Production potential in sunflower cultivation

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Abstract. Sunflower oilseed production is a profitable activity for agricultural enterprises. Volgograd region specific natural and climatic conditions for growing oilseeds and a developed material and technical base. The share of oilseeds in the production of crop products is about 20%. Comparable national and world prices for sunflower oilseeds, we will determine the competitiveness of oilseeds, applying the OECD methodology, that in the Volgograd region the equality coefficient is 0.62, which means that agricultural producers sell their products at lower prices than prices than traders in foreign food markets [3,6]. In the open market, the domestic producer will be non-competitive foreign [12]). One of the ways to increase the competitiveness of oilseeds produced in the region will be the rational use of production potential. Economy is studied in modern economic conditions by foreign and domestic agricultural scientists [1, 13]. It was determined that the results of the statistical analysis of the average yield of sunflower according to the data of 23 favourable crops. The model included the following production factors: capital supply, energy efficiency, tractor supply, labour productivity, soil score, which influence their competitiveness. It has been established that the most influential factors of the production factor are the soil and climatic conditions of the region, strategic (y controlled) factor - productivity, depending on the level of technological development of production.

1. Introduction

Oilseed production is the most important component of the country's food security and an important basis for a rational human diet. The production of oilseeds, in comparison with other commercial types of crop products, is the most effective due to the high sales prices of oilseeds and their products due to high demand in the consumer market. The Volgograd region has favorable natural and climatic conditions for the cultivation of oilseeds (sunflower, mustard) and a sufficiently developed material and technical base for their processing. The share of oilseeds in the production of crop products in the Volgograd region is about 20%. Various oilseeds are grown in the fields of the region: mustard, soybeans, flax, but the main oilseed crop is sunflower. In terms of gross harvests of sunflower, in the Southern Federal District the region ranks second after the Rostov region. Currently, more than 11% of the total Russian arable land area occupied by sunflower is concentrated in the region, and more than 24% - in the Southern Federal District. Sunflower is a profitable crop for Russian farmers, the profitability of which in favorable years is above 80% [11]. Vegetable oils are obtained from sunflower oilseeds, which are used for technical and food purposes. In 2018, a significant part of the vegetable oil produced in Russia was exported and amounted to 1.331.0 million tons, while 584.0 million tons were supplied to the domestic food markets [11]. Oils of tropical origin are also imported to domestic markets. The production of oilseeds in the Volgograd region has the same problems associated with the use of production potential [13], associated with depreciation of fixed assets and
underfunding. However, a continuous search is being undertaken for an innovative way of development, the use of production potential using new high-yielding varieties and hybrids [2], production management [10].

The question of the rational use of production potential is relevant in the world economy and is being studied in modern economic conditions. In studies on the rational use of production potential in agriculture and in the cultivation of oilseeds, attention is paid to the placement of crops [15] of sunflower in crops. And it is determined that in order to comply with the rational use of natural resources in the agricultural landscape it is necessary to place sunflower crops, observing the crop rotations recommended by science to prevent depletion of the humus layer in the soils, to reduce the phytopathogenic load on agricultural landscapes. Research has been carried out, where the production potential is considered - natural and climatic conditions [8]. The development of natural potential, namely, soils, is assessed not only by the sown areas, but also by its qualitative parameters, soil scores [5]. It was found that with the existing methods of using the potential, the profitability of production is 12.22%, instead of the possible 13.86% [8]. It is recommended to conduct research, including in the model not only the natural and climatic factor of production potential, but the factors associated with the structural elements of the resource potential, material, technical, labor and innovation potential, labor and innovation potential. The interaction of the listed components of the derivative potential in agricultural production work, producing products when they interact, being included in the economic and technological sphere, are transformed and directly take and participate in obtaining agricultural products, in our case, sunflower oilseeds.

The purpose of the article is to determine the main directions of increasing the efficiency of using production potential in obtaining a crop of sunflower oilseeds in the Volgograd region, which will have a beneficial effect on the level of competitiveness of oilseeds.

2. Materials and methods

The methodology of the analysis presented in this article is based on a systematic deductive approach to objects and the observance of the foundations of dialectical development. The material used in the article and the results obtained were analyzed using the design-constructive method. To identify the dependence of sunflower yield on strategic and objective factors of production, a study was carried out and the existing dependence was revealed. Correlation analysis was carried out on the basis of data from 23 districts of the Volgograd region, where sunflower was grown (using Statistica 7 and Microsoft Excel 7).

3. Results and Discussion

The strategic factors include the factors that depend on the availability of fixed assets, working capital, which is often associated with the provision of production and financial resources. When forming circulating funds (fuels and lubricants, chemical plant protection products, fertilizers, a set of seed material), it is necessary to plan the purchases of circulating assets that will be most effective. Seed material is more adapted to the soil and climatic conditions of the economy, plant protection products required according to the results of the epidemiological survey in the fields, fertilizers according to the results of analyzes for NPK, etc. For example, for the most effective treatment of sunflower seed against fusarium, white rot, it is possible to process seeds against diseases with tank mixtures of preparations that give an economic and economic effect of an increase in yield on average 0.09-0.14 t/ha, and their biological efficiency will be 28.4-76% [14], saving money - about 75%.

Objective (uncontrollable) factors can be attributed to natural and climatic: the arrival of precipitation, moisture content in the soil, temperature regime, soil fertility, etc. The presence of a strong relationship between the output of a unit of production (sunflower oilseeds) per 1 hectare of arable land from the following strategic factors was determined: capital availability (X1), material availability (X2), tractor availability (X3), labor productivity (X4), and the objective Factor – soil score (X5).

The multiple correlation coefficient is 0.799 (Table 1), which indicates that the relationship between the unit output and the factors of production embedded in the economic-mathematical model is strong enough and each factor is important for the production of oilseeds in the region.
Taking into account the obtained analysis results allows making management decisions when developing strategies for the development of oilseeds production and predicting their yield depending on the production factors incorporated into the model.

The resulting model (set of parameters):
\[
Y = 7.9548 - 16.456X1 + 1.1931X2 + 0.09365X3 - 0.03816X4 + 0.2985X5
\]

It characterizes the following connections:
- the regression coefficient \(X1\) (capital adequacy) indicates that with a decrease in capital provision per unit, the yield of oilseeds per hectare of arable land will decrease by 16.456 centers.
- the regression coefficient (material supply, \(X2\)) 1.1931 informs that with an increase in the material supply of farms per unit of material resources, the yield from oilseeds from 1 hectare of arable land increases by 1.1931 centers;
- the regression coefficient characterizing the tractor availability (\(X3\)) of work 0.09365 indicates that with an increase in tractor availability per unit, the yield of oilseeds per hectare will increase by 0.09365 centers;
- a decrease in labor productivity of man-hours by 1 center (\(X4\)) under the given production conditions will contribute to a drop in sunflower yield by 0.03816 centers;
- coefficient \(X5\), which characterizes the soil score (soil conditions) of oilseeds production in the region, shows that with an increase in soil fertility, the yield of oilseeds increases from 1 hectare to 0.2985 centers.

The coefficient of determination \(R^2 = 0.533\) shows that the yield of oilseeds by 53.3% depends on the studied set of factors.

The relationship between the yield of sunflower oilseeds and the factors included in the model is different:
- capital provision - in the model, the tightness of connection is average (0.3325), and \(R^2 = 0.1105\), indicating that the yield depends on the factor under consideration by 11.5%;
- material supply - in the model, the tightness of communication is moderate, the reverse is 0.4975, and \(R^2 = 0.2475\), that is, the yield depends on the power-to-weight ratio of production by 24.75%;
- tractor availability - in the model, the tightness of the connection is weak, reverse (-0.1813), and \(R^2 = 0.0329\), that is, the yield depends on the factor only by 3.29%;
- labor productivity - tightness of connection is strong 0.7619, and \(R^2 = 0.5805\), that is, the yield of sunflower oil seeds depends on labor productivity by 58.05%;
- cumulative soil score - the tightness of the connection is quite high (0.814), \(R^2 = 0.4567\), that is, the yield of sunflower depends on the soil conditions of its growth by 45.67%.

In the meaningful analysis of the regression model, we use the partial elasticity coefficients to characterize the average change of the attribute-result \(Y\) with an increase in the attribute-factor \(X\) by 1% from its average level with a fixed position of other factors of the model.

The resulting model, which includes the factors that determine the production of oilseeds in the region, shows a close relationship (0.7299) between the yield of a unit of production per 1 hectare of arable land. Strategic (controlled) factors indicate that their effective use will allow implementing the optimistic scenario of the industry production of sunflower oilseeds in the region, since the increase in labor productivity will result from the growth of the stock of commodity producers (equipping with modern highly productive and resource-saving machines, tools, highly productive seeds and hybrids of oilseeds). However, the most significant factors affecting the efficiency of oilseed production are the objective factor of production, namely, the soil and climatic conditions of the region, and the strategic (controllable) factor - labor productivity, which depends on the level of technological development of production.

Considering the production costs in 2018, we can say that in the short term, an increase in the yield of sunflower oilseeds by 1 center is possible due to an increase in production costs by 2.0686 thousand rubles. In the long term, an increase in crop yield can be achieved by increasing production costs by 2.2985 thousand rubles: 2.0686 / (1-0.1) = 2.2985 [4].
Table 1. The degree of influence of factor parameters on the results of sunflower oilseeds production in the Volgograd region (2015-2018)

| Factors of producing | Changing | The view of coherence | Coefficient of correlation |
|----------------------|----------|-----------------------|---------------------------|
| fund availability (X1) | X1 | $y = 0.8409 x_1 - 0.6743$ | 0.484 |
| material security (X2), | X2 | $y = 0.0255 x_2 + 0.9802$ | 0.29 |
| tractor supply (X3), | X3 | $y = 0.00613 x_3 + 0.256$ | 0.321 |
| labor productivity (X4), | X4 | $y = 1.5349 x_4 + 54.5194$ | 0.329 |
| soil score (X5) | X5 | $y = 0.1491 x_5 - 3.5677$ | 0.603 |
| set of parameters | | $Y = 7.9548 - 16.456 X_1 + 1.1931 X_2 + 0.09365 X_3 - 0.03816 X_4 + 0.2985 X_5$ | 0.7299 |

In the agricultural industry, the results of crop production are influenced by many factors that do not depend on humans and which a person can directly control. Equipping farms with high-performance equipment, the introduction of advanced technologies will increase labor productivity. Timely and high-quality carrying out and organization of repair of agricultural machines and tractors will contribute to reducing the load by 1 ha of arable land of tractors.

For the successful modernization of the competitive positions of domestic producers of oilseeds, the following ways of stabilizing product production can be proposed:
- increasing the level of intensity of production of oilseeds;
- rational organization of production and the use of working capital;
- optimization of the structure and size of sown areas through the use of more productive varieties and hybrids;
- the use of new energy-saving and economical ways to increase yields;
- strengthening the material and technical base of commodity producers;
- strict adherence to agro technical terms for all technological operations.

4. Conclusion

Thus, for sustainable and efficient production of oilseeds and increasing its competitiveness, it is necessary to increase labor productivity in the region, effectively use fixed and circulating production assets. Maintaining a stable position in food markets, oilseed enterprises need to include in the strategy for managing oilseeds production measures to strengthen their competitive position, which are based on high quality of oilseeds and cost, allowing ensuring a high level of profitability of production.

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