Asia Pacific Journal of Research in Business Management
Vol. 9, Issue 6, June 2018 Impact Factor: 5.16, ISSN: (2229-4104)
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ECONOMIC-MATHEMATICAL MODELING OF OPTIMIZATION PRODUCTION OF AGRICULTURAL PRODUCTION

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ABSTRACT

This article proposes a unified economic and mathematical model designed to form the optimal production program, the sectoral structure and the use of the region's resource potential, followed by the development of appropriate normative indicators. The most important feature of such a model is the consideration of the global requirement for planning agricultural production, reflected in federal and regional programs for the development of agricultural production - preservation of soil fertility. At the same time, one of the main requirements for the optimal use of the non-renewable and basic element of the resource potential in agriculture is the consideration of agro ecological user heterogeneity of lands. This requirement determines the overall layout of the economic-mathematical model of this optimization task, which has a block structure, where the number of blocks corresponds to the selected user groups of arable land. To carry out computer calculations on a specific economy based on the economic-mathematical model, it is necessary to first form arrays of technical and economic coefficients and the amount of constraints that represent conditional variables, that is, data specific for each enterprise and (or) the planning period.

KEY WORDS: economic-mathematical model, optimal planning, agrarian production, region, agricultural production planning, agricultural production location, resource potential, resource potential

INTRODUCTION

Agriculture plays an important role in the Uzbekistan economy, providing 37% of GDP and about 55% of employment.

According to the Ministry of Agriculture of the Republic of Uzbekistan, about 600,000 tons of vegetables or 4 kg per capita per year are currently produced in the agricultural production of protected soil.

To ensure, according to the medical norm (15 kg per person per year), the country's agrarians need to produce annually about 1.7 million tons.

To increase the production of greenhouse vegetables and increase the competitiveness of greenhouse vegetable production, within the framework of the State Program for 2016-2020, a partial (up to 20%) cost recovery for energy resources is envisaged, which will ensure an increase in the profitability of vegetable production of the closed soil.

At the same time the gross harvest of vegetables in 2018 should reach 720 thousand tons, and in 2020 - 1720 thousand tons [5].

In recent years, the volume of agricultural production has increased more than twofold. This allowed increasing per capita consumption of meat by 1.3 times, milk - more than 2 times, fruits - almost 4 times.

Scientific works of scientists are devoted to scientific research of theoretical and methodological aspects of the problem of sustainable development of agriculture and the market of vegetable growing of protected soil. Zuev, U. Umurzakov, A. Kadirov, V.P.Zvolinsky, M. Lee, A.S. Ermakova, L.P. Silayeva and others.

OBJECT

The purpose of the study is to substantiate the theoretical and methodological provisions and develop practical recommendations for improving the organizational and economic mechanism for the development of greenhouse organizations.

METHODS

The methodology of the organizational and economic mechanism for the sustainable development of the vegetable market for protected soil is based on a complex and systematic approach. The integrated approach takes into account a combination of market factors that influence the management of sustainable development of the vegetable market for protected soil. The application of the systemic approach as a general methodological basis for the objective reflection of the systemic properties of the functioning of the subjects of the vegetable market for protected soil considers a set of interrelated elements, taking into account the characteristics of agriculture, the variability of external and internal factors, the level of state support in order to meet the social needs produced by enterprises in conditions constant changes in the elements of the market environment.

The inconstancy of the external environment, the limited resources, the existence of highly profitable and unprofitable production in greenhouse farms located in the same natural and economic conditions, does not allow us to determine the single most effective methodological approach.

The general theoretical and methodological basis of the research is the work of national and foreign scientists and economists on the problems of the development of the agro-industrial complex and agriculture, in particular, the market for oak-sheltered protective soil; analysis of intra-industry competition and increasing the competitiveness of enterprises in the current economic conditions.

In the process of using the methods used in economic science: general scientific (dialectical, analysis and synthesis, comparisons and analogies, tabular, graphical); special (system, comparative analysis, statistical-economic, economic-mathematical, experimental-experimental, mathematical modeling).

Information base of the research is made up of official state statistics; normative legal acts of federal and regional levels; data of the Ministry of Agriculture of the Republic of Uzbekistan; reference materials of specialized publications on the topic; materials received from participants of the vegetable market of protected soil, own research; Internet data (industry portals, sites of producers of protected ground products, articles and reviews).

RESULTS AND DISCUSSION

Drawing up forecasts of the development of production is an actual task at the local, regional, federal levels, for individual organizations. Due to a number of micro- and macroeconomic reasons, it is rather difficult to do this at the present stage of economic reforms. Currently, there are no universally recognized methods that allow predicting the development of production in organizations for the future with satisfactory reliability. It should also be noted that strengthening the economic freedom of participants in the reproduction process at the regional level causes a probabilistic image of the economic processes taking place in different sectors and forces us to apply the scenario approach and multivariate alternative ways of finding solutions.

To solve this problem, it is proposed to use methods of economic-mathematical modeling and multidimensional statistical analysis - one of the main tools for progressing the economic mechanism, structural transformation of the regional market and forecasting the dynamics of production and sales of products. Changes occurring in the modern economy lead to the compilation of new and improved systems of economic and mathematical modeling. All this allows us to identify hidden reserves of economic growth of organizations at the regional level.

A variety of economic and mathematical models is the optimization model. Its use allows you to analyze the dynamics of the development of organizations in the region and take advantage of large amounts of real information.

This article proposes a model for optimizing the production of agricultural products, which will allow the enterprise to increase the profitability of its production based on a number of limitations (which corresponds to a certain use of production resources) [1].

At the moment, the financial and economic condition of agricultural organizations of various formations remains rather complicated. The following factors have a negative impact on the financial and economic state of agricultural organizations:

- Increase in physical and moral depreciation of fixed production assets;
- A decrease in the yield of agricultural crops as a sad consequence of the reduction of mineral fertilizers due to lack of money;
- A fall in the volume of production of the agricultural organization and the sale of its various products;
- Low volumes of investment in industrial and social infrastructure;
- Inadequate supply of specialists and lack of skill in the production workers involved;
- Reduction of technical equipment of agricultural producers [9].

The final goal of creating the model is to create effective prerequisites for intensive development of agricultural production and obtain the greatest profit, which is an important indicator of the effectiveness of financial and economic activity. This is ensured by rational use of possible production resources and contributes to increasing the profitability of economic activities of agricultural organizations in modern conditions. [8].

Stages of development of the economic-mathematical model for optimization of production

It is supposed to divide the input information into the following groups:

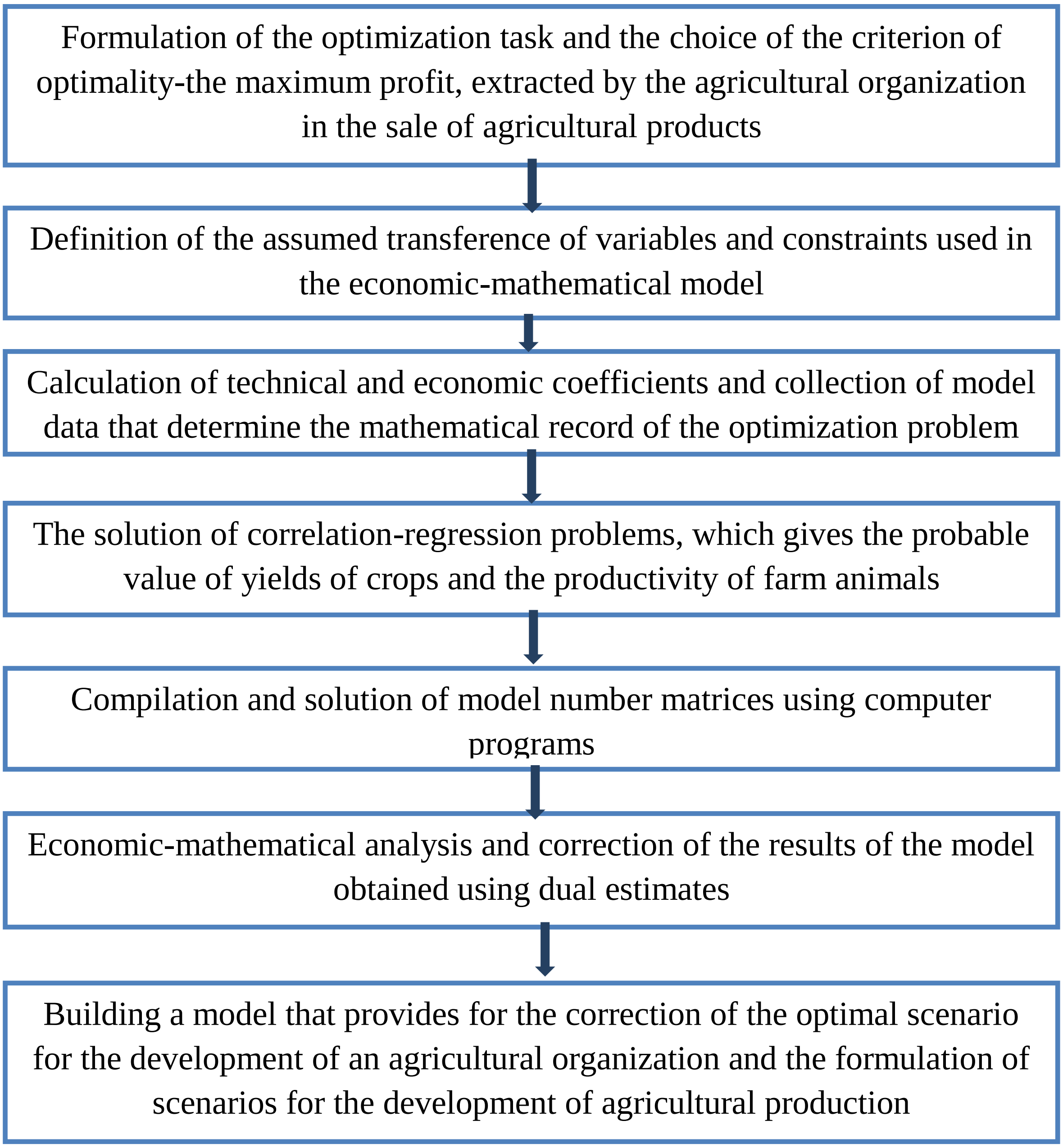
1. costs (labor, for the formation of an insurance fund, forage, for material costs per unit of Production agricultural output produced).

2. The results of the variables (yield data of agricultural crops and productivity of animals - yield levels of commodity and gross production, feed units and protein).

3. Land resources, volumes in accordance with the production, use and sale of agricultural products.

The developed optimization models allow minimizing the lack of resources available in agricultural organizations, mainly through the rational use of labor, land, financial, technical and other n-resources, fertilizers and feed. The task is achieved through the criterion of optimization of the analyzed system [10].

The solution of the developed economic-mathematical model is carried out in several stages (figure).



The maximum profit, obtained through the sale of agricultural products, is the criterion of optimization. It is the objective function. This preference is justified by the fact that profit is one of the significant indicators of financial and economic efficiency of agricultural organizations.

This allows us to ensure the optimal use of existing production n-resources and increase the profitability of the agricultural organization in modern conditions.

Dedicated criterion of optimization - the maximum profit for the full planned period of long-term development of agricultural organizations - in accordance with its content is fully consistent with the solution of this optimization task.

The study of the model on the set of other variants of the development of agricultural production appearing in the process of solving allows us to study and find the best option in accordance with the agreed optimization criterion. The selected criterion, according to the established task, meets the requirement to ensure the fulfillment of obligations for the supply of products in accordance with contracts and in public funds. Thus, the circle of interests and the customer of the product, and its producers are taken into account [3].

When building an optimization model, it is necessary to take into account the following main variables: livestock by species, area of fodder land, crop area of agricultural crops. In addition to the main ones, auxiliary variables are included in the model, which reflect the quantities of production and sales of the crop and livestock sectors sold the optimal organization of animal feed rations, and the volumes of production and consumption of fodder [5].

The model also introduces restrictions:

- Guaranteed production of the main types of commodity products for state funds and mandatory implementation in accordance with contracts for the supply of agricultural products;
- Size of land resources, livestock;
- Production and use of feed;
- Production and sale of agricultural products;
- Financial resources.

Within the existing boundaries of the region of research, changes are made in the basic parameters of the models compiled, which in turn are based on the actual size of the crop and livestock sectors.

In models, the number of unknowns and constraints is determined during the preparation of the matrix, which takes into account the specific characteristics of the farms. In determining the variables, it is also necessary to take into account the production use of agricultural products received by organizations of the region, the content of farm animals and the agro technical and zoo technical features of cultivation of individual crops [7].

The use of multifactor correlation-regression analysis for calculation of the order of model coefficients is carried out according to several production functions in order to select the best predicted probable levels of crop yields and productivity of animals with extrapolation of the data of the dynamic series.

The proposed optimal balance in economic-mathematical models of feed production and consumption is calculated. The modeling of the forage base assumes that for each type of agricultural animal feed should be aggregated in accordance with the group of details of individual types of feed [4].

The compiled economic-mathematical models are statically significant. The optimization task of the structure of agricultural production for each organization of the region can be represented as follows:

Z = X – Y → max,

where Z is the objective function, expressed in the maximization of profit; X - a set of revenues from the sale of agricultural products; Y - the aggregate of production costs for products.

Based on the compilation of the model of the problem under solution in economic and mathematical modeling, it is proposed to use methods of mathematical formalization of the conditions and requirements required for the production of agricultural products.

When solving the problem and selecting the best option for the development and location of production, it is necessary to use the system of agricultural production restrictions, which includes limits from below and from above. This will ensure achievement of planned growth rates with the proper organization of agricultural products, not only in quantitative but also in qualitative technical and economic indicators [6].

The construction of the optimization task includes the following limitations:

1. On the use of forage and arable land:

$$\sum_{j\in J_n} d_{ij}x_j \le B_i, \quad i \in I_m,$$

where j is the sequence number of the variable (j = 1, 2, ..., n); i is the ordinal number of the constraints (i = 1, 2, ..., m); dij - costs of the i-th n-resource per unit of measurement of the j-th industry; xj - argument denoting the size of the j-th industry; Bi - limiting the size of agricultural land of the i-th species; Jn - a set of variables in accordance with crops and lands; Im is a set of restrictions in accordance with the use of arable land and forage land.

2. By the ratio of acreage and crops:

$$\sum_{j\in J_a} x_j \ge (=,\ge) \sum_{j\in J_b} w_{ij}x_j, \quad i \in I_b,$$

where wij is the component of proportionality between individual crops; Ja - a set of variables in accordance with the use of crops in crop rotations; Ib - a lot of restrictions in accordance with the rotation requirements.

3. By groups of feeds:

$$\sum_{j\in J_c} b_{ij}x_j \geq \sum_{j\in J_d} c_{ij}x_j, \quad i \in I_c,$$

where bij is the output of the i-th type of feed units in the calculation for the unit of measure of the j-th crop sector; cij - the need for the i-th species of one head of the j-th type of livestock in the group of feeds; Jc - a set of variables in accordance with fodder production; Jd - a set of variables in accordance with the livestock sector; Ic - a set of restrictions in accordance with the feed balance.

4. Production and use of agricultural products:

$$\sum_{j\in J_d} a_{ij}x_j \geq \sum_{j\in J_f} x_j, \quad i \in I_y,$$

where aij is the output of the i-th type product in the calculation for the j-th industry unit of measurement; Jd - a set of variables in accordance with types of livestock sectors; Jf - set of variables in accordance with the types of products sold; Iy - a lot of restrictions in accordance with production and using products.

5. On the guaranteed volume of production of agricultural products:

$$\sum_{j\in J_f} a_{ij}x_j \leq Q_i, \quad i \in I_z,$$

where Qi is the guaranteed volume of production; Iz - a lot of restrictions in accordance with the guaranteed production of products.

6. By definition of total revenue:

$$\sum_{j\in J_p} q_j x_j = X',$$

where qj - output of commodity output in monetary terms for a unit of the j-th industry;Jp - a set of variables in accordance with the summation of the proceeds from the sale of products.

7. By definition of production costs:

$$\sum_{j\in J_t} g_j x_j = X'',$$

where gj - the cost of material assets in monetary terms for a unit of the j-th industry; Jt - a set of variables in accordance with the summation of the cost of agricultural products.

7. Criterion of non-negativity of variables:

$x_j \geq 0$.

Any imposed restriction corresponds to the use of production resources, which in turn makes it possible to balance the number of n-resources with their availability in the agricultural organization.

The degree of development of production, n-resource potentials for each agricultural organization is determined by a set of variables. Units of measurement of variables in the model are not only natural indicators (hectares, centers), but also cost indicators.

Also, when constructing optimization models, it is necessary to take into account that all agricultural organizations functioning within the administrative boundaries have given soil and climatic conditions and, accordingly, equal economic circumstances should be determined for them. We also need to pay attention to the fact that when constructing production models for an individual agricultural organization, production alternatives are inherent with the same initial volume of resources involved.

As a result of the solution of the optimization problem, it is assumed that the crop yields, the productivity of the animals, and all the derivatives of economic indicators (labor productivity, production costs and the sale price of the products) are fully taken into account.

To focus on the highest possible level of efficiency in determining the prospects for the development of agricultural organizations, it is necessary to take into account the actual results and the production n-resources involved. Consequently, there is a disparity in model variants, which implies correction of crop yield levels and productivity of farm animals, cash costs and prices for agricultural products, taking into account the official level of inflation [1].

Also, as a result, the resulting optimization models allow finding the most optimal quantities of production of various types of agricultural products and their combination among themselves. For each agricultural organization in the process of performing the calculations, it is determined:

- Size and composition of agricultural production branches and their rational compliance in the total amount;
- Distribution, taking into accounts the requirements of crop rotation of the main agricultural crops;
- livestock number provided with full-value feeds and containment premises, volumes of feed production and its use, optimal rations in animal feeding;
- The size of production of the crop and livestock sectors and its implementation;
- The main performance indicators of financial and economic activity [2].

Establishing dual assessments for the production of agricultural products and for the use of productive resources is accompanied by the solution of the main task.

CONCLUSIONS

Thus, the construction of the models proposed in the study makes it possible to identify a variant that is optimal for combining the structures of agricultural production, and on this basis the volumes of production for agricultural organizations in the future. The implementation of the calculated optimal options in practice, as a result, will lead to a stable increase in profit, ensuring the profitable work of agricultural producers, which can be used to expand and develop production and meet social needs.

Practical implementation of the compiled models, in accordance with preliminary estimates, will allow reducing the costs of agricultural production and, accordingly, improving the financial result as an indicator of the successful conduct of economic and production activities by agricultural organizations.

Also, application of modeling results will help to highlight those priority perspectives of agricultural organizations that should be developed taking into account the existing climatic conditions, cultural and national traditions of the rural population and its production qualification.

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