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Modeling Specialization and Combination of Agriculture Branches.

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ABSTRACT

The rational specialization of agriculture is a complex task of agro-economic. One of promising approaches to solve this problem is a method of block problems solve, which allows gettingoptimal plan, taking into account various factors. For the communication unit, as a rule, need information that allows us to solve the problem as a whole and helps to establish the most appropriate allocation of capital investment in agricultural production in zones (farms, districts, etc.), thereby determining the specialization of each zone. As such information may be used guaranteed volumes of main kinds of commodity products, as implemented in the framework of the objectives of this study, as the total amount of investments, amounts of scarce resources (fertilizers, etc.) as a whole on the planned site.

Keywords: agriculture, model optimal combination of industry, two-level optimization, area specialization

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INTRODUCTION

The community of productive resources in agriculture is a close relationship between all its branches, which is also have reflected in the fact that the development of one industry affects other. There are many options for using each resource. Furthermore, for agriculture characterized interchangeability certain types of products.

Plans specialization of agricultural production has as its ultimate goal of a scientific substantiation of the rational development of agricultural production options for a specific term, the definition of specialization in objects commercial potential settlement of all types of agricultural products, etc [8].

Economic-mathematical problems of optimal combination of industry expertise and is to determine the production structure of the economy. In other words, it must determine the optimum size of the areas of crops, livestock individual species and groups of animals, etc. In addition to quantifying the size of the area, the problem of the right combination of industry covers the seasonality of agricultural production.

Model optimal combination of industry expertise and should reflect the optimal ratio between the cost of resources and the results of production, a balance between production and use of resources to ensure the rational use of available production resources [3, 6, 9].

With the transformation of a centrally planned economy into a market affected by natural disaggregation of the agricultural enterprises (collective and state farms), and the emergence of a small-scale farms, for which the problem of optimal specialization no longer play a significant role.

In the Stavropol region are numerous medium-sized and large enterprises in a variety of state unitary enterprises and municipal unitary enterprises (state unitary and municipal unitary enterprises), for which the optimal specialization is urgently needed. However, their limited financial resources, low level of information, an acute shortage of specialists do not allow farmers to deal with problems of optimization of the production in all its spheres, including intra-industry specialization to optimize agricultural production.

MATERIAL AND METHODS

The purpose of this study is to develop a model of optimization tools, including models for individual enterprises and block model for their set. Models are have made up on the example of the agricultural enterprises of Stavropol Territory, specializing in the production of grapes, combined with the production of other agricultural products (milk, grain and meat, etc.).

One of the first steps in the development of a mathematical model is to determine the list of the required performance and the introduction of symbolic notation for them.

For the task of optimal specialization following notation:

x_j– the desired value of the j-th variable, meaning economic sector or type of activity;
x_i– the desired value of the i-th variable, meaning Estimate (unknown amounts of resources, material and financial costs, and commodity gross output and other totals);
c_i– assessment of the i-th variable corresponding optimality criterion adopted;
a_{ij}– input coefficients i-th type of resources based on the j-th unit of a variable;
a'_y–output coefficients i-th type of resources or products based on the j-th unit of a variable;
b_i– level of cash resources for the year as a whole;
q_{ij}– rate yield of marketable productsi-type per unit of j-th variable;
Q_i– the minimum volume of production of i-type, the production of which must will be guaranteed for any solution of the problem;
p_{ij}– ratio, which means the share of the i-th crop in total sown area;
N –number of variables, meaning all sectors of the economy:
N_1– crop industry;
N_2– the livestock industry;
M –band limits:

M_1– for the use of production resources in the economy;
M_2– the production and use of feed;
M_3– for the production of guaranteed products;
M_4– for the calculation of the total production indicators (gross and marketable products, profits, etc.);
M_5– the ratio of crops.

After determining, the list of variables should identify the list of conditions, restrictions. In the classical formulation of the problem of optimization of intra-industry specialization [3, 6, 7] need to find the values of xj, in which the extremes objective function $F = \sum_{jiN} c_j x_j \rightarrow \max(\min)$by the following restrictions:

1) on the use of productive resources in the economy

$$\sum_{jiN} a_j x_j \leq b_i (i \in M_1);$$

2) the production and use of feed

$$\sum_{jiN2} a_j x_j \leq \sum_{jiN3} a_j x_j (i \in M_2);$$

3) for the production of marketable products of guaranteed volume

$$\sum_{jiN2} a_j x_j \geq Q_1 (i \in M_3);$$

4) calculation of the total production figures

$$\sum_{jiN2} a_j x_j = x_i (i \in M_4);$$

5) to comply with the ratios in the sown area of agricultural crops

$$p_{ij} \sum_{jiN2} x_j \leq \text{or} \geq x_i (i \in M_5);$$

6) non-negativity of the variables included in the problem

$$x_i \geq 0;\ x_j \geq 0$$

As constraints in the developed model adopted agricultural land, livestock, the volume of production, the output rate of the production of 1 head of cattle and 1 ha of agricultural land, as well as the value of a number of major economic indicators on the unit.

The dimension of the block optimization model is 49×78.

Is required to determine a production plan {x_1, x_2, ..., x_{12}}, {x_{13}, x_{14}, ..., x_{24}}, {x_{25}, x_{26}, ..., x_{36}}, {x_{37}, x_{38}, ..., x_{49}}, at which the optimal value objective function.

With the help of the common variables can impose restrictions to comply with the ratios in the crop area farms. In this problem, the restriction imposed on the vineyard area, namely the area of vineyards should be at least 60% of the total cultivated area. Of-limit conditions are mathematical notation is as follows:

$$x_{37} - 0{,}6x_{49} \leq 0,$$

where x_{49}–the total sown area all of three farms; x_{37}–the total vineyard area.

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RESULTS AND DISCUSSION

In addition, the common variables make it possible to set the guaranteed volumes of production of certain types of agricultural products within the area, and thus determine the optimal specialization of each farm.

Detail working matrix for solving the problem is have shown in table 1.

Table 1: Detail of the augmented matrix block model for optimizing agricultural production in farms of Stavropol Territory

Name	№	Chapaevsk			Russia			Kazminsky			General variables		
		x_1	…	x_{12}	x_{13}	…	x_{24}	x_{25}	…	x_{36}	x_{37}	…	x_{49}
Chapaevsk	1	1	…										
	…	…	…	…									
	9	22	…										
	…	…	…	…									
	20		…										
Russia	21				1	…							
	…				…	…	…						
	31				24	…							
	…				…	…	…						
	40					…							
Kazminsky	41							1	…				
	…							…	…	…			
	50							24	…				
	…							…	…	…			
	60								…				
General limit at ion conditions	61	1	…		1	…		1	…		–1	…	
	…	…	…	…	…	…	…	…	…	…	…	…	…
	70		…			…			…		1	…	–0,6
		…	…	…	…	…	…	…	…	…	…	…	…
	78											1	

The volume of agricultural products actually on the best options, calculated for each sector separately (Option 1) on the optimal solution triblock problem (2nd and 3rd options) are shown in table 2.

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Table 2: Volume of agricultural production in farms Stavropol Territory and in fact the best option, calculated using a block model

		fact	1-option	2-option	3-option
Crops	Chapaevsk	2665	2001	2640	2640
	Russia	1734	1728	1633	1608
	Kazminsky	2830	2760	2789	2760
Grapes	Chapaevsk	8961	9360	8580	8970
	Russia	8000	7900	7706	7980
	Kazminsky	51230	51303	51289	51095
Meat	Chapaevsk	51	66	101	96
	Russia	39	25	0	0
	Kazminsky	54	50	0	0
Milk	Chapaevsk	646	641	614	618
	Russia	256	212	283	281
	Kazminsky	306	262	0	0

Notes: 1st option - optimal solutions obtained by model of each company; 2nd option - on a single block model (optimality criterion - the total cost of production); 3rd option - on a single block model (optimality criterion - commercial products).

According to the optimal plan table. 2, obtained by a single block the problem as in the case of minimizing the total cost of production, and in the case of maximization of commercial products, Chapaevsk is the only one among the considered farms, which keeps the production of meat, along with other types of agricultural products. Russia should develop crop production, and this sector is one of the largest grape producers in the country. Kazminsky according to the second and third options should made grapes, cereals and milk.

CONCLUSION

Thus, the transition from the administrative methods of management to economic methods actualized the problem of determining the specialization of the municipality, that is, to identify competitive opportunities and resources of agricultural production, the largest share in the total volume produced in the area of production.

The developed block model of specialization enables the unification of geographically adjacent agricultural organizations with a uniform view of production based on the coincidence of economic interests, helping the most profitable use of land funds, labor, establish a rational combination of branches, etc. This problem is urgent for the Republic of Dagestan, as in recent years it has highlighted the need for the creation of agro-industrial groups and associations of various types, which reduces the risk of investors in connection with the strengthening of competitiveness and the situation on the commodity markets.

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