

Actual problems of mechanization of agriculture in the Smolensk region and directions for their solution in modern conditions

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Abstract. Due to a number of objective and subjective reasons, the technical potential of agriculture in the Smolensk region has significantly decreased. The problems affecting the development of this market have become especially acute against the backdrop of ongoing changes in the geopolitics of Russia and the world. The article presents an overview of the current problems of agricultural mechanization in the Smolensk region. In addition, possible directions of resource saving in modern conditions are considered in order to prevent further aggravation of the situation in the agricultural sector of the Smolensk region.

1 Introduction

At the moment, as a result of a strong decrease in the level of mechanization and the fleet of agricultural machines in the Smolensk region, the load on each unit of agricultural machinery has greatly increased. The lack of funding for agriculture in the Smolensk region does not allow farms to upgrade the current fleet of agricultural machinery. It also becomes a problem to timely replace faulty equipment, purchase spare parts in the required quantities, as well as fuel and lubricants. The agro-industrial complex of the Smolensk region is going through difficult times. There are a number of problems that require immediate intervention by the Government. To solve urgent problems of agricultural mechanization in the Smolensk region, dozens of new technical means should be used.

2 Materials and methods

The following methods were used as the methodological basis of the study: analytical, system analysis, methods of spatial GIS analysis, retrospective analysis, as well as methods for processing geodetic measurements and data obtained using unmanned technologies.

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3 Results

Having studied a number of statistical reports of the Smolensk Statistical Committee, we also received a number of important results.

From the beginning of 2020 to the present, the total area of agricultural land in the Smolensk region has increased by 0.4 thousand hectares and amounted to 4977.9 thousand hectares. [1].

The number of write-offs of agricultural machinery (forage harvesters, tractors, grain harvesters, potato harvesters, flax harvesters, trucks) significantly exceeded the level of purchases for the same period of time. The gap between these indicators ranges from 6% to 11.0%. Taking into account the actual wear and tear of the listed agricultural machinery, the level of mechanization in the Smolensk region is slightly more than 50%.

At the moment, as a result of a strong decrease in the level of mechanization and the fleet of agricultural machines in the Smolensk region, the load on each unit of agricultural machinery has greatly increased. So, for 1 physical tractor, the load increased from 42 to 53 hectares, that is, by 26%; for 1 combine harvester from 88 to 130 ha, i.e. by 45%; per 1 forage harvester from 170 to 200 ha, i.e. by 18%.

Thus, we come to the conclusion that at present, in view of the current situation, maintaining, restoring and developing the potential of agriculture in the Smolensk region is impossible without financial support from the state. At the same time, a regulatory and legal framework is already being prepared to support agriculture in the Smolensk region. In 2021 - 2022, a number of regulatory legal acts were issued aimed at developing agriculture in the Smolensk region, including supporting agricultural producers.

4 Discussion

One of the most important problems of agricultural mechanization in the Smolensk region is the low fertility of soils, which has a negative impact on crop yields.

In addition, an insufficient number of modern agricultural machinery and equipment, an insufficient number of qualified personnel in the field of agricultural mechanization, are making their own destabilizing contribution to the current situation.

An important direction in solving this problem is the introduction and development of new technologies for cultivating the land, such as mulching, applying organic fertilizers and planting new crops that improve soil fertility. It is also necessary to carry out work on the qualitative improvement of the soil, including through the use of mineral and organic fertilizers.

To increase the productivity of agricultural crops, it is necessary to increase the number of modern agricultural machinery and equipment. Regional and federal authorities can provide support in the form of subsidies to agricultural enterprises for the purchase of new and modern equipment.

Also, a priority task is to improve the skills of agricultural workers in the field of agricultural mechanization. To do this, it is necessary to create specialized training centers and refresher courses, pretraining, as well as organize internships and exchange of experience between leading specialists.

In general, solving the problems of the development of agricultural mechanization in the Smolensk region requires an integrated approach and joint efforts on the part of federal and regional authorities, agricultural enterprises, manufacturers of agricultural machinery and equipment, and educators.

To solve urgent problems of agricultural mechanization in the Smolensk region, dozens of new technical means developed in Russia should be used. So over the past 5 years, the state has been increasing the volume of its own mechanical engineering, including in

agriculture. The growth in the output of agricultural machinery in Russia will, to some extent, solve the problems that hinder the effective development of agriculture, including in the Smolensk region. Due to the Russian mechanical engineering, at least 50% of the required range of agricultural machinery in the Smolensk region can be formed [3]. First of all, these measures are aimed at solving problems associated with the level of mechanization of the main most energy-intensive processes.

The Smolensk region can solve the problems of resource saving in agriculture in the following recommended areas:

- Reduce the level of losses of agricultural products.
- Increase crop yields and animal productivity.
- To work on the rationalization of production structures.
- Conduct work on the development of resource-saving technologies; apply resource-saving technological processes and technical means.
- To raise the technical and operational levels of all means of mechanization.
- To carry out systematic organizational and technical resource-saving measures.

4.1 In particular

4.1.1 Reducing the level of losses of agricultural products

According to the estimates of researchers from the Belarusian Research Institute of Agriculture and Feed, the volume of annual grain losses during harvesting, processing and storage is more than 1.0 million tons [5]. These significant losses arise due to the incorrect application in practice of technologies for harvesting agricultural products (non-compliance with regulatory indicators, imperfection of the applied technologies and machine complexes). Losses are especially significant when harvesting high-moisture bread. In addition, about 30-40% of the grown potatoes are lost during their delivery to the final consumer. The main reasons leading to such losses are: an insufficient number of modern storage facilities for potatoes (especially in places where it is grown); damage to tubers during harvesting; natural losses from improper storage.

4.1.2 Increasing the level of crop yields and animal productivity

Studies by many agricultural research institutes in Russia and the CIS countries confirm that a 1% increase in crop yields leads to an increase in total energy costs. Thus, in relation to the cultivation and harvesting of grain crops and corn for silage, the total increase by 0.7%, respectively, for potatoes by 0.6%, sugar beet (forage root crops) and flax by 0.9%. Accordingly, the growth of crop yields and livestock productivity can be called one of the main directions in resource conservation.

4.1.3 Choice of rational production structures

Let us note the importance of determining the preliminary volume of consumed material and energy resources in the cultivation of certain agricultural crops. The development of this direction will significantly affect the performance of agricultural enterprises.

For example, the level of labor costs in the production and sale of agricultural products in the Smolensk region has the following structure (in descending order) [4]: potatoes - 28.4%; grain crops - 19.0%; annual and perennial grasses - 14.9%; natural hayfields - 14.0%; fodder root crops - 10.1%; corn for silage - 4.9%; sugar beet - 4.0%; other crops - 4.7%.

Thus, the largest production and labor costs in the Smolensk region fall on 3 agricultural categories - cereals, potatoes, and annual (perennial) grasses. In total, these three categories receive in the production segment - 80.7% of the total level of costs, respectively, in the segment of labor costs - 62.3%. Labor costs remain significant when working on natural hayfields and when growing fodder root crops.

It is necessary to reduce costs through the use of resource-saving technological processes and modern agricultural innovations.

4.1.4 Development of resource-saving technologies. Application of resource-saving technological processes and technical means

One of the most important areas in agriculture of the Russian Federation and the Smolensk region in particular can be called the development of resource-saving technologies. The following examples can be given as ways to apply resource-saving technologies:

- There is an opportunity to reduce the level of consumption of fodder grains by increasing the production of fodder crops with the inclusion of protein raw materials in their composition [6].
- Currently there are reserves to reduce the energy intensity of such a complex process as tillage from 40% to 20% [7].
- Increasing the economy of material and energy resources by increasing the share of universal and combined agricultural machines. At the same time, experts recommend using a modular approach when creating these agricultural machines [8].
- Development of tillage machines. In agriculture, there is a need to develop tillage machines with lower resistivity; introduction of technologies with minimum tillage capabilities.

4.1.5 Raising the technical and operational level of mechanization

With the improvement of the quality and reliability of agricultural machinery in the Russian Federation, significant reserves of material and energy resources appear.

4.1.6 Implementation of a system of organizational and technical resource-saving measures

An important role in saving resources is played by the improvement of both the standard size ranges of individual mechanization means and the structure of the machine and tractor fleet as a whole.

5 Conclusion

Solving the problems of self-sufficiency in the Smolensk region requires increasing the level of consumption of crop and livestock products. But at the moment, it is difficult for the region to meet the planned pace of increasing production due to the low level of mechanization of agriculture. Nevertheless, the Smolensk region can achieve high performance in this industry, subject to the large-scale involvement of energy and resource-saving technologies, as well as the modernization of all mechanization. At the same time, it is necessary to constantly increase the energy balance of the share of local energy carriers, secondary energy resources and renewable energy sources.

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