting and Personnel Development of the Agro-industrial Complex", the materials of the Ministry of Agriculture of the Russian Federation on the participation of branch educational institutions in the development of agricultural consulting, the works by national and foreign researchers [3, 4, 5, 6, 7, 14, 18, 21], the materials of thematic research-to-practice conferences and other congress events. The empiric, inductive and deductive and statistical methods were used, as well as comparative and abstract-logical analysis and psychological research.

RESULTS AND DISCUSSIONS

Institute of agricultural consulting in the modernization of agro-industrial production

On December 15, 2017, the cooperation agreement was signed between the Ministry of Agriculture of the Russian Federation and the Russian Academy of Sciences, which provides support of the scientific and technical development of agriculture and reduces the technological risks in the production field. This is the most important document for the modernization of the agro-industrial complex, if for no other reason than according to the words of the former Minister of Agriculture A.N. Tkachev: "unfortunately, the technological development still relies upon the achievements of foreign science".

Among the total number of scientific and technical developments, completed, accepted and recommended for the implementation into production, up to 40-50 percent are left non-demanded. Furthermore, agricultural enterprises use less than 10% of technological innovations. Not more than 12 percent of agricultural manufacturers use intensive resource-saving technologies. In this regard, the use of inefficient technologies is, according to the scientists, the reason for the annual short supply of agricultural products for the amount of 200-250 bln roubles [8, 19].

The currently implemented strategy of innovative development of the agro-complex is aimed at modernization of production including:

•maximal use of national scientific developments;

•creation of innovative products on the basis of foreign analogs;

•accelerated implementation of foreign innovative technologies.

Among the specified directions, the most preferable is modernization using national innovative products due to their adaptability to the local conditions, the absence of dependence upon all kinds of international political factors, and the cost.

One of the reasons for the unsatisfactory state of branch modernization using national scientific and technical developments is the necessity of improvement of infrastructure, forms and methods of innovative support of the agro-industrial complex [20] including the methods and technologies of formation of orders for scientific developments. Until now, the Ministry of Agriculture of the Russian Federation has not participated in the planning of scientific research of the branch subject by academic institutions. Scientific developments are made according to the view of the problem by researchers and their capabilities to develop innovative products. And as there are no potential consumers in this process, their opinion is not always taken into account. Thus, science was separated from real production and as a result, the developments of national scientists do not find any practical application.

Simultaneously, due to the necessity of competitiveness, production requires constant updating – more efficient technologies, modern machines and equipment, the introduction of new species, breeds, etc. [22]. Naturally, in the market conditions, the niche is taken by foreign companies offering innovative products that, however, do not always suit the real conditions of national production.

In this regard, the understanding of the necessity of the joint research and production activity, large-scale involvement of national science into the innovative process, determined by the above-stated agreement of the branch ministry with the Academy of Science, can become the start of the major reconstruction of the principles of scientific and technical modernization, the basis of which is the formation of orders for scientific developments.

The first and, in the authors' opinion, the most important stage of the process of order formation is the determination of production problems that require a scientific solution. The main mechanism of realization of such problems is the regional structures of agricultural consulting.

The technology of participation of the entities of agricultural consulting in the innovative support of production [15] assumes that:

•consulting centers reveal the availability of applicable innovative proposals in the region and determine the demand of agricultural manufacturers for new developments in situ that can serve as the basis for the government R&D order organization.

•the innovative products developed by scientific and other organizations of Russia are added to a general database [6]. The distribution of innovative resources is performed using the Internet, arrangement of congress and exhibition events, training of consultants, managers and specialists of agricultural organizations, farmers.

•consultants assist during the process of implementation of innovations and can provide the monitoring of the use of scientific and technical achievements in the agro-industrial complex.

Thus, the developing structure of the system of agricultural consulting shall play an important role in the provision of the process of modernization of agro-industrial production mainly on the base of national innovation products [20].

Development of the system of agricultural consulting

By the end of 2017, the institute of agricultural consulting functioned in 63 regions of the Russian Federation [12].

In these regions, 93 regional and 162 district information and consulting services of agricultural consulting are rendered.

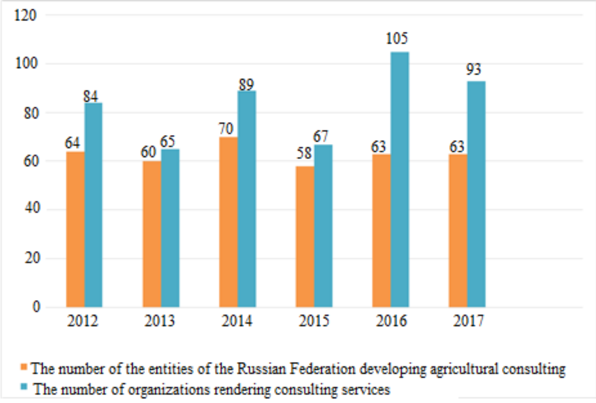

Fig.1. Dynamics of development of agricultural consulting in the regions of the Russian Federation
Source: Information Regarding the State of the Continuing Professional Education, 2018b

The regional level is represented by 44 consulting organizations (governmental, commercial and non-profit) and 49 educational institutions subordinated to the Ministry of Agriculture of Russia: 37 institutions of higher education, 12 institutions of continuing professional education.

The district level is represented by 162 organizations, 79 of which are structural subdivisions of the regional centers, 36 organizations are subdivisions of the district authorities of the agri-food complex; there are also 47 independent organizations (Figure 2).

Currently, 1,613 consultants work at consulting centers. More than 1,300 employees of mainly educational institutions and authorities of the agro-industrial complex render consulting services part-time. In total, 2,951 specialists were engaged in the consulting activity in 2017.

In total, about 2,950 specialists were involved in consulting activities in 2017, including 638 livestock specialists and veterinarians, 452 agronomists, 294 engineers, 413 economists, 221 accountants, 122 lawyers, 101 IT specialists, 908 other specialists of a different profile (Figure 3).

In 2017, agricultural advisory services provided agricultural producers and the population more than 250 thousand consulting services.

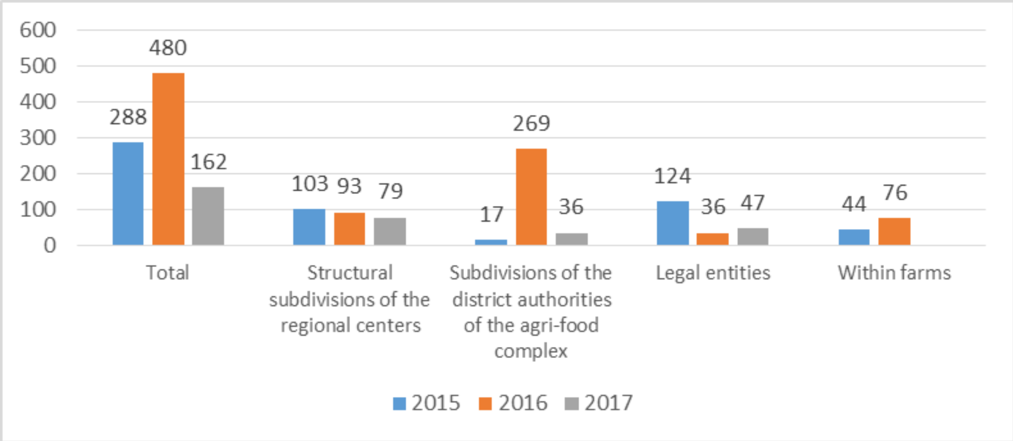

Fig.2. Dynamics of the development of district agricultural consulting

Source: Report of the Monitoring of Consulting Assistance to Agricultural Manufacturers and Rural Population in the Russian Federation in 2017

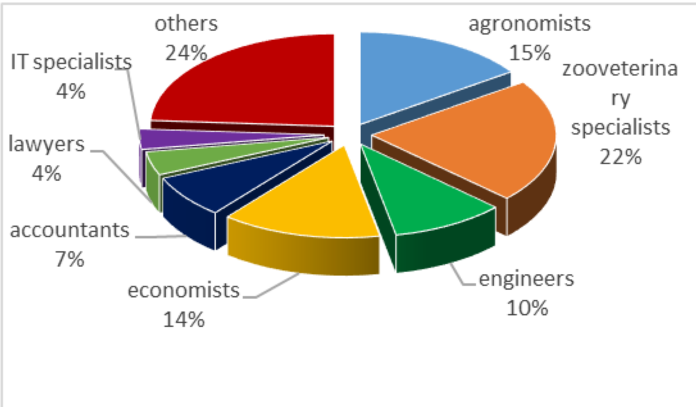

Fig.3. Structure of consulting staff

Source: Information Regarding the State of Higher Education, 2018a; Information Regarding the State of the Continuing Professional Education, 2018b

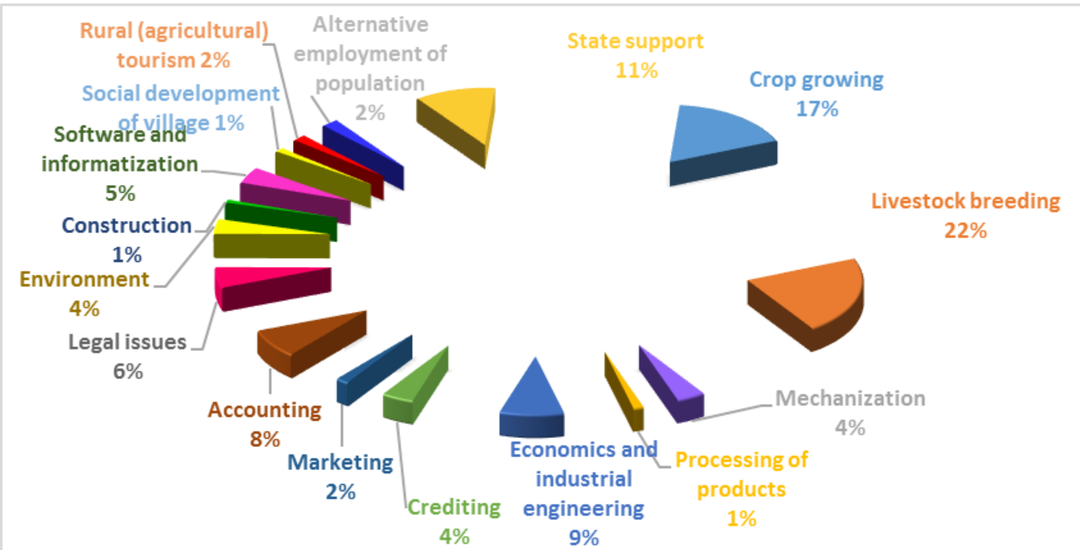

Fig.4. Structure of the rendered consulting services

Source: Report of the Monitoring of Consulting Assistance to Agricultural Manufacturers and Rural Population in the Russian Federation in 2017, 2017; Ministry of Agriculture of the Russian Federation, 2002

As the monitoring of consulting activities shows, there is a stability in the structure of consultations provided. At the same time, in 2017 technological consultations in the field of crop production, animal husbandry, government support, the economy and production organization were the most popular (Figure 4).

Among the recipients of consulting services, peasant (farm) holdings lead by a large margin, followed by agricultural enterprises and personal subsidiary farms (Figure 5). Significantly less consultants are approached by the management bodies of the agri-food complex, processing enterprises and agricultural cooperatives.

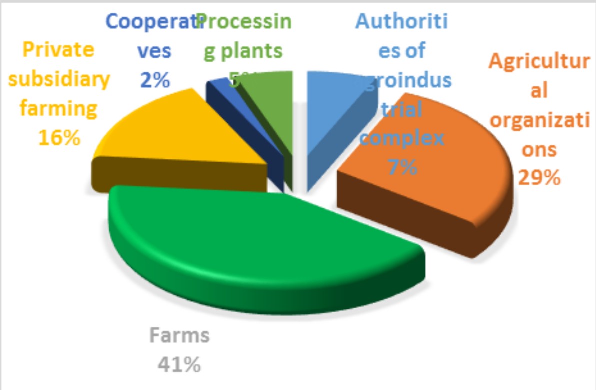

Fig.5. Distribution of consulting services according to the groups of users

Source: Report of the Monitoring of Consulting Assistance to Agricultural Manufacturers and Rural Population in the Russian Federation in 2017, 2017

Table 1. Exhibition events

Name of event	Total, unit	including			
		Interregional level	Regional level	District (interdistrict) level	According to the contract with enterprises (businessmen)
Demonstrational objects (land lots, farms, etc.)	434	21	106	137	170
Events held	1565	157	479	851	78
- including exhibition and demonstration events	494	101	257	137	0
- including Days of field	155	21	85	47	2
- including other events	915	35	137	667	76

Source: Report of the Monitoring of Consulting Assistance to Agricultural Manufacturers and Rural Population in the Russian Federation in 2017, 2017

Information and consulting centers and consulting subdivisions of educational institutions organized 434 demonstration objects, 649 exhibition and demonstration events, including 155 "Days of field" and 494 exhibitions, 915 other events were held (Table 1).

Also, the monitoring gives the reason to mention the sustainable growth and a tendency for the organization of innovative exhibition and demonstration events (Table 2).

Table 2. Dynamics of the number of exhibition and demonstration events

Name of event	2014	2015	2016	2017
Demonstration objects	42	217	378	437
"Days of field"	13	No info	334	155
Exhibition and demonstration events	78	387	474	494

Source: Report of the Monitoring of Consulting Assistance to Agricultural Manufacturers and Rural Population in the Russian Federation in 2017, 2017

The organizations participating in the information and consulting provision published more than 4,413 titles of printed materials, 1,400 articles, posted about 1,100 materials on the Internet, organized 1,160 programs on the radio and plots shown on television and posted on the Internet (Table 3).

Table 3. Information activity

Directions	Quantity	
	Names	Printed copies
1. Printed products prepared for publishing, including:	4,413	424,756
- books, brochures	623	79,227
- magazines	133	33,574
- articles in the journals of other organizations	1430	140,137
- booklets	1916	49,361
- others	311	100,542
2. Media materials prepared and issued, including	2547	
- radio and TV broadcasting	400	
- videos on DVD (CD)	632	
- videos on the Internet	129	
- articles, reviews on the Internet	1154	
- articles, reviews in the regional and local press	232	
3. Site maintenance (section of consulting activity)	114	

Source: Report of the Monitoring of Consulting Assistance to Agricultural Manufacturers and Rural Population in the Russian Federation in 2017, 2017

670 innovative products (Table 6) were implemented with the participation of consulting centers into the real sector of agro-industrial production; 750 innovative projects were developed with the expected economic effect for the total sum of 594.7 mln roubles (actual economic effect in 2017 was 365.1 mln roubles) (Figure 6).

The total economic effect from the innovative activity of organizations rendering consulting services to agricultural manufacturers and rural population was approximately 2.4 bln roubles in 2017 (Table 4).

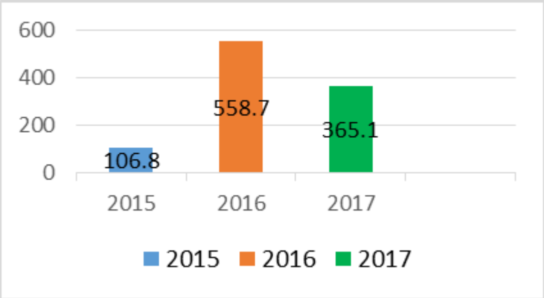

Fig.6. Dynamics of economic efficiency from the implementation of the innovative projects developed by consulting centers, mln roubles
Source: Report of the Monitoring of Consulting Assistance to Agricultural Manufacturers and Rural Population in the Russian Federation in 2017, 2017

The largest number of innovative products was implemented in livestock breeding – 305 innovations. Then in the descending order, there are crop growing – 262 innovations, the field of economy and industrial engineering – 103 innovations.

The total volume of implementation of innovative products in 2017 had a tendency to growth (670 innovations in 2017 in comparison with 634 innovations in 2016).

Innovative products were more actively used by agricultural enterprises – 394 innovations, by farmers – 144 innovations, by private subsidiary farms – 64 innovations.

Table 4. Innovative activity of organizations rendering consulting services

Innovations, implemented by means of consultants	Receivers of services				Economic effect, thousand roubles
	Agricultural organizations	Farms	Private subsidiary farms	Others	
Innovations implemented into crop growing, qty	148	58	37	19	1,955,191
Innovations implemented into livestock breeding, qty	199	40	21	45	58,189
Innovations implemented in the field of economy and industrial engineering, qty	47	46	10	0	8,080
Total	394	144	68	64	2,021,460

Source: Strategy of the Innovative Development of the Agro-industrial Complex of the Russian Federation for the Period till 2020, 2011

Agricultural enterprises increased their activity of implementation of innovations in 2017 by one third but farmers and private subsidiary farms maintained the same activity.

The situation with the order of innovative projects is not so good. Agricultural enterprises decreased orders by 23%, farmers decreased them by 8% and the owners of private subsidiary farms decreased them by 47%.

Organizations of agricultural consulting performed 2,698 thousand trainings attended by 22 thousand listeners (Figure 7).

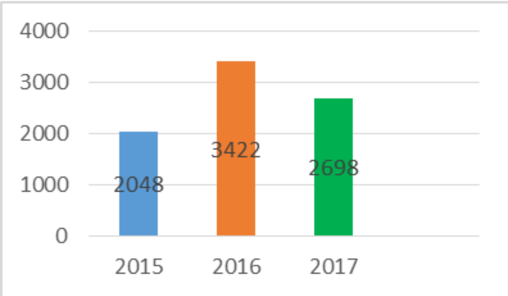

Fig.7. Dynamics of performed trainings, units
Source: Information Regarding the State of Higher Education, 2018a

The topics of learning of new technologies in crop growing and livestock breeding, organization and economy of production were the most popular among agricultural manufacturers and rural population.

The information and consulting activity was financed in 2017 from the budgets of different levels and from non-budgetary sources (Figure 8).

In addition to the general increase in the level of funding for consulting activities, there is an increase in the volume of financing regional budgets. This demonstrates the increasing role of regional agricultural advisory systems.

Agricultural manufacturers earned approximately 2.4 bln roubles from the design and implementation activity at the total costs for the whole system of 860 mln roubles. One more positive fact is the maintaining of the volume of consulting services paid by agricultural manufacturers, which, on the one hand, is the confirmation of their demand and, on the other hand, it is the proof of the professionalism of consultants.

Currently, the agricultural sector of the economy is represented mainly by the two types of economy management. One can say about the gradual formation of the dualistic model of the commodity agrarian sector of Russia. On the one hand, there are large holdings; on the other hand, there are rather small farms [2].

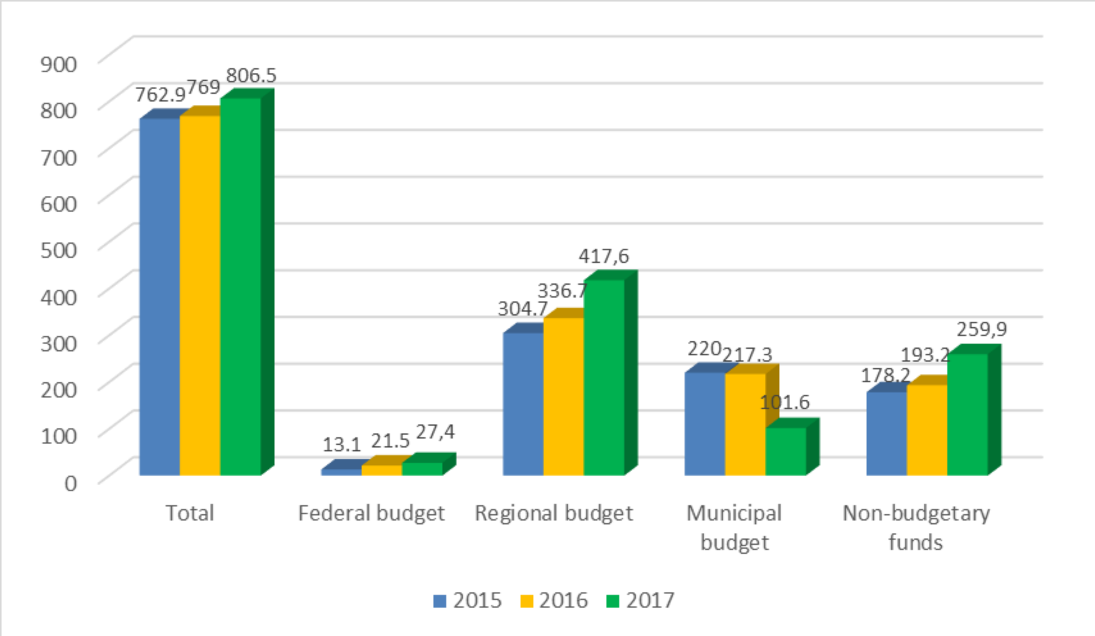

Fig.8. Dynamics of financial support of consulting activity (mln roubles)
Source: Report of the Monitoring of Consulting Assistance to Agricultural Manufacturers and Rural Population in the Russian Federation in 2017], 2017

Together with these two opposite forms of organizations of agricultural business in the country, households of other legal forms transformed from the former state farms and collective farms are engaged in agriculture to a different degree of efficiency that can be referred to large as well as to small forms according to different criteria.

Large agricultural enterprises use the services of consulting structures, as a rule, for the selection of modern highly intensive technologies, selective results, business planning, and supervision of investment projects. Specialists of agroholdings are visitors and participants of exhibition and demonstration and congress events organized by consulting centers; they actively attend seminars and conferences, order projects, implement scientific and technical achievements. All of this can provide the innovative development of enterprises.

There are many highly profitable households among the farms but in its lump, they are yet weak, technically poor equipped, insufficiently developed households that have more problems than capabilities. As a rule, they do not order large projects but they are ready to pay for single consultation services.

In this regard, the two main directions of activity are determined – innovative due to the constant demand for modernization of production, and consulting – to solve the urgent problems.

The first innovative direction is related, to a great extent, to the competitiveness of the branch on the whole and it should be the point of the state agrarian policy. The main forms of promotion of innovations into production by the state structures are informational, exhibition and demonstration and educational activity [17]. Such events shall be planned and financed by the federal ministry and regional authorities of the agro-industrial complex. Their organization is given to the subordinated institutions and large regional consulting centers. The successful examples of such activity are the "Information and Consulting Service of the Agro-industrial

Complex " of the Yaroslavl Region, "Voronezh Regional Center of Informational Support of the Agro-industrial Complex ", "Centre of Agricultural Consulting of the Republic of Bashkortostan", "AgroInnovatsia" in the Chuvash Republic, "Samara – Agrarian Information System" and some other regional authorities that work by an order or the consulting centers that won the contests for the government orders.

State consulting shall be developed. But the state cannot cover all the directions, because all manufacturers of agricultural products are entrepreneurs. And, as is known, an entrepreneur is a person who builds his/her business at his/her own risk. Therefore, the state is not obliged to render services or consult him. In this case, consultations shall be a paid service. And it is real as the system of agricultural consulting came into the period of demand by agricultural manufacturers and even now it provides its maintenance by one third by means of the payment of its services by the consumers.

The confirmation of capability of self-dependence is the activity of some commercial consulting structures. For example, the consulting center "Assistant" in Kalmykia, commercial centers in Smolensk, Irkutsk, Vladimir, Leningrad, Yaroslavl Regions and some other regions.

This became possible because the group of professional consultants was formed in the country [18], which is ready and capable to provide high-quality consulting services that the client is ready to pay for (he is satisfied with the quality and prices). The economic efficiency from the implementation of innovative projects is an example of it. As is known, more than 800 mln roubles are spent on the activity of the whole system annually, and from the implementation of the innovative projects developed by the centers in 2017, the profit was approximately 2.4 bln roubles.

The further development of the two main directions of the development of consulting service can be presupposed:

- governmental (federal institutions and regional organizations) with the main function of innovative support. This category shall include also the municipal centers, the purpose of which is to fulfill the municipal tasks and implement the municipal projects (which earlier was the task of the district authorities of agriculture).
- private organizations with the consulting functions, rendering various consulting services (technological consulting, business planning, execution of documentation, accounting and legal support, etc.) and this cannot be paid by the budget funds (Figure 9).

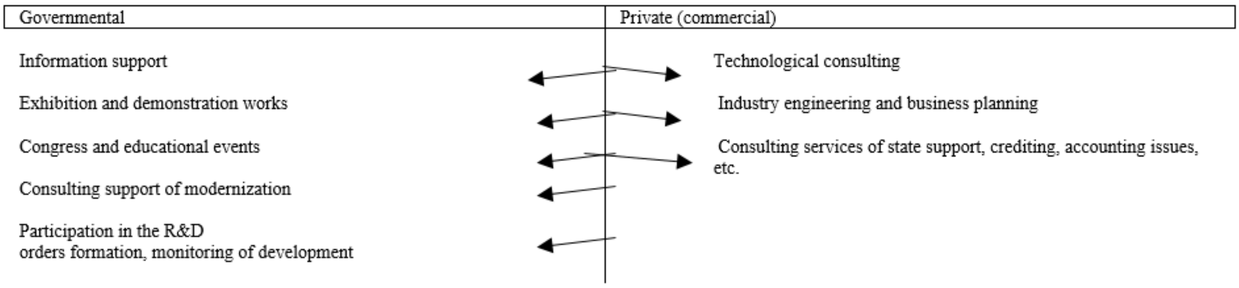

Fig.9. Differentiation of functions of governmental and private (commercial) consulting centers
Source: Sandu and Ryzhenkova, 2017a

The first governmental direction of the development of the consulting institute shall contain the inclusion of educational institutions subordinated to the Ministry of Agriculture of Russia into the consulting activity.

Participation of educational institutions in the consulting activity

The Ministry of Agriculture of Russia coordinates the activity of 54 federal state budgetary educational institutions of higher education and subordinates also 22 institutions of continuing professional education [9, 10].

All educational institutions, to some extent, along with the direct educational activity, consult specialists and participate in exhibition and demonstration innovative events. As of December 2017, 43 institutions performed the consulting activity (29 at higher education institutions and 14 in the system of continuing professional education). 1,252 tutors gave consultations part-time.

In 2017, specialists of educational institutions rendered 29.4 thousand consulting services (12% of the total volume), which does not correspond to their capabilities (on the average, one part-time consultant of an educational institution gives 22 consultations when one full-time consultant gives on the average more than 150 consultations annually).

But the development of the consulting activity at educational institutions is perspective:

Firstly, it means the available highly qualified academic staff performing the scientific research of masters and postgraduate students;

Secondly, it is the material and technical resources that allow performing the consulting activity in all its forms – group and mass educational congress events; provision of conditions for consultants' work; the possibility to arrange the exhibition and demonstration events in the scientific-experimental subdivisions of the institutions, the publishing and polygraphic base allows providing the listeners and clients with the necessary handout.

The main task of institutions of continuing professional education is the professional retraining and advance training of specialists, that is, a transfer of new knowledge that corresponds completely to the functions of consulting centers.

On the base of continuing professional education, using the academic staff and administrative methods (making changes (additions) into the statutory documents), it is reasonable to develop the complete state consulting centers in the regions with the functions of implementation of the state agrarian policy, support of modernization of the branch and development of the rural territories. And the educational functions will be maintained completely but will be complemented by the real content and the significant financial resources will not be required.

At the same time, the participation in the consulting activity increases the level of knowledge and competence of the teachers, as the consultations "in general" do not satisfy the client and the consultant-teacher shall improve his/her professional knowledge, to offer services that can satisfy completely the demands of clients.

Thus, the organization of regional information and consulting centers on the base of continuing professional education has a structural character and can be solved within the framework of the Ministry of Agriculture of Russia using the administrative methods. It can be solved in two ways: the creation on the basis of an educational institution of an autonomous consulting center, one of the founders will be the educational institution itself, or the creation of a special structural unit within the institution.

The importance of the problem of improvement of the quality of information and consulting support of agricultural manufacturers and the development the rural territories is confirmed by the scientific discussion, the agenda of which includes the issues of searching for the new forms and methods of consulting services according to the changes occurred in the organization of the agricultural business [2], urgent necessity of modernization of the processes of management of technologies and innovations [1, 7, 11, 13], and also due to the development of the institute of agricultural consulting, development of the new forms and methods of rendering consulting services and improvement of the existing ones [16].

The solution of the growing problems in the information and consulting support of the branch requires scientific grounding and expert estimation. Researchers offer to use the existing forms of organization of agricultural consulting that were tested by time and practice, to complement them with the new innovative content, to have a more clear distinction of the functions of state and private structures, to provide the large-scale involvement of branch educational institutions into the consulting process, development of the expert society of consultants-experts [18].

CONCLUSIONS

As a result of the performed research of the activity of the system of agricultural consulting, one can determine the two main directions of its development: innovative, due to the constant demand for production modernization, and consulting. The first innovative direction is related to a great extent to the competitiveness of the branch on the whole and shall be the point of the state agrarian policy. The main forms of promotion of innovations into production in the governmental structures are informational, exhibition and demonstration and educational activities. This direction should be implemented by state information and consulting centers, as well as by private organizations with the functions of consulting, assistance in the development of innovations and rendering of various consulting services (technological consulting, business planning, execution of documentation, accounting and legal support, etc. that cannot be paid by the budget funds).

The first governmental direction of the development of the consulting institute shall contain the inclusion of branch educational institutions into the consulting activity.

It is reasonable to give a status of federal informational and consulting centers to all institutions of continuing professional education with the functions of implementation of the state innovative policy and staff retraining for its support.

The problem of increasing the level of participation of branch institutions of higher education in the consulting activity can be solved by developing an independent consulting center on the base of the educational institution, the founder of which can be the educational institution itself.

Due to the fact that the system of agricultural consulting is not provided with the expert staff and specialists capable to estimate the innovative proposals analytically, it is offered to determine the consultants-experts for the main directions of agro-industrial production from the academic staff of the universities for the assistance to the practicing consultants in the selection of the innovations potential for implementation, participation in the development of the innovative projects at agricultural universities.

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AROMATIC COMPOUNDS IN WINES

Luminita VISAN[1], Radiana-Maria TAMBA-BEREHOIU[1], Ciprian Nicolae POPA[2], Silvana Mihaela DANAILA-GUIDEA[1], Rodica CULEA[1]

[1]University of Agriculture and Veterinary Medicine Bucharest, Faculty of Biotechnologies, Mărăşti Bvd, no. 59, zip code 011464, Bucharest, Romania, tel. +40721135314, Emails: l_visan@yahoo.com, radianatamba@yahoo.com; silvana.danaila@yahoo.com;
[2]Farinsan SA, Gradistea village, Giurgiu district, Romania, cipnpopa@yahoo.com

Corresponding author: l_visan@yahoo.com

Abstract

The aroma of wines is represented by a complex of volatile compounds coming from several sources, as well as their interaction with the other chemical substances of the wine: water, ethyl alcohol and other alcohols, phenolic compounds, polysaccharides, fatty acids, etc. The main compounds that participate in the aroma of wine and which give, for the most part its typical flavour are the primary or varietal flavours, coming from grapes and which, besides the phenolic compound's secondary metabolites of vineyards. These compounds are in the free state or in the form of flavour precursors that are in a bonded state. During the processing of grapes and musts a multitude of volatile compounds are formed which together with the primary aromas give the aroma of the young wine, typical of the variety from which it originates, as well as terroir. The Saccharomyces cerevisiae yeasts have an essential role in the complex of fermentation flavors.Thus, in addition to the flavors formed in the fermentative process, other volatile compounds are formed by the action of the yeast on the primary flavors. In the case of matured wines, the flavour is complemented by compounds formed during the maturation period, forming the so-called wine bouquet.

Key words**:** *Varietal flavours, terpene, methoxypyrazines, volatile thiols, 3-mercapto-hexanol*

INTRODUCTION

The composition of wines in aromatic compounds is a basic component of their quality, the odorant compounds being responsible, for the most part, of the typical wines [26]. Thus, although they are secondary metabolites of grapevines, grape aromas are an essential component of the quality of the harvest and an important basis for the aromatic quality of wines [4], [14].
The aromatic substances are in the epicarp (in the cells of the hypodermis and epidermis), and in some varieties, called aromatic and semi aromatic varieties (*Muscat Ottonel, Traminer, Tămâioasa Românească, Busuioaca de Bohotin* - aromatic varieties, *Sauvignon* - semi aromatic variety) are also present in the grain pulp [13], [17]. Grapes of aromatic varieties contain, besides a high concentration of aromatics and specific molecules, called terpinols, which may constitute "key substances" or "signature" of the variety [8], [13]. Thus, depending on the aromatic variety potential *Vitis vinifera* varieties have been classified into two classes:
-simple flavour: Grapes are not flavoured, but the resulting wine contains flavouring substances derived from compounds called flavour precursors. These compounds are found in grapes in a bound form, being odourless.
Some examples of varieties belonging to this group: *Sarba, Cabernet Sauvignon, Pinot noir, Chardonnay, Sauvignon* (considered to be a semi aromatic variety).
-aromatic varieties, in which the grapes contain chemical odorants. Although they are found in very low concentrations, in the order of ng/L, these compounds are perceptible since most of them are in a free, odorous form.
From this variety class belong the varieties *Muscat (Muscat Ottonel, Muscat de Hamburg, Muscat d'Adda, Muscat de Alexandria), Tămâioasa Românească, Traminer*.
The aromatic potential of the grapes is changed during vinification. In addition to varietal aromas (also called primary flavours), other classes of aroma compounds, which are of major importance in the aromatic quality of wines, are found in wine [2]. Thus, they are: preferential flavours, which are born during the processing of grapes, enzymatically [6]; the aroma of fermentation (secondary flavours), which is formed during the fermentative process [5], through the metabolism of the yeast; the maturing aromas (wine bouquet)

that are formed post-fermenting during the maturing and aging process (Fig.1).

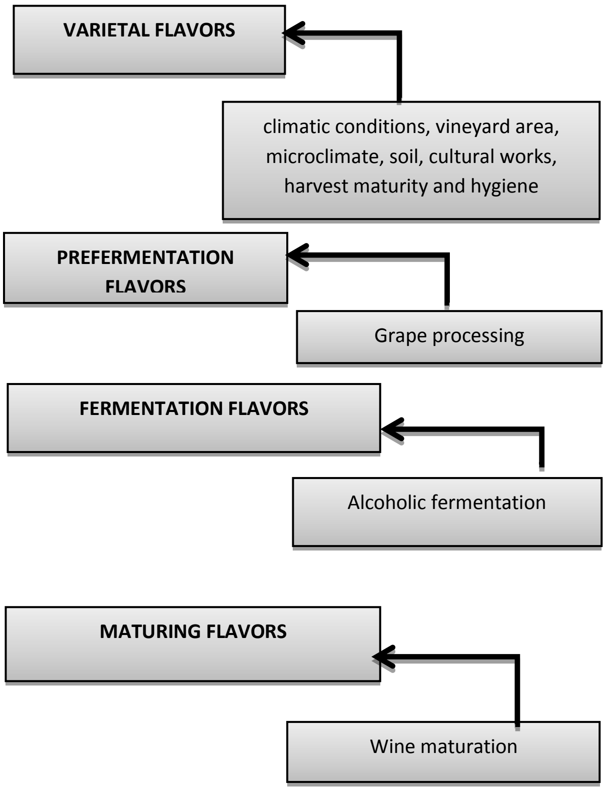

Fig. 1. Wine flavors
Source: Subileau M., Schneider R., 2008

During alcoholic fermentation, a very important class of flavours is formed which have an essential role for the aroma of wine. These compounds are born through a multitude of physicochemical and enzymatic processes due to levurian activity. In the fermentation process the yeast *Saccharomyces cerevisiae* acts on the terpenic compounds, by hydrolysis of glycosides and isomerization and reduction of free terpenic alcohols, leading to the production of aromatic compounds, compounds that give the typical wines [5].

Table 1. Classification of flavours according to the odour character imprinted on wines

Series	The flavor imprinted on wines
Animal series	musk, smell of meat
Balsamic series	amber, resin, conifer
Chemical series	mercaptan, phenol, sulfur
Wood series	bark, cedar, oak, pencil
The empireumatic series	cocoa, coffee, smoke, leather
Spicy series	anise, cinnamon, mint, pepper, sweet wood
The floral series	iris, peony, rose, violet
The fruity series	blueberries, cherries, pears, plums, strawberries, pineapples, bananas
Plant series	grass, hay, olives, pepper, tobacco, truffles

Source: http://biosol.free.fr.

Finally, the aroma of wines is a complex assimilation, due to a very large number of volatile compounds (over 1000 compounds), compounds that impart a specific odor character to wines [15]. From the point of view of this olfactory character, the aromas of the wines were classified in 9 flavoured series (Table 1).

MATERIALS AND METHODS

To highlight the complexity of wine aroma and the origin of volatile compounds, numerous bibliographic databases have been studied.

RESULTS AND DISCUSSIONS

I. Varietal flavours

These chemical compounds are born in grapes through the secondary metabolism of the grapevine [2], [3]. Primary flavouring compounds (varieties) are found in grape berries as free aromas and aroma precursors [14].

(i)Free aromas are made of olfactory perceptible compounds: terpenic compounds (terpene and terpenoids), methoxypyrazines and rotundones.

Terpenic compounds have tropical floral and tropical flavours and are found in aromatic varieties. Terpenes are found in grapes most often in the form of monoterpenes: α-terpineol, linalol, nerol, geraniol and citronelol [7], [16]. These terpenic compounds are attributed to various flavours: rose (geraniol, nerol), coriander, rosewood (linalol), field flowers (linalol oxide), citrus (citronelol) etc. and determine the floral flavour specific to the *Muscat* geraniol, nerol, linalol), *Tămâioasă* varieties (a-terpineol), *Traminer* and other [15].

The terpenic content varies depending on the variety, from very low content to simple varieties (*Feteasca*, *Cabernet*) of about 2 μg/L, at a higher concentration of approx. 2000 μg/L for *Muscat* varieties [7]. In the Table 2 are shows the terpenols identified and dosed in the *Muscat* white variety [31].

Methoxypyrazines are free aromas, with plant flavour, green pepper, capsicum, etc. The flavour of these compounds can have an undesirable effect on wines, with a negative impact on their quality or, on the contrary, they can cause a complex flavour, typical of the *Cabernet* sortgroup and the *Sauvignon* variety [1], [10].

The biosynthesis of methoxypyrazines in the vine is associated with the metabolism of the amino acids: leucine, isoleucine, valine and glyoxal [18], [24], [32].

Table 2. Terpenols content in grape wort *Muscat alb* variety (µg /L)

Terpenols	Free	Combine
trans-furaninaloloxid	33	44
cis-furaninaloloxid	18	33
Linalol	291	95
ho-trienol	19	19
α-terpineol	27	26
trans-piranlinaloxid	96	12
cis-piranlinaloxid	39	3
Nerol	25	160
Geraniol	45	247
3,7-dimetil-1,5-octadien-3,7-diolo	282	534

Source: Sârghi, C., Zironi, R., 1994.

Rotundone is another class of free flavours and is responsible for spicy flavour, white pepper and black pepper, specific to the *Syrah* variety. In fact, these flavourings have been identified in *Syrah* wines from Australia [25]. Subsequently, they were also identified in other wines: in the Italian red wines *Schioppettino, Vespolina* and *Groppello di Revò;* in the Austrian white wines of the Grüener Veltliner variety and in the French wines of the *Gamay* and *Pineau d'Aunis* varieties. Rotundones are very odorous molecules, their perception threshold being very low, 8 ng/L in water and 16 ng/L in wine. For example, *Syrah* wines, and those of *Schioppettino* and *Pineau d'Aunis* show concentrations of about 200 ng/L.

(ii)<u>The flavour precursors</u> are unnatural compounds in the bound form (compounds bound to other molecules). These compounds (fatty acids, glycosides, phenolic acids), during the processing of grapes and alcoholic fermentation are cleaved, thus obtaining volatile odorants [9]. The aroma precursors consist of chemically and organoleptically different substances, grouped into: glyosidic precursors, carotenoids, precursors of volatile thiols and dimethylsulfurite precursors [13].

The *glycosidic precursors* identified in grapes are: β-D-glucopyranoside; α-L-Ramnosyl: 6-O- (α-L-ramnopyranosyl) -β-D-glucopyranoside; α-L-Arabinofuranosyl: 6-O-α-L-arabinofuranosyl) -β-D-glucopyranoside; β-D-Apiosil: 6-O- (β-D-apofuranosyl) -β-D-glucopyranoside [30].

Carotenoids identified in grapes are the precursors of C13-norisoprenoids, the free forms of which are represented by a variety of compounds with a great aromatic diversity [3]: β-damascenone, with flower aroma, exotic fruits, plum jam, apples etc. identified in all wines); β-ionone, with violet flavour (compound perceived only in red wines); 1,1,6-Trimethyl-1,2-dihydronaphthalene (TDN) with kerosene flavour (compound to be found in Riesling's old wines); isotypes of vitisperine, with camphor aroma and eucalyptus; (E) -1- (2,3,6-trimethylphenyl) buta-1,3-diene with freshly cut grass aroma [16].

Precursors of volatile thiols. In grapes, thiols components are found only as precursors, non-volatile and odorous. Odorant character appears in wine during the fermentation process, thiol precursors being degraded by the yeasts of *Saccharomyces cerevisiae,* under the action of S-β-lyse enzymes [5]. Among the precursors of the volatile thiols identified in grapes, we mention: the precursors Cys-4MMP and Cys-3MH [39**], [**42], cysteine-linked molecules and a glutathione-containing 3-mercapto-hexanol thiol precursor identified in the *Sauvignon* variety (Table 3). In addition to these compounds, a *precursor of dimethyl sulfide,* a compound responsible for the typical *Syrah* [33**], [**34]. Segurel and others. shows that the most likely compound of DMS (dimethyl sulfide) in wine is S-methylthionine [13**], [**14**], [**33].

Table 3. Content in flavour precursors of *Sauvignon* variety (ng/L)

The Thiol precursors	**Contents**
4-mercapto-4-methylpentan-2-one	715
4-mercapto-4-methylpentan-2-ol	2059
3-mercapto-hexanol	14812

Source: Tominaga, T. et al., 1998; Deloire A., 2007.

II. Fermentation flavours

Fermentative aromas are also called secondary flavours and are born through the secondary metabolism of yeasts during alcoholic fermentation of grape must [19]. If the varietal flavours are very important for the aroma of wines, being responsible for their typical character, the fermentation aromas have an essential role, by imprinting the wine character of the wine, specific to this alcoholic beverage [5], [23]. Schneider shows the importance of leafy wines in wine making and the fact that a correct choice of spruce can interfere with the final flavour of wines. It also emphasizes that *Saccharomyces cerevisiae* not only leads to the formation of aromatic compounds derived from the secondary metabolism of yeast but can also interfere on varietal flavouring compounds [5], [35]. During the alcoholic fermentation process, higher alcohols, volatile fatty acids, aldehydes, esters, sulphur compounds, etc. - compounds with direct or indirect impact on the olfactory character of wine [20] are obtained by the enzymes produced by the yeasts. These compounds form the class of fermentation flavours [6].

1.<u>Group of superior alcohols</u>. Depending on the assimilable nitrogen level for the grape wort yeast

and the sugar concentration of the grape wort, higher alcohols are born through one of two metabolic pathways [26]:
-through the Ehrlich pathway, corresponding to the catabolism of the amino acids;
-from the anabolic pathway of amino acids, starting from sugars.
The concentration of wines in higher alcohols is quite low, 400-500 mg/L, most of them being found in concentrations lower than their sensory threshold of perception [6]. Except for 2-phenylethanol, which has rose floral aroma, the rest of the higher alcohols have a slightly aromatic flavour of wine.

Table 4. Superior alcohols present in wine

Higher alcohols	**Precursors**	**Aromatic notes**	**Content in wines**
D-amyl alcohol (2-methyl-1-butanol, Pentan-1-ol)	isoleucine	nail polish, solvent malt	8-150 mg/L
Isoamyl alcohol (3-methyl-1-butanol)	leucine	alcohol notes, nail varnish, solvent amilic notes, malt, fragipan, pungent, unpleasant smell	under the 0,2 g/L
Propanol		solvent odor, chemical	5-125 mg/L
Isobutanol or isobutyl alcohol (2-methyl-1-propanol)	valine	solvent, chemical alcoholic, malt notes pronounced wineosity note	9-174 mg/L
Butanol		alcoholic notes, alcoholics participates in fruity wine notes	traces - 8 mg/L
2-feniletanol	fenilalanine	floral, rose, honey notes, peach notes	4-197 mg/L
3-metiltiopropanol	metionine	cruel potatoes	
Thyrozol	from 2-phenylethanol	bitter taste, honey odor	
Tryptophol	triptofan	alcoholic notes	

Source: Nykanen, L., 1986

Numerous authors believe that a low concentration of higher alcohols (below 300 mg/L) leads to a pleasant wine aroma; however, a concentration above 400 mg/L of higher alcohols is undesirable for its quality [20]. The main superior alcohols present in wine are shown in Table 4.
2. ***<u>The fatty acid group</u>*** comprises short chain fatty acids formed during yeast alcoholic fermentation by lipid metabolism. Volatile fatty acids result from acyl-S-CoA hydrolysis, either by the synthetic anabolic pathway (by which most fatty acids are formed) or by β-oxidation of the lipids. The production of volatile fatty acids by lipid oxidation occurs at the beginning of the fermentation process under the action of dissolved oxygen in the wort. Of the volatile compounds formed during the fermentation, higher alcohols and volatile fatty acids are linked to the "gross" character of the wine's flavour. However, there are authors who claim that volatile fatty acids have their importance in wine by helping to balance flavours.

Table 5. Volatile fatty acids and aldehydes present in wine

Fatty acids and aldehydes	Precursors	Aromatic notes
Volatile fatty acids		
acetic acid	asparagine, glycine, serine, alanine	sour smell, vinegar, pungent
propionic acid	threonine	disagreeable smell, sour
2-methylpropanoic acid (isobutyric acid)	Valine	apple rot, butter ran, sweat
2-methylbutanoic acid	isoleucine	fruity, sweat, sour
3-methylbutanoic acid (isovalerianic acid)	leucine	rotten fruits sweat
phenylacetic acid	phenylalanine	floral, green notes
hydroxyphenyl acid	tyrozine	floral, green notes
methylthiopropionic acid	methionine	
Aldehyde		
aldehidă acetică	threonine	green notes, ether, sour smell
2-methylpropanal	Valină	green notes, malt, animalic
2-methylbutanal (isovalerian aldehyde)	isoleucine	green notes, malt, animalic
3-metilbutanal	leucine	green notes, malt, animalic
Phenylacetaldehyde	phenylalanine	floral notes rose
benzaldehidă	phenylalanine	bitter, almond smell, sweet
3-metiltiopropanal	methionine	boiled potatoes
methylthioacetaldehyde	methionine	green notes, apples
Hexanal (caproic aldehyde)		Sweet, disgusting, floral, fruity
Heptanal		
Octanal (caprylic aldehyde)		Citrus, lemon, sweet, sour

Source: Lonvaud-Funel A.et al., 2010.

Fatty acids have unpleasant odors, but the content of wines in these compounds rarely exceeds their perceptual threshold, except for 2-methylbutanoic acid and 3-methylbutanoic acid (Table 5). As for branched aldehydes with pleasant smells of dried fruit, their contribution to the aroma of wines is positive [43].
3. ***<u>The group of esters</u>***. Esters are volatile compounds essential to the aroma of young wines. Most of the esters have floral odours (rose, jasmine) and fruits (green apples, strawberries, pineapples) The formation of the esters is due to the metabolism of levurian and is achieved by enzymatic reactions involving acyl-S-CoA. Thus,

in grape wort found in fermented process, in which acetyl-coenzyme A and ethyl alcohol predominate, the yeasts generate fatty acids, but also their ethyl esters, as well as acetates of superior alcohols [36]. During the alcoholic fermentation three groups of esters are formed:
-ethyl esters of linear fatty acids; are formed through lipid metabolism;
ethyl esters of branched or hydroxylated fatty acids;
-acetates of superior alcohols; the latter two groups are associated with nitrogen metabolism. The main esters involved in wine flavour are presented in Table 6.

Table 6. Esters that participate in the aroma of wines

Esters	Aromatic note	Detection threshold µg/L
Ethyl butanoate	Pineapple, strawberries	20
Ethyl Hexanoate	green apples, strawberries, pineapples, blackberries	14
Ethyl Octanoate	floral, fruity, pear, soap	2
Ethyl Decanoat	floral, fruity, soap	200-500
Ethyl acetate	neplăcut, de dizolvant, fructat unpleasant, solvent, fruity	
Butyl acetate	Banana, floral, fruity	1 ppm
Ethyl Propanoate	cherries	
2-methylbutyl acetate	fruity	
3-methylbutyl acetate (isoamyl acetate)	bananas, ripe apples, candy	2000-3000
2-phenylethyl acetate	rose, fruity	2000
2--methylpropanoat of ethyl	strawberries, blackberries	
2-methylbutanoate of ethyl	apples, strawberries (chemical)	
3-methyl butanoate of ethyl	green fruits, blueberries, strawberries (chemical)	
Hexyl acetate	pear, plum, banana, currant	15 ppm
Linalool acetate	bergamot	
Benzyl acetate	apple, pear, jasmine	

Source: : Ribereau-Gayon J. et al., 1972

4.Group of sulphur compounds. The sulphur compounds present in the wine come from both grapes (varieties of sulphur, such as precursors of volatile thiols) and from the fermentation process (at the end of alcoholic fermentation) through sulphur and nitrogen metabolism [29], [36]. From the sulphur compounds, have importance the mercaptans (volatile thiols) and the sulphur fermentation compounds.

Mercaptans (volatile thiols) are part of the sulphur compound group and are of great importance in the aroma of wines, attended by exotic fruit aromas (pomelo, the fruit of passion). Volatile thiols were identified in different wines: *Sauvignon*, *Gewurztraminer*, *Riesling*, *Muscat of Alsace*, *Cabernet*, etc. [37; 38; 40; 41]. About *Sauvignon* wine, two volatile thiols participate in the flavour specific to this wine: 3-mercapto-hexanol and 3-mercaptohexyl acetate [41]. According to some authors, the flavour specific to *Sauvignon* wine is given by the thiol 4-mercapto-4-methylpentan-ol, which has been identified in concentrations between 5 and 50 ng/L ([11], [21], [22], [44]).

In the wines was identified 4 volatile thiols: 3-mercapto-hexanol-3MH; 3-mercapto-hexyl-A-3MH acetate; 4-mercapto-4-methylpentan-2-one-4MMP; 4-mercapto-4-methylpentan-2-ol-4MMPOH. These thiols are formed during alcoholic fermentation by enzymatic degradation (S-β-lyse type enzymes) of cysteine precursors, mainly Cys-4MMP and Cys-3MH [11], [12], [22], [36], [44].

The concentration of wines in volatile thiols is linked, on the one hand, to the content of grapes in precursors, and on the other hand to the levs involved in the alcoholic fermentation [29], [36].

Sulphur fermentation compounds. Although the concentration in wine does not exceed their threshold of olfactory perception, the contribution of these compounds to the fermentation of the wine depends on their molecular weight and their volatility. sulphur compounds may be classified, depending on the above-mentioned characteristics, in light and heavy or higher compounds [28].

The " lightweight " compounds are associated with the olfactory defects of the wines, they produce an unpleasant, repellent aroma ("reduced" smell, spoiled eggs, mushrooms, garlic etc.). However, under optimal fermentation conditions it does not distort the aroma of wine, being present in low concentration below the level of sensory perception.

During the alcoholic fermentation, most of these compounds are eliminated from the wine, being trained by CO_2 bubbles, and only a small part remains in wine and participates in the olfactory balance and the overall flavour of the wine. There are cases when alcoholic fermentation does not normally occur due to unfavourable conditions (temperature, speed, extreme anaerobiosis), certain strains of yew or because of the high content of grape wort in sulphates, sulphites, assimilable nitrogen [27]. In this case, the concentration of sulphur compounds increases and there are various olfactory defects that can compromise the wine.

"Heavy" or "superior" compounds with a complex aroma of wine are 2-methylthioethanol, 3-methylthiopropanol and their derivatives (corresponding thioethers and disulphides). These compounds are actively participating in the aroma of young wines, the concentrations of which are around 0.1 mg/l. However, 3-methylthiopropanol and N-(3-methylthiopropyl) acetamide may exceed the value of 2-3 mg/L. The main sulphur fermentation compounds in wines are presented in Table 7 [2].

Table 7. Sulphur fermentation compounds present in wine

sulphur compound	Aromatic note
Thioethyl acetate	Burner, sulphurous
Thiomethyl acetate	Cheese, rotten plants
Acetyl 2-thiazoline	Rice, popcorn
Methyl-3-propionic acid	Grill, flavour of maderization
Benzothiazole	rubber
Dimethyl disulphide	Quince, asparagus
Ethan thiol	onion
Furan methane-2-thiol	Coffee
Hydrogen sulfide	Rotten egg
2-mercapto-ethanol	Burned rubber, barley smell
Methane thiol	Smell of low
Methyl thio-2-ethanol	Cauliflower
Methyl-2- -tetrahidrotiofenone	Gas
Dimethyl sulphide	Quince, asparagus, truffle

Source: Ségurel, M. A., 2005

CONCLUSIONS

The aromatic potential of wines involves a series of aromatic compounds that come from both grapes (the primary or varietal flavours) and their vinification, mainly formed during alcoholic fermentation (secondary or fermentation flavours). From the point of view of the varietal aroma, the varieties are classified in aromatic varieties, where the grapes contain odorant chemical compounds, perceptible due to the fact that most of them are in free, odorous form and varieties with a simple flavour, to which grapes are more or less odorless and do not contain terpenes the typical character of the wine being given by other volatile compounds formed during the fermentation process.

Primary or varietal flavours are represented of chemical compounds found in grapes in free form as well as in the form of flavour precursors.

Secondary or fermentation flavours are due to levurian metabolism, as well as its action on primary flavors; the secondary flavors are represented by several groups of volatile compounds: the group of higher alcohols; the group of volatile fatty acids and aldehydes (these groups form the "gross" character of the wine flavor), the group of esters; the group of sulphur compounds.

The latter group includes volatile mercaptans or volatile thiols and sulphur fermentation compounds, which in turn are "light" compounds associated with olfactory defects of wines and "heavy" or higher sulfur compounds that actively participate in the formation of the aroma of young wines.

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ECONOMIC SECURITY OF REGIONS AS A CRITERION FOR FORMATION AND DEVELOPMENT OF AGRICULTURAL CLUSTERS BY MEANS OF INNOVATIVE TECHNOLOGIES

Roman Viktorovich ZHARIKOV[1], Valerii Vasilievich BEZPALOV[2], Sergei Aleksandrovich LOCHAN[2], Maksim Vyacheslavovich BARASHKIN[2], Aleksandr Romanovich ZHARIKOV[3]

[1]Tambov State Technical University, 1 Leningradskaya Street, 392036, Tambov, Russia, Phone: 8 (475) 263-10-19, E-mail: rv.zharikov@bk.ru
[2]Plekhanov Russian University of Economics, 36 Stremyanny Alley, 117997, Moscow, Russia, Phone: +7 (495) 958-27-43, E-mails: valerii.bezpalov@mail.ru; lochans@bk.ru; barashkin.mv@bk.ru
[3]Moscow Technical University of Communications and Informatics, 32 Narodnogo Opolcheniya Street, 123423, Moscow, Russia, Phone: 8 (499) 192-72-47, E-mail: zharikov.ar@inbox.ru

Corresponding author: rv.zharikov@bk.ru

Abstract

The article provides an algorithm and development phases aimed at the creation of a complex economic security system for agricultural regions including an economic risk analysis and management system. In order to ensure the economic security of regions, the authors have developed a network model of cluster agricultural economy based on cooperation between small and medium-sized processing companies and suppliers of agricultural raw materials with due account for system requirements relating to economic security protection of business entities in the corresponding region. In this case, the cycle "Research — Production — Sales" remains within one cluster with the help of a corporate logistics system integrated into global networks, which allows all elements (business units) of the cluster to create a joint development framework and pricing strategy and establish fair distribution of profits among the units based on mutual competitive partnership principles, which, in their turn, promote economic security in the corresponding region. Classification and structure of clusters across the whole agricultural production of a region has been given. Apart from that, the authors have offered a methodology for defining economic potential of a cluster providing for synergetic effect of separate potentials and cumulative cluster potential achieved by integrating separate potentials. For the purpose of efficient cluster management, the authors suggest a model of cluster economy management, which includes management phases, goals, principles, and functions.

Key words: *economic security, cluster, agricultural region, info-communications, cloud technologies, Internet of things*

INTRODUCTION

In order to improve competitive performance of a region under acute shortage of resources, it is reasonable to consider priority areas of infrastructure development taking into account absolute and relative advantages, thus defining the specialization of the region and enhancing its investment appeal. The economic structure of most economically depressed regions in Russia can be described as a nonstructural specialization system [14]. It is necessary to pay attention to those regional industries which could, on the one hand, determine the competitive performance and economic security of the region and, on the other hand, improve the life quality of its population. Agriculture and processing industry can arguably perform these functions in many Russian regions, which means that the spheres in question should form a market for high-quality food and agricultural products. Therefore, work towards this goal should become the top priority task for the regional authorities.

Presently, the Russian Federation, which possesses 10% of the world's ploughland, continues to import around 35% of its food and agricultural products and remains to be on the edge of losing its own food security. In view of the current situation in the agricultural industry, the national project on import substitution and upsurge of agricultural production has been put into operation. In 2008, it was transformed into a state-supported program "Development of the Agricultural Complex".

However, this project cannot be deemed totally successful, since it has not only helped to solve problems connected with funding of the industry and investment inflow, but also contributed to the integration of the country into the global economy: there have been an increasing number of holding companies dealing with crop raising, dairy husbandry, pig and poultry farming with long-term land lease arrangements. There has been no increase in competitive performance of the Russian agricultural production because virtually the whole industry operates on a tolling basis, whereas the ploughland is cultivated by utilizing imported equipment and technologies. For example, the Swedish company Black Earth Farming admits the purchase and management of 300,000 hectares of land in the Central Black Earth Region of Russia through the connected company Agro-Invest, while the Danish company Trigon Agri declares its control over 100,000 hectares of land in Penza and Samara Regions, not to mention the 49-year lease of land in Primorye to the Chinese. This long-term strategy has been approved by the "New PRC Governmental Program" which encourages and subsidizes farmers who buy ploughland abroad [15]. This is an elaborate program with phased subsidizing: for instance, if a manufacturer cuts the production costs (e.g. due to the usage of alternative energy sources), the company will get gradual reimbursement for the cost of corresponding equipment and preferential taxation. As a result, the Chinese authorities also address the issue of production support and the need for a supply of agricultural raw materials as well as the reduction of unemployment in the countryside.

MATERIALS AND METHODS

The methodology of the complex economic security system (ESS) development should contain the following algorithm and phases:

– Analysis and review of specific features, business operations, market segment, management structure and business reputation of the main region’s industry;
– Analysis of external and internal threats to the economic activity in the region and the degree of their influence;
– Modeling elements of the complex EES with direct and reverse connections for a particular business unit;
– Conducting an audit of the existing measures ensuring the economic security of the region and their correlation with the identified risks and threats;
– Finalization and approval of the complex ESS model and the required budget;
– Establishing the actual structures and regulations of the region’s ESS;
– Expert efficiency evaluation of the introduced ESS and bringing its regulations to the required level.

As a rule, financial security is a matter of utmost importance as far as economic security is concerned, which is why both experts and scientists pay great attention to the detailed analysis of financial security in the course of program and project development. Besides, the teaching staff of educational institutions also incorporate topics connected with financial security into learning and teaching support kits for specialized subjects.

However, it constitutes only a small part of economic risks and conditions of uncertainty relating to external and internal organization environment, which should be regularly monitored and constantly controlled with respect to their dynamics. Thus, one should not get obsessed with the analysis of financial and operating performance [4], although it is a very important component and it is advisable to use such detailed analysis of 3-5 years dynamics as the basis for business analysis.

Nevertheless, talking of economic security as a complex system, one should represent such a system as a set of multiple variables, such as characteristics of a particular business unit, sub-industry and industry, within which it operates, and a number of elements in direct and reverse correlations with each other aimed at ensuring competitive performance of the business unit in question. A solution to such tasks implies that the organization should create unique analysis systems in order to reduce the influence of economic risks. Such systems are not only unique for each business unit but also individual in terms of risk priority ranking. At the same time, there have been attempts to create universal risk assessment solutions with the use of statistical data both on the global and microeconomic levels (that of separate business units) [11, 12, 13].

At the same time, specific operating characteristics of a particular organization will definitely serve as the main factor for risk prioritization.

The authors suggest the development of agricultural clusters by means of innovative technologies as a solution to the problem of providing the population with all necessary food products, which is one of the most important criteria for the economic security of any region. Scientific papers written by such academic economists as M. Porter, P.F. Drucker, I.V. Lipsitz, L.E. Mindeli and others should be considered and studied as the basis for the methodological instruments. "Cluster is a network of suppliers, producers, customers, elements of industrial infrastructure and research institutions interconnected in the process of creating new types of products and rendering services" [6].

The founder of cluster development theory is M. Porter who explored the issue by researching the competitive positions of over 100 industries in different countries. [6] M. Porter noticed that, as a rule, most internationally competitive companies from the same industry are located in the same region. This phenomenon can be explained by waves of innovation spread by the most competitive companies and affecting suppliers, customers and competitors of those companies.

High competitive performance of a region relies on the strong positions of separate clusters, whereas even the most developed economy without advanced clusters can produce mediocre results. In the modern economy, competitors are not separate companies or industries, but clusters.

RESULTS AND DISCUSSIONS

Clusters are formed around processing companies: sugar plants, butter and cheese making plants, oil mills, meat plants, flour mills, etc. Within one region there might be several clusters of the same type according to the number of processing facilities.

There are several factors that can both promote and hamper cluster development in Russia.

Specialists in the field name the following positive factors:

– existence of technological and scientific infrastructure;
– psychological readiness for cooperation.

The constraining factors include the following:

– low quality of business climate, low development level of associative structures (chambers of commerce, industrial associations), which cannot cope with the task of formation and promotion of priorities and interests of the regional business;
– short-term planning — real benefits from cluster development appear only 5-7 years later [9].

For the purpose of efficient cluster management, the authors suggest a model of cluster economy management which includes management phases, goals, principles, and functions (Fig.1).

Objects of management are clusters, which, as a rule, consist of several business units. Coordination and infrastructure issues should be dealt with by officials authorized as a regional administration. Objects of management and sub-systems of quality control are indicated in the model. In order to assess the efficiency and quality of cluster-produced goods, the authors have developed criteria and assessment levels, the most important among which is the utilization efficiency of financial resources).

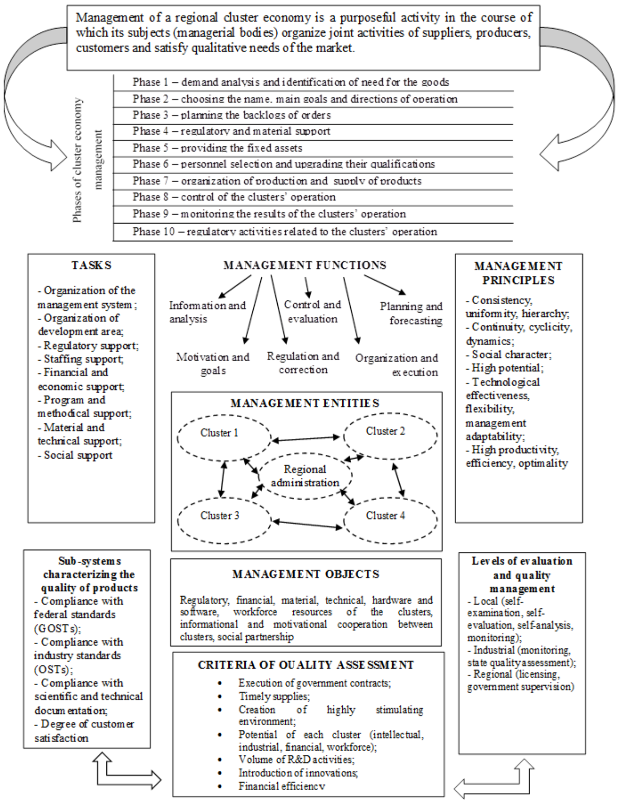

Fig.1. Model of regional cluster economy management
Source: Compiled by the authors

The authors have chosen the method of cluster formation based on specialization of raising and processing agricultural raw materials. The original method has been changed so that business units located not in one territory, but preferably in one region can become cluster participants. In this case, it is easier to choose the subject of research and assess the operational efficiency of a cluster.

Depending on the number of centers (nuclei) within a cluster it can be a simple network model (one center) or a complex network model (two and more centers).

The most important condition and advantage of economy clusterization for an agricultural region is integration of potentials:

– intellectual, $\sum Int$

$$\sum Int = Int1 + Int2 + \ldots + Intn; \quad (1)$$

– innovative, $\sum In$

$$\sum In = In1 + In2 + \ldots + Inn; \quad (2)$$

– investment, $\sum Inv$

$$\sum Inv = Inv1 + Inv2 + \ldots + Invn; \quad (3)$$

– industrial, $\sum Ind$

$$\sum Ind = Ind1 + Ind2 + \ldots + Indn; \quad (4)$$

– workforce, $\sum W$

$$\sum W = W1 + W2 + \ldots + Wn; \quad (5)$$

where 1,2…n is the number of business units participating in a cluster.

Then the common potential of the cluster, $\sum P$, will be equal to the sum of all the cluster potentials, which allows to conduct research and development activities (using the cluster's own resources or contracting other organizations), experimental design work aimed at development of new technologies and equipment, retraining of staff and other types of scientific, industrial and personnel activities within the cluster:

$$\sum P = \sum Int + \sum In + \sum Inv + \sum Ind + \sum W; \quad (6)$$

Joining the potential of all business units within a cluster allows getting the synergetic effect as a result of using all types of potential.

This approach also helps to ensure the economic security of the cluster and its separate elements (business units), regions and country as a whole. Under the current conditions of economic development implying unstable market environment, fierce competition for market segments, industrial espionage, benchmarking, implementation of innovations and bankruptcy threats resulting from different reasons, the necessity for economic security arises together with the need to ensure it by means of complex frameworks.

Judging from the analysis outlined above, it may be concluded that increase in labor productivity in the agricultural sphere is possible only due to the reduction of the living labor share (in its material form), which can be encouraged by the implementation of fundamental scientific discoveries and technological innovations, such as automatization and robotization.

In this case, a paradigm shift takes place as a result of using innovative approaches in agricultural activities.

Currently, infocommunication technologies and cloud services are penetrating the agricultural sphere. It is possible to identify several most progressive and advanced trends, which are likely to exercise great influence on the development of the whole agricultural industry in the coming years [1].

Development of robotic engineering and usage of big data and computer-aided learning in the agricultural sphere.

One of such examples is the invention of Australian scientists called Flow [7] — a fully automatic beehive. The design of the cells allows them to transform into channels, through which the honey flows into special containers. The main element of the design is a plastic frame which prevents violation of the beehive's integrity. Another example is the project 30Sec Milk [10] — a compact device, which performs the full cycle of milk production (including milking and pasteurization) and packaging. This invention allows shortening the chain of participants and speeding up the delivery of milk to the end consumer. Besides, various instruments and CRM tools for data collection, aggregation and analysis also regularly emerge. The AgCode software [8] was developed for vineyard companies and helps them to manage production: save data in a single database, monitor the crop yield, weather conditions, degree of ripeness and costs relating to each employee.

Usage of neural networks and artificial intelligence.

In the market, there are a number of standardized products from large-scale manufacturers, such as IBM, Google, or Monsanto. There are also targeted solutions: for example, OneSoil, a startup from Belarus — it is an online service, which monitors the condition of cultivated areas, crops increase and resources saving with the help of artificial intelligence. Drones, a "flying wing" and a helicopter are used for data collection.

Innovative solutions for plant treatment.

For example, the company Azotic uses a specially modified type of bacteria, which are able to extract nitrogen from the atmosphere and deliver it to plants as a fertilizer. Indigo uses the microbial coating on cotton seeds, which increases its crop yield by 10%. Scientists from the University of Queensland have received good results after treatment of plant leaves with ribonucleic acids. Another example — Sample6 system [3] — is used to detect food pathogen agents in plants. The Russian startup SBV24 — a solar bio-vegetarium — is a new generation of greenhouses accumulating solar energy several times better than its standard counterpart and regulating the temperature conditions thanks to the preserved heat. The bio-vegetarium uses the protected ground system, which regulates four factors affecting crops: light, temperature, water and fertilizers.

Tracking and control of production and transportation in real-time mode.

The system developed by SpensaTechnologies [2] allows farmers to track, trap and identify crop pests and receive daily reports. Startup Gamaya [15] provides a solution which allows saving a lot of time on examining the fields by identifying deviations in the soil parameters of separate plants. The program analyzes the images from the cameras carried by drones and, using the information about the necessary amount of chemical substances, soil characteristics and the cultivated crops draws a conclusion about any existing plant diseases and their causes. After that, the system sends a notification to the farmer indicating the location of the ill plants and lack of nutrients in the soil, which allows reducing the amount of fertilizers and other resources.

Development of the industrial Internet of things.

Over the last few years, the efficiency of irrigation has been substantially improved and water use has been reduced due to the data received from sensors installed on the ground, satellite images, weather forecasts and exploitation of drones. Edyn [3] is a solar-powered technology designed for monitoring the information about the condition of soil and air in order to calculate the necessary types and dosage of fertilizers and determine the appropriate time for planting and cropping, as well as increase the crop yield. The device is a system of solar-powered ground sensors, which send the information about the condition of soil, air temperature and humidity, light intensity and electrical conductivity to the farmer via a special application and give recommendations about the cultivation of particular plants. The irrigation system CropX [3], which has been developed in Israel, helps to reduce water and electricity usage by 20-30% as a result of division of the plot into separate irrigation zones (according to the soil type, humidity and terrain) and installation of sensors that analyze samples and calculate optimal amounts of water. The virtual agronomist Agrilyst [2] is a system of intellectual sensors used for data collection, analysis and visualization. It helps farmers to make informed decisions related to agricultural crops, animals, soils and other things. Bovcontrol [5] is a set of tools (ear rings, chips, smart scales etc.) for data collation and analysis aimed at boosting productivity in meat-and-dairy farming and genetic improvement in livestock breeding. The complementary program is designed for feeding, vaccination and inventory management.

The spread of urban hydroponic farms using polymer film.

One of the examples is BrightFarms [2] — the project of building greenhouses in urban conditions in close vicinity to the points of sale. Another project — Freight Farms [5] — has made farming possible in an urban setting offering shipping containers for growing agricultural products (due to their large size up to 4-5 thousand plants can be grown there). The company produces blocks ready for plant cultivation, which are equipped with all the necessary instruments for intensive and sequential cropping. The project employs innovative climate technologies based on hydroponics; it is possible to control lighting and regulate parameters remotely.

Quantitative and qualitative growth of data about the environment.

For example, AeroState [5] allows controlling the quality of air anywhere in the world. AeroState is a platform with interactive pollution heat map, which provides agricultural producers with the opportunity to add information about air quality to their product. Satellite systems, traffic data, information about emissions within cities including vehicle and industrial emissions are all used for analysis. Agri Eye [2] is a self-learning system able to assess the condition of soil and vegetation by means of multispectral field analysis and remote vegetation and soil sounding. The technology allows farmers to save up to 30% of resources used for crop treatment, keep soil in a good condition, calculate the indexes describing the condition of a plot and predict profit in a long-term perspective.

The innovative approach implies the creation of tools integrated into the key agricultural processes and allowing to monitor the changes in farming data in real-time mode. This information is used as the basis for forecasts and plans, making decisions and modifying logistic processes in order to optimize time and resources (Fig.2).

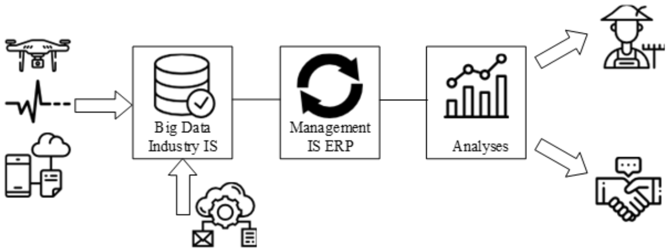

Fig.2. Usage of big data and ERP systems in agriculture
Source: Compiled by the authors

Analysis of this trend leads to the conclusion that over the last decades agricultural production has been undergoing revolutionary changes, from mechanization to robotization processes with the use of innovative technologies and artificial intelligence. In its turn, this allows not only reducing the labor input into production processes of the industry increasing labor productivity, efficiency and quality of products but also, as it has been mentioned earlier, it helps to reduce the share of living labor in the material product. Definitely, these developments can also have more serious consequences: industrial relations are changing, as well as the share of workforce taking part in the agricultural production of both raw materials and finished products.

One of the possible development patterns for regional markets is the production of ecologically clean agricultural products with the opportunity of clusterization of the regional economy for the purpose of reducing the costs of production.

Among the most important benefits that business will get as a result of cluster formation, the following ones should be mentioned:

– development of workforce potential thanks to training, retraining and exchange of experience between the staff of similar clusters;
– growth of separate and common potentials;
– civilized contractual relationships between suppliers, processors and sales companies;
– increase of manageability as far as separate industries and regional economy in general are concerned;
– creation of infrastructure for research and development and experimental design activities;
– cost minimization thanks to the scale of production, introduction of new technologies and equipment;
– identification of agricultural export opportunities in the international market;
– strict and constant quality control of raw materials and other products provided by suppliers;
– incorporation of know-how and innovative technologies into production without losing quality characteristics or useful properties of products.

The government of the Russian Federation provides agricultural industry with significant support, but, unfortunately, the main result of these efforts is favorable credit facilities for agricultural companies. In this connection in 2018, the total sum of credit resources allocated for companies and organizations in the agricultural sector amounted to 23.75 bln roubles: 15.58 bln was assigned for short-term credits and 8.17 bln — for preferential investment credits. As of the first half-year period of 2018, the Ministry of Agriculture of the Russian Federation has received 12,236 applications for preferential credits from the authorized banks for an overall amount of 907.01 bln roubles including the total subsidy amount of 19.21 bln roubles: 11.36 bln assigned for short-term credits and 7.91 bln — for investment credits. Insufficient collateral and unsatisfactory credit report remain the main reasons for preferential credit denial.

In the modern realia of market reforms in Russia, there are some priority areas and competitive industries favored by government support, which directly leads to the further disintegration of the population in terms of living standards. The situation is made even worse by the quality gap between the living standards of different regions and purchasing power of their population, immaturity of market infrastructure and small business and depressive state of the central Russian regions.

CONCLUSIONS

In view of the abovementioned conditions, it is necessary to create risk analysis and management systems in order to ensure regional economic security.

Such systems may consist of similar structural blocks:

– modeling of risky situations;
– assessment of losses resulting from risks;
– permissible limits for each risk category;
– development of algorithms aimed at avoiding risks or reduction of losses resulting from emerging risks;
– development of an action plan and its variants with the purpose of reducing negative effects of risks in order to avoid reaching the critical limits (bankruptcy risk);
– practical risk-preventing actions;
– control of risk-neutralizing measures and amendment of actions and decisions if necessary.

Assessment of risky situations can be implemented with the help of a set of analytical actions which allow predicting the possibility of receiving additional profit or amount of losses resulting from a risk, which emerged in a particular situation under the influence of certain external and internal factors. The most important parameter of this approach is possible damage and assessment of optimal investment necessary to reduce it to an acceptable level. As a rule, the possible damage is estimated by such methods as the statistical, expert or analytical approaches.

Endowing Russian food products with competitive advantages and revival of Russian agricultural production under governmental control will allow speeding up the process of socio-economic transformation of the territories. The growth of employment and income of the population will encourage the revival of the countryside and consumer cooperation, whereas high-quality nutrition at affordable prices will contribute to the general health of the population and national security of the country. In light of this, it is more important than ever to establish a thought-out support program for small and medium-sized business in the countryside, look for new development incentives for agricultural enterprises, reconsider the Russian and global agricultural experience and work out the optimal development path with due regard to national and regional specific features.

Establishing the cluster system of regional agricultural production management based on networking models allows achieving the following:

– increase the volumes of production and labor productivity in the agricultural sphere;
– receive higher incomes, which improves the financial capacity of the cluster's business units;
– set up venture funds within the cluster;
– create (purchase) and use innovations both in crop raising and livestock breeding;
– improve the quality of agricultural raw materials and food products and, as a result, promote the competitive capacity of such goods in the internal and external markets.

Production and distribution of ecologically clean products in necessary amounts will allow improving the quality of life in the country.

As far as the management of an agricultural region economy is concerned, clusters have the following advantages:

– constant demand for agricultural raw materials and their processing on a regular basis under long-term contracts for the supply of agricultural raw materials;
– growth of separate and common cluster potentials thanks to the integration of potentials belonging to all business units within the cluster;
– growth of volumes of agricultural products, development of food products market in the country thanks to long-term contracts for the supply of food products to the northern regions of the country;
– improvement of competitive performance of Russian ecologically clean food products, which, in its turn, boosts the competitive performance of the Russian regions.

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