ECONOMIE ŞI CONTABILITATE

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DECISIONS REGARDING PRODUCTION STRUCTURE IN AGRICULTURE. CASE STUDY IN AREA PLAIN, GIURGIU COUNTY, ROMANIA

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Rezume. Rezultatele economice ale exploatărilor agricole depind în mare măsură largă de alegerea structurii producţiei. Ansamblul activităţilor agricole, proporţiile între ele şi partea fiecăreia în activitatea de exploatare pot genera unvolum diferit de cheltuieli şi determină obţinerea unui profit variabil. De asemenea, structura producţiei influenţează gradul de stabilitate a pieţei, poziţia competitivă în reşaţie cu exploatările care duc o activitate similară. Prin urmare, structura producţiei are o putere de decizie foarte mare şi necesită utilizarea unui process foarte minuţios de selecţie, folosind instrumente şi metode economice de calcul adecvate.

Articolul intenţionează să studieze condiţiile naturale, economice, de piaţă şi să identifice măsuri de politică agricolă pentru diferite ramuri, punînd accent pe analiza fermei din judeţul Giurgiu, România, cuscopul de a realiza o structură care ar combina producţia culturilor agricole cu sectorul zootehnic. Astfel, a fost luat în consideraţie modul de lucru, stabilirea semnalelor interne, elaborarea structurilor de producţie şi analiza impactului acestora.

Cuvinte cheie: Combinarea ramurilor agricole, Decizii, Metode economice şi matematice, Selecţie, Structura producţiei.

INTRODUCTION

In an economy characterized, increasingly, by changes, the production branches involved in this process acquired new dimensions and often decisions have to be taken in conditions of risk and uncertainty.

Such state of affairs is also specific for Romanian agriculture, which in its way towards the European Union, must meet its requirements using the available strengths and opportunities.

Among the arguments supporting ours agricultural capacity to materialize these benefits are relevant the following:

- the diversity ofagricultural land use (arable land, pastures and natural meadows, vineyards and orchards);
- a diversity of crop varieties, animal breeds and categories;
- the ability, almost historical, of the Romanian producers in this field;
- extrovert activity of entrepreneurs or managers.

Decision making process and its variants concerning the structure of production is based on the choice of the best required knowledge in many fields of the current situation within the studied area. Therefore, a specialist should refer also to natural conditions and market analysis, to the diagnostic analysis of the production structure, being based on analysis of the balance sheet and methods to optimize the combination of agricultural branches.

When choosing the most suitable options, there were taken into consideration the peculiarities of agricultural branches and relations between them, and also some necessary principles in combining branches. Also, the general information was taken from the Statistical Yearbook of Romania.

MATERIAL AND METHODS

A component that stratifies the economic dominance of agriculture in a country is represented by products quality and performance. In this context, we have the image of what, how much and how much of each product is produced, and what is the value and balance of trade in agriculture, what are the positive effects assuming coherent decisions and how accurately the presented information reflects reality (Gheorghiţă, M., 2001).

Determinants of production structure. The answer to the questions like: What to produce? How much of each product to produce? Which is the proportion of branches?, is influenced by a number of variables the effect of which is manifested by varying degrees of intensity. Some of them are characterized by certain constancy in time and space and others change at short intervals (Voicu, R., Dobre, Iuliana, 2003).

Being decisive in the structure of production, these factors determine or influence each other and they cannot be addressed separately, that's why the decision will be given by the sum of the effects of interaction between them.

Specifically, among the factors contributing to decision making and having a wider coverage area, are the following:

- Environmental conditions of the area in which the farm activates;
- Market demands;
- Capitalization of exploitations;
- Providing classified employment;
- Agricultural policy support of the production branches (plants, animal husbandry);
- Removing the effects of risk and uncertainty.

Other involved factors are: the restrictive nature, type and size of farms, consumption needs of family members, specific nature of farms providing „intermediate inputs" for those whose activity is not exclusively agricultural.

Taking into consideration the set of mentioned conditions, irrespective of the scope of work, the farm remains of a constant type, size and also the number of animals in their possession.

In Romania, the farms are diverse in structure, form of organization, size, operating capital (fixed and circulating), economic power: family farms, agricultural associations (simple forms of association or separate legal personality), agricultural companies, agricultural joint stock companies, producer groups etc. Also, their management is different because the structure of production is directly proportional to the ability to connect the unit to its economic determinants.

All these elements determine, for each type of farm, different production structures. The presented structure of production starts from simple to complex, which in literature is found in both types of structure: diversification and specialization.

Diversification is specific to households, because:

- they have small areas of households, averaging about 2,29 hectares;
- they breed a small number of animals, but diverse in terms of species: cattle 2.2, 2.03 pigs, sheep 18,2 and 19,1 birds;
- their surfaces are limited;
- their production systemis traditional;
- their fixed capital investment is small and rudimentary, which does not allow agricultural work required by production technologies;
- they have not enough financial possibilities (and they are very small) for investment interest in purchasing agricultural inputs (seeds, planting materials, fertilizers). In these circumstances, market connection is sporadic, therefore the interest of standards imposed by the rules, national or European, is low, producers acting according to the local tradition instinct;
- their economic power is low, agriculture is supported by revenue from other sources (pensions, aid etc.).

Specialization is a form of production structure, which is reflected in farms of juridical person and has an acceptable size for this process to take place. The main determinants of the structure of specialization production are the natural conditions in the farm and operating market needs.

Along with them also may occur the following:

- industrial type of applied technologies;
- rational proportion of the branches;
- size of agricultural farms (economic power in order to ensure production factors: mechanization, fertilizers, irrigation etc.).

Specialization creates economic benefits of agricultural holdings: the homogeneity of the production process, specialized technical resources and labour, increase of employers' skills, insurance of an uniform output and in large quantities, facts that facilitate the relations with different beneficiaries.

But there are also negative consequences of specialization and namely its vulnerability, which increases the risk of partial or total loss of production and income. For these reasons, the owners of vegetable exploitations do not take decisions depending on the specialization but, rather, on the diversification of business, trying on the one hand, to achieve a rhythm of revenue, and on the other hand, to compensate the loss of income of some cultures with its achievement due to other cultures.

The case study accomplished in Giurgiu County is based on the analysis of local data, and the production structure design is done using appropriate statistical and mathematical methods: regression equation, linear programming.

RESULTS AND DISCUSSIONS

Case study. Statistical data on Giurgiu County shows that it has an area of 352,602 hectares, representing approximately 1.5% of the total area of Romania. The categories of agricultural use are different, indicating a greater "availability" of its zonal conditions for special varities of crops as: arable land, pastures, meadows, vineyards and nurseries, orchards and fruit tree nurseries (fig. 1).

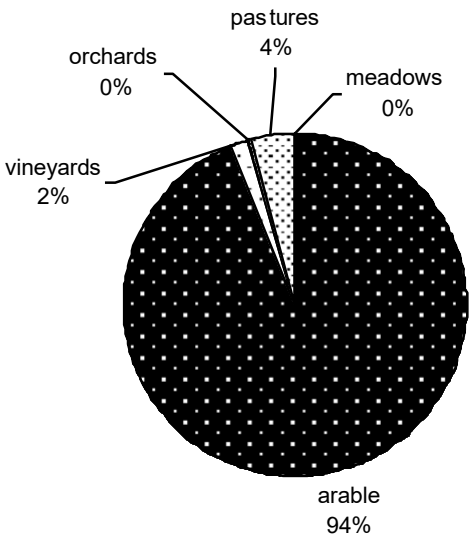

Figure 1. Categories of agricultural use in Giurgiu County

The types of soil which prevailing are mold (classified as the Zone Iof fertility in the South County and as the Zone II of fertility in the Central and Eastern County), reddish brown soil and brown forest (Zone III of fertility in the North County).

Given the high degree of fertility of the area and suitability for cereal grains, the potential of production is high, if managing properly the water factor.

Giurgiu County's agricultural area is about 277,182 ha, out of which 154,929 ha for grain cereals (80,466 hectares of wheat and rye and 11,652 hectares of barley - fig.2). Examining the average production, it specifically attains the planned production level.

These crops are objects of different types of farms (fig. 3).

In terms of value, the branch cereals production of the Giurgiu Country is approx. 50% of total agriculture production sector:

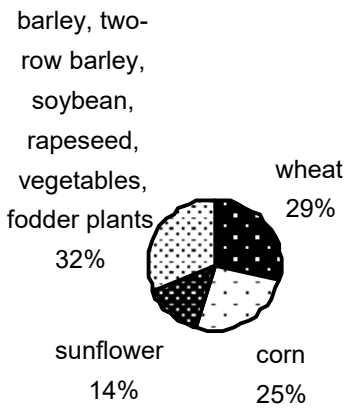

Figure 2. Crops structure

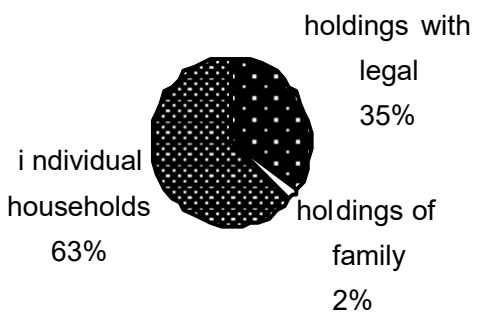

Figure 3. Agricultural sector organization

Table 1

Design of production structure in a farm from Giurgiu County

Specification	2002	2003	2004	2005	2006	2007
Total, mii lei (RON)	587780	656371	1169761	897676	868834	615451
Vegetal, mii lei (RON)	319011	367963	817740	491678	477940	267431

Source: Eurostat methodology „Economic Accounts for Agriculture"

The farm is of an associative type and it was established under the Law 36/1991. The object of its activity is manufacturingand marketingof highly productive varieties of cereal grains and industrial crops.

Forecast of the average production. In the forecast of the average production, the farm needs data on production results in recent years**:**

Table 2

Crop	Average production obtained, kg/ha				
	2004	2005	2006	2007	2008
Wheat	3125	3200	3228	2423	3176
Spring barley	3170	3275	3452	2302	2497
Winter barley	2560	2875	4458	2972	2136
Sunflower	1230	1300	1378	800	1425

For the forecast of the average production we used the regression equation method corresponding to data series. The average production can be represented by a coordinate system XOY. Evolution curve representing the level of production achieved per hectare - y - directly depends on time - X. The relation has the following form y = f (x). In relation to the distribution of pairs of values it was established a trend in the average production (y), which is a parabola of the form y '= a + bx + cx2. Using the regression equation parameters (a,b,c), it can be determined that the sum deviations between the actual y value and trend value y ' are minimal:

$$\sum (y - y')^2 = 0$$

This condition is solved by the following system of equations:

$$na + b\sum x + c\sum x^2 = \sum y$$
$$a\sum x + b\sum x^2 + c\sum x^3 = \sum xy$$
$$a\sum x^2 + b\sum x^3 + c\sum x^4 = \sum x^2 y$$

For the forecast of the average production, for 2009, the method of regressionequations can be used.

Table 3

Year	Average production, kg/ha
2004	3125
2005	3200
2006	3228
2007	2423
2008	3176

x	y	x y	x^2	x^4	$x^2 y$
-2	3125	-6250	4	16	12500
-1	3200	-3200	1	1	3200
0	3228	0	0	0	0
+1	2423	2423	1	1	2423
+2	3176	6352	4	16	12704
Σx=0	Σy=15152	Σxz=-675	Σ x^2 =10	Σ x^4 =34	Σ $x^2 y$ =30827

The following calculation is obtained: Y = 2955,7 +67,5 x+37,35 x2. For x= 3 (number of years), Y = 3494 kg / ha, representing the average production of wheat for 2009.

Average production for spring barley, in 2009, is about 1671 kg/ha, for winter barley is about 1089 kg/ha and for sunflower is about 1420 kg/ha.

Optimizing the overall production structure. *Linear programming method*

Linear programming method is based on an economic-mathematical model consisting of an objective function to maximize profits or minimize costs and a system of restrictions in the employed available resources and restrictions regarding crops rotation.

The developed model should lead to the achievement of the expected production and complete use of resources. To optimize the structure of production with the help of linear programming method, the data given in the table below are necessary:

Table 4

Nr. crt.	Specification	U.M.	Crops				Availability of resources
			Wheat (x1)	Spring barley (x2)	Winter barley (x3)	Sunflower (x4)	
1	Area	ha	-	-	-	-	508
2	Production expenditure	lei/ha	1960	1900	2000	2200	150000
3	Consumption days per person/ha	z.o.	2	2	2	10	5200
4	Profit	lei/ha	50	70	90	120	max

The components of the linear programming model are: variables, restrictions and criteria.

The variables of the model are the following four crops: wheat, spring barley, winter barley and sunflower and the coefficients of each variable are defined according to the resources existing in the farm. Production resources are: the area of land and its degree of favourability for different cultures, labor and material resources and available money resources. Restriction model ensures the optimum use of resources and it is made so as to comply with the intended purpose and to ensure maximum functionality of each of them:

- arable land is integrally cultivated;
- restriction of rotation;
- use of labour in full capacity;
- obtaining income security;
- costs per hectare should not be higher than the available resources.

Optimization criterion is to *maximize total profit* of the agricultural farm. The following notations were used:

x1, the area planted with wheat;
x2, the area planted with spring barley;
x3, the area planted with winter barley;
x4, the area planted with sunflower.

The objective function is the following:

Max (F(x)) = 50x1+70x2+90x3+120x4

The restrictions of the model are:

1. integral cultivation of area:

x1+x2+x3+x4<=508

2. integration with the availability of money resources:

1960x1+1900x2+2000x3+2200x4<=150000

3. integration with the availability of labour:

2x1+2x2+2x3+10x4<=5200

4. negativity of variables:

x1, x2, x3, x4 >0

Using the software package QM, the new production structure can be represented as follows:

Table 5

Nr. crt.	Crops	Area	
		ha	%
1	Wheat	177	35
2	Spring barley	121	24
3	Winter barley	100	20
4	Sunflower	110	21
Total		508	100

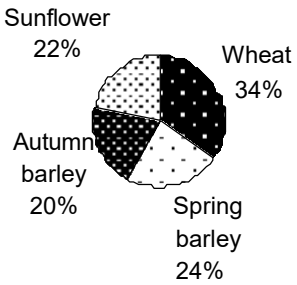

Figure 4. New production structure

Results of the estimated production. ***According to the obtained results, in the new production structure, the highest weight is still of wheat cultivated on 177 hectares, and representing 35%. Spring barley follows after wheat, which is 23%, then the sunflower with 22% and winter barley with only 20%:***

The decisions regarding productionstructure are based on the simple processes of optimization of the overall branches within a farm, such as the replacement of crops. In this case, the decision will be made by performing the calculations and using the economic efficiency, which is expressed by indicators whichwould give the possibility to determine if the new culture able to give more positive and higher results than those of the previous crop. In order to do this one could also use other statistical and mathematical methods applicable in agriculture.

Table 6

Nr. crt.	Crop	Area cultivated (ha)	Average production (kg/ha)	Total production (kg)	Cost (lei/kg)	Price (lei/kg)
1.	Wheat	177	3494	618438	0.655	0.7
2.	Spring barley	120.52	1671	201388.92	0.45	0.5
3.	Winter barley	100	1089	108900	0.645	0.7
4.	Sunflower	110	1420	156200	0.8	0,95

Expected economic results

Nr. crt.	Crop	Total production (kg)	Price (lei/kg)	Total revenue (lei)	Total expenditure (lei)	Profit (lei)	Rate of profit (%)
1.	Wheat	618438	0.7	432906,6	405076.89	27829,71	6,8
2.	Spring barley	201388.92	0.5	100694,4	90625	10069,0	11,1
3.	Winter barley	108900	0.7	76230,0	70240.5	5989.5	8,53
4.	Sunflower	156200	0,95	148390,0	124960	23430,0	18,75

CONCLUSIONS

The presented analysis allows to make many important conclusions about the optimization of production structure:

- in Romanian agriculture there is a large diversity of crop varieties and animal species that canbe used;
- there is a wide range of farms of various physical and economic dimensions;
- production structure has practiced various forms (diversification, of wider or more narrow specialization)
- Giurgiu County is representative for its plain area where can be cultivated predominantly cereal grains and industrial crops;
- the design of production structure is not only a methodological support, but the applied extension model can be used for various combinations of crops, crops and livestock species, using, of course, specific indicators.

BIBLIOGRAPHY

1. Gheorghiţă, M. *Modelarea şi simularea proceselor economice*, Bucureşti, ASE, 2001.
2. Voicu, R.,Dobre, Iuliana *Organizarea şi strategiadezvoltării unităţilor agricole*, Bucureşti, Edituara ASE, 2003.
3. * * * Anuarul Statistic al României, 2007.
4. * * * Proiectul Realizarea unui sistemde elaborare a planurilor de afaceri, a studiilor de fezabilitate, a planurilor, a strategiilor şi a altor soluţii utile în procesul decizional din producţia vegetală, Plansectorial nr. 369/2006.

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