

**THE INCREASE OF PROFIT BY OPTIMIZING
THE PRODUCTION STRUCTURE OF LIMITED LIABILITY COMPANIES**

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Under the conditions of the market relations in the activity of the agricultural exploitations, the profit role is considerably increasing as a complicated economic category, the size of which depends not only on the results of the management year but also on the pace of further development of the enterprise. The aim of the research is to study the influence of the optimization of production structure on the profit increase. The problem of profit increase is studied by many scientists in scientific literature, including L. Zahiu, L. Kulikov, D. Parmacli, N. Volkova, etc., however its increase by optimizing the production structure of S.R.L. is not approached. We have tried to solve this problem using the mathematical modeling method, making up the economic-mathematical model, in which a unique calculation takes into account the multitude of factors that influence the production structure of agricultural exploitations. Several modifications of the mathematical models and especially of M. Braslavet and R. Kravchenko scientists were studied in this context, on the basis of which the model corresponding to the working conditions of the research object – S.R.L. „Regis-Agro” has been developed. According to the restrictions of the economic-mathematical model, the objective function and the input information there was formulated the concrete problem which was solved with the computer. Analyzing the obtained data, we can see that the optimal production structure will give the household the opportunity to increase the profit by 80.2% compared to the average of the years 2011-2016.

Keywords: size of profit, optimizing the production structure, production program, economic-mathematical modeling methods, current assets, structure of production, mathematical methods.

În condițiile relațiilor de piață în activitatea exploatațiilor agricole crește considerabil rolul profitului ca o categorie economică complicată, de mărimea căruia depind nu numai rezultatele anului de gestiune, dar și ritmul de dezvoltare a întreprinderii în continuare. Scopul cercetării constă în studierea influenței optimizării structurii de producție asupra majorării profitului. Problema sporirii profitului în literatura științifică este studiată de către mulți savanți, printre care: L. Zahiu, L. Kulikov, D. Parmacli, N. Volkova, însă majorarea acestuia prin optimizarea structurii de producție a S.R.L. nu este abordată. De aceea a fost întreprinsă o încercare de a soluționa o astfel de problemă, utilizând metoda modelării matematice, alcătuiind modelul economico-matematic, în care într-un calcul unic se ia în considerație multitudinea de factori ce influențează asupra structurii de producție a exploatațiilor agricole. În acest context, au fost studiate mai multe modificări ale modelelor matematice și îndeosebi ale savanților M. Braslaveț și R. Kravcenko, în baza cărora a fost elaborat modelul care corespunde condițiilor de funcționare a obiectului de cercetare – S.R.L. „Regis-Agro”. Conform restricțiilor modelului economico-matematic, a funcției obiectiv și a informației de intrare a fost formulată problema concretă și soluționată la calculator. Analizând datele obținute, am constatat că structura de producție optimă va permite gospodăriei să majoreze profitul cu 80,2% față de media anilor 2011-2016.

Cuvinte-cheie: mărimea profitului, optimizarea structurii de producție, program de producție, metode economico-matematice de modelare, active curente, structura producției, metode matematice.

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В условиях рыночной экономики в деятельности сельскохозяйственных предприятий значительно возрастает значение прибыли, как сложной экономической категории, от размера которой зависят не только результаты текущего года, но и темп дальнейшего развития предприятия. В научной литературе этот вопрос анализировался многими учёными, среди которых Л. Захиу, Л. Куликов, Д. Пармакли, Н. Волкова и другие, но увеличение названного показателя посредством оптимизации структуры производства Обществ с Ограниченной Ответственностью в аграрном секторе не изучено. Цель данного исследования состоит в изучении влияния оптимизации структуры производства на увеличение прибыли. На основе метода математического моделирования была разработана экономико-математическая модель, в которой в едином расчете учитывалось множество факторов, влияющих на структуру производства хозяйства. В этом контексте были изучены несколько модификаций математических моделей, в первую очередь, ученых М. Браславца и Р. Кравченко, на основе которых и составлена модель, соответствующая условиям объекта исследования – О.О.О. «Regis-Agro». В соответствии с ограничениями экономико-математической модели, функции-цели и входной информации была сформулирована конкретная задача и решена с помощью компьютерной программы. Полученные результаты показали, что оптимальная структура производства даст хозяйству возможность увеличить прибыль на 80,2% по сравнению со средним показателем за 2011-2016 гг.

***Ключевые слова:** размер прибыли, оптимизация структуры производства, производственная программа, методы экономико-математического моделирования, оборотные активы, структура производства, математические методы.*

JEL Classification: C02, D20, D39, E23.

UDC: 631.16:658.155

Introduction. The effectiveness of the enterprise's production, investment and financial activity are reflected in the financial results: income and profit from the sale of the output, profit tax, and net profit. As an economic category known from time to time, in the contemporary economic development, profit has received new content and as a market economy instrument – it ensures the interests of the state, the owners and the staff of the enterprise. For these reasons, currently one of the main issues is the appropriation of techniques by the managers and staff employed in the economy, of the contemporary methods of efficient management in the formation of profit in the process of operational, investment and financial activity.

Under the conditions of market relations in the activity of enterprises, the role of profit considerably increases as a complicated economic category. Its size and level of profitability depends not only on the results of the management year, but also on the pace of further development of the company.

The problem of increasing the profits of agricultural holdings has been studied by several students, among which we mention: M. Kulikov [11], L. Zahiu [8], V. Balanuta [3] and others.

Material and method

As the basis for calculating the profit to maximize the balance sheet items, the enterprise's production program is used, which can be achieved by optimizing the production branch structure.

A number of scientific research methods can be used to establish a more rational production structure, such as multiple variants, balance, index, planning, mathematical modeling, and so on [6].

From the methods listed, only the mathematical modeling method allows us to determine the optimal variant of the farm production structure, including the limited liability company in order to maximize profit. This method provides the compilation of the economic-mathematical model which takes into consideration many factors in a single calculation: the specialization, the rational use of the available production resources, the requirements of the recommended crop, the productive potential of the soil, the level of the demand for production on the market, sales outlets, managerial capacity, and so on. These factors influence the production structure.

The importance of this method speaks also of the fact that the use of mathematical modeling for solving economic problems in the CIS countries, as mentioned by many scholars, did not play a useful role in the methodological arsenal of the agrarian economy. While Western scholars, in the complexity of the economic mechanism of market relations, do not carry out any real research without using mathematical modeling, computer imitation experiments, and other information technologies. It is certain that the market itself is a model built on a system of hypotheses and operating rules.

The models of the economists-mathematicians M. Braslavet [9] and R. Kravchenko [10] have been used to elaborate the modification of the economic-mathematical model of optimization of the production structure, which will contribute to maximizing the profit size appropriate to the operating conditions of the research object.

We currently do not know an approach to the problem and we use the mathematical model to increase profits by optimizing the production structure of S.R.L. This model was used by the M. Lishansky and I. Maslova [12] scholars only for the argumentation of loan size of the agricultural holding, and in the publication of the D. Haruta, V. Calmac, R. Haruta [4] authors for the Republic of Moldova.

The economic-mathematical model in general form Goal-Objective-Maximize Profit:

$$Z_{\max} = \sum_{j \in J} C_j X_j,$$

In the following restrictions:

1) The use of agricultural land:

$$\sum_{j \in J} X_j = S \pm X'_j$$

2) observance of the requirements of the crop for the minimal-maximum share of the surface of some crops or groups of crops in the arable land:

$$\alpha_j^{\min} S \leq \sum_{j \in J} X_j \leq \alpha_j^{\max} S;$$

3) compliance with the crop rotation requirements in accordance with the scheme:

$$\sum_{j \in J} v_{ij} x_j = \sum_{j \in J} v'_{ij} x'_j, (i \in I_1);$$

4) according to rational use of production resources:

$$\sum_{j \in J} a_{ij} x_j \leq b_i, (i \in I_2);$$

5) according to the required feed volume for livestock sector:

$$\sum_{j \in J} a_{hj} x_j + D_h \geq b_h, (h \in H);$$

6) according to the contracts with the economic agents for the main types of vegetable products:

$$W_{pj} x_j \geq Q_p, (p \in P);$$

7) the equation of balance for determining some economic indicators:

$$\sum_{j \in J} a_{ij} x_j = x_i, (i \in I_5);$$

8) variables cannot get negative values:

$$x_j \geq 0, (j \in y); x'_j \geq 0; x_i \geq 0$$

In the mathematical model, the following conventional signs are accepted:

j – number of variables;

J – crowd, the elements of which indicate the number of types of activity;

J1 – crowd, the elements of which indicate the number of types of activity in plant culture;

i – number of restrictions;

I – crowd, the elements of which indicate the number of restrictions;

I1 – crowd, the elements of which indicate the number of restrictions related to limited production resources;

I2 – sets, the elements of which indicate the number of restrictions related to the min-max weight of the crop areas in the arable land;

I3 – crowd, the elements of which indicate the number of restrictions relating to the rotation of crops under cropping;

h – number of types of feed and nutrients;

H – crowd, the elements of which indicate the number of restrictions relating to the total forage and variety;

p – number of production-goods types;

P – crowd, the elements of which indicate the number of restrictions related to the modes of production-commodity;

- seeded (planted) surface of culture (type of activity) – j;
- amount of humus required to maintain its positive balance in soil;
- value of the indicator which is determined (as needed) in the process of solving the problem;
- size of agricultural land, arable;
- value of production in the calculation of 1 hectare of the crop j, 1 ha of the variety j, the same to an animal head of the j type;
- limited reserve production resource of the kind – i;
- resource consumption norm of the kind – i calculated in a unit of measure of the variable – j;
- min-max share of the crop area j in the arable land;
- logical coefficients linking the crops, so that one of them is the precursor r of another according to the agrotechnical condition;
- amount of investments;
- investment rule calculated in a unit of measure of the variable – j;
- fertilizer incorporation rule for 1 ha;
- norm for obtaining the fertilizer from 1 animal head;
- removing (mineralizing) the humus from the respective crop;
- removing humus from the soil washing process;
- B – total amount of organic fertilizers in recalculation to humus, tons;
- yield of type-h forage from 1 ha of culture j;
- amount of forage – h forage on pasture, siphon;
- consumption of fodder by – h by 1 animal head – j;
- production plan of the kind – p;
- productivity of the type – p production in the calculation of a unit of measure of the variable j;
- value of the type indicator is calculated as a unit of measure of the variable – j.

The mathematical model was approved based on L.L.C. "Regis-Agro" data, Falesti district. The nominated agricultural holding deals with the production, supply and marketing of wheat, maize, sunflower and sugar beet. In the structure of the sales revenues of L.L.C. "Regis-Agro" in the years 2013-2015 a considerable share of the production of cereals (43.3%), of sunflower (31.1%) and sugar beet (29.9%) can be found.

The utilization rate of the factors of production contributes to the development of the enterprise's activity and to the size of the financial results [6, p.19-20].

After analyzing the data in Table 1, we observe that the size of the indicators of the economic and financial activity in dynamics records considerable fluctuations during the analyzed period. The gross profit within the enterprise in 2015 compared to 2013 and 2014 increased by ROL 483.75 and 142.2 thousand, respectively and the profit before tax and net profit increased in 2015 compared to 2013, and diminished compared to 2014.

Further, we will continue to analyze the financial results of L.L.C. „Regis-Agro” for the period 2013-2015 in the analytical table 1.

Table 1
The analysis of Financial Results and Profitability at L.L.C. „Regis-Agro”, Falesti district

Indicator	Year			Deviation (+; -) of 2015 towards:	
	2013	2014	2015	2013	2014
A	1	2	3	4	5
1. Gross profits, thousands of lei	883,18	1224,73	1366,93	+483,75	+142,2
2. Profit (loss) to tax, thousands of lei	975,02	1128,64	1024,07	+49,05	-104,57
3. Net Profit, thousands of lei	894,63	1014,99	934,21	+39,58	-80,78
4. Profitability of means of production, %	26,81	21,89	20,53	-6,28	-1,36
5. Profitability of agricultural production, %	40,86	59,06	53,4	+12,54	-5,66
6. Economic profitability, %	29,05	24,44	20,41	-8,64	-4,03
7. Financial profitability, %	34,78	27,37	19,95	-14,83	-7,42

Source: Developed by authors based on data from S.R.L.

The profitability of the means of production in 2015 compared to 2013 and 2014 decreased by 6.28 and 1.36 percentage points, respectively. We mention that the profitability of agricultural production in 2015 compared to 2013 increased by 12.54 percentage points, but declined by 5.6 percentage points compared to 2014. The economic profitability, which characterizes the amount of profit tax per leu of the enterprise's assets, decreased in 2015 compared to 2013 and 2014 by 8.64 and 4.03 percentage points, respectively. Financial profitability which reflects the efficiency of using the enterprise's own resources in 2015 decreased compared to 2013 and 2014, corresponding to 14.83 and 7.42 percentage points, respectively.

We note that the economic and financial activity of L.L.C. "Regis-Agro" in the analyzed years are positively appreciated, as gross profit is somewhat rising and economic and financial profitability tends to diminish.

Therefore, in order to highlight the untapped reserves and improve the economic and financial situation, it is important to optimize the production structure of the household based on the economic-mathematical modeling to maximize the size of profit.

Formulation of the economic-mathematical problem and solving it on a computer, based on data from L.L.C. "Regis-Agro", was prepared the following information:

- 1) The area of arable land, ha;
- 2) Production resources available;
- 3) Enumeration of all crops (genres of activity) cultivated in L.L.C. according to pedo climatic conditions and cropping requirements recommended by a group of scholars (coordinating Professor V. Vronskih) from the Research Institute of Field Crops in Balti [1] with the following varieties:
 - Corn for silo and green mass
 - Lucerne;
 - Lucerne;
 - Lucerne;
 - Autumn wheat;
 - Sugar beet;
 - Corn for grains;
 - Peas for grains;
 - Autumn wheat;
 - Sugar beet + sunflower;
 - Corn for grain + corn for silo and green mass.
- 4) production plan of the main types of products needed to fulfill contracts with economic agents and to meet the requirements of the employees of the enterprise;
- 5) planned harvest of crops;
- 6) Consumption of production resources per 1 ha for each crop (type of activity);
- 7) selling price and cost of one quintal of production, calculated profit per hectare of each agricultural crop, various normative materials [7].

Based on the above, the economic-mathematical problem is formulated as follows: "It is necessary to determine the optimal variant of the production structure of L.L.C. "Regis-Agro" that will maximize profit by rationally using arable land, available production resources, respecting the conditions of the recommended harvest, ensuring the production of the main types of products to fulfill the contracts with the economic agents".

The system of variables of the problem includes a number of 21 (which means the crop area, ha) over which 27 restrictions have been overlapped.

The problem was solved on the computer according to the "Programmer Linear" program of the QM application package.

Results and discussions

After analyzing the obtained results, we find that the production resources existing in L.L.C. "Regis-Agro" are sufficient to carry out the production process according to the optimal plan of the production structure that allows us to obtain maximum profit in amount of 1925, 2 thousand lei, with financial resources in the amount of 2881,5 thousand lei, which is 27.2% higher than the average for 2013-2016 (Table 3).

The optimal production structure of the mathematical model, which, apart from other conditions, also took into account the requirements of the recommended crop, provides for some changes in the sown areas of agricultural crops (Table 2).

Table 2

Comparative structure of sown areas under agricultural crops in L.L.C. "Regis-Agro", Falesti district

Types of agricultural crops	Average of years 2013-2016		Optima plan for 2018	
	ha	%	ha	%
Autumn wheat	126	32,1	105	26,8
Spring barley	14	3,6	11	2,8
Soy	10	2,5	-	-
Rape	10	2,5	-	-
Corn for grains	85	21,7	71	18,1
Maize for silo and green mass	-	-	9	2,3
Peas for grains	-	-	63	16
Sunflower	112	28,7	27	6,9
Sugar beet	30	7,6	65	16,6
Lucerne	5	1,3	41	10,5
Total	392	100	392	100

Source: Authorized by the authors of the optimal plan, based on the data of the specialized forms and financial reports of the S.R.L.

Thus we observe that in the structure of the sown areas, on the average years 2013-2016, where only 6 crops were cultivated, the technical cultures (sugar beet and sunflower – 36.2%) are considerably bigger, which is in contradiction to the observation of the rotation seed crops, and autumn wheat sowings are not provided with good precursors (alfalfa, peas, corn for silage and green mass). These drawbacks in the crop rotation are to some extent corrected in the structure of the sown areas of the crops according to the optimal plan for the year 2018.

The recommended areas of agricultural crops will allow L.L.C. "Regis-Agro" to produce and market the following types of products:

- grains – wheat 4305;
- grains – barley 396;
- grains – corn 4970;
- peas – 1764;
- sunflower seed – 702;
- Sugar beet roots – 42250.

The harvest of corn and green mass, Lucerne, as well as grain waste and sugar beet leaves from surfaces will be used for individual livestock.

Table 3

Determination of economic efficiency of the optimal production plan of L.L.C. "Regis-Agro" compared to the average for the years 2011-2016

Indicator	Average data over the years 2011-2016	Data according to the optimal plan for the year 2018	Optimal plan data (%) vs. year average 2013-2016
1. sales revenue, thousands lei	3115,6	4806,7	154,3
2. The cost of sales, thousands lei	2047,4	2881,5	140,7
3. Profit, thousands lei	1068,2	1925,2	180,2
4. Revenue of sales, lei			
in consideration of:	7948,0	12262,0	154,3
-1 ha agricultural land	346178,0	534078	154,3
-1 average scriptic worker	1,52	1,67	109,9
-1 leu of the cost of sales	1,38	2,03	147,1
-1 leu fixed assets			
5. Profit, lei calculated for:	2725,0	4911,2	180,2
-1 ha agricultural land	118688,9	213911	180,2
-1 average scriptic worker	0,52	0,67	128,8
-1 leu of the cost of sales	0,46	0,81	176,1
-1 leu fixed assets	52,17	66,8	+14,63 p.p.

Source: Authorized by the authors of the optimal plan, based on the data in the specialized forms and financial reports of the S.R.L.

We should also mention that maximizing profit by optimizing the production structure will deepen the specialization of S.R.L. "Regis-Agro" in the production of sugar beet to some extent because it is located in the North Region where agricultural holdings are specialized in producing this crop as well as the grain.

The optimal production structure, along with profit maximization, will allow L.L.C. "Regis-Agro" to increase economic efficiency according to the indicators presented in Table 3.

Analyzing the data in Table 3, we note that according to the optimal plan for 2018 the household will have the possibility to increase the sales revenues by 54.3%, the profit by 80.2% compared to the average of the years 2011-2016, and the profitability level will reach 66.8%, which is 14.63 percentage points higher than de facto one. The profit growth rate in 2014-2016 compared to the average of 2011-2013 was circa 67%.

Therefore, finally, we find that optimizing the production structure of L.L.C. "Regis-Agro" has helped to maximize the profits.

Conclusions

1. Currently, in order to maximize the profit by optimizing the production structure of L.L.C. "Regis-Agro" and agricultural holdings, in general, it is rational to use the mathematical modeling method, building the economic-mathematical model, or solving the problem with the computer.

2. It would be beneficial for L.L.C. "Regis-Agro" to deal in perspective with the cultivation of several agricultural crops, focusing on the crop rotation recommended by the scientists for the conditions of household operation, which will allow to improve the fertility of the soil, obtaining higher yields and quality.

3. Computer calculations based on L.L.C. "Regis-Agro" shows us that organizing the production process according to the optimal production structure will allow the nominee farm to increase economic efficiency.

4. For a more remote perspective, it would be beneficial to make profit maximization calculations based on more extensive, real and qualitative information, possibly automated.

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Recommended for publication: 15.11.2017