Development of innovative technologies in the agricultural industry

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Abstract. The article explores the development of engineering technologies. Problems of the agricultural sector which affect the improvement and development of the technological process were identified. It was emphasized that new technologies can reconstruct the structure of the agricultural industry and provide the population with agricultural products. The analysis of the economic activity of agricultural enterprises of the Russian Federation, new technologies and research programs for the development of the agricultural industry was conducted to summarize and describe the latest engineering technologies using special specialized equipment. Attention was paid to the development of energy and resource-saving technologies, which play a key role in processing, harvesting, and transporting crops and increasing yields and shelf life of foods. Scientific and practical recommendations for improving energy-resource-saving technologies in the agricultural industry were developed.

1 Introduction

The agricultural industry is one of the major intersectoral sectors. It encompasses diverse areas, including agriculture and agricultural production-related industries [1].

The agricultural industry is dependent on the quality and relevance of the production technologies. The implementation of innovative technologies is a key factor in the successful management of the economy and achievement of food independence of the country. It provides farmers with the possibility of producing competitive products [4].

Technologies such as energy and resource-saving solutions, technical re-equipment of the agricultural sectors play a crucial role. This approach implies the use of non-traditional ways of exploiting the national natural potential [6].

Currently, the domestic agricultural industry experiences numerous problems that prevent it from implementing new technologies: degenerated natural resources, the lack of funding, qualified specialists and a national development strategy for the innovation area [9].

Nevertheless, the reconstruction of the industry through engineering technologies aimed to provide the population with agricultural products can be promising. New technologies...
are being implemented within development programs for the agricultural industry; new production methods and forms are being identified to achieve results in land cultivation and management of natural resources [12].

2 Materials and methods

Currently, the latest technical developments can increase the productivity of agricultural enterprises due to the labor automation and treatment of large areas in the shortest possible time [14]. Consider the engineering technologies (figure 1) used depending on climatic conditions, soil and crop types.

![Innovative technologies in agribusiness](image)

Fig. 1. Innovative technologies in agribusiness.

For over ten thousand years, mankind has been cultivating soil. Loosening and weed control increase the yields, and harrowing contributes to the efficient seed planting. Plows and harrows were the first helpers of man in the struggle for fertility [8]. Over the millennia, soil cultivation technologies have undergone significant changes. Due to high-performance agricultural tillage machines that can revive the most difficult agricultural backgrounds, farmers do not have to worry about the safety of farmland fertility [15].

As for energy and resource-saving technologies, they have long been of interest to agricultural analysts [5]. Resource saving in the agricultural industry plays a key role as an effective means of accelerating the pace of production and increasing labor productivity.

3 Results

The peculiarities of functioning of the agricultural industry are related to the fact that the object of influence of machine technology is most often biological objects: soil, plants, animals. This affects the peculiarities of consumption and distribution of energy and resources. In the process of economic activity resources of the enterprise take one of the
central places, so the question of resource and energy saving and determination of the optimal ratio of resources at the enterprise is very relevant at present.

The main types of energy resources consumed by agriculture are petroleum, oil and lubricants, thermal energy, electricity, and gas. Depending on the direction of agriculture, priority is given to different types of its, if for cattle breeding it is fuel and lubricants and electricity, for crop production it is fuel and lubricants, and for closed ground it is thermal energy and electricity.

One of the key factors of the cost of the obtained agricultural product is its energy intensity. Namely, the amount of energy used to produce a unit of product. According to this indicator, Russian producers have a significant lagging behind their Western counterparts. Undoubtedly, geographical location and climatic conditions have a significant influence, but one should not deny the shortcomings in the technologies used, technical devices and management system, either.

Due to the fact that energy and resource saving is a modern technology and a relevant issue, but there is a limited amount of energy resources, high prices of electricity, and negative impacts on nature, it is advisable to develop scientific and practical recommendations to make energy saving more efficient in the agricultural industry (table 1) [16].

Table 1. Scientific and practical recommendations to improve energy-saving technologies in the agricultural sector.

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Efficiency</th>
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<tr>
<td>Energy saving</td>
<td>Reduces energy consumption by replacing it with energy-saving equipment [2].</td>
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<tr>
<td>Use of Combined Aggregates</td>
<td>Reduces the cost of labor and fuel and lubricants due to the smaller number of passage of the machine through the field [13].</td>
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<tr>
<td>Saving water through drip irrigation</td>
<td>Reduces water costs by several times.</td>
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<tr>
<td>Use of technology in automatic mode</td>
<td>Increases labor productivity, reducing staff fatigue, equipment maintenance costs, fuel consumption, seed and fertilizer losses.</td>
</tr>
<tr>
<td>Analysis of the collected information about fields</td>
<td>Increases production volumes, reduces processing, fertilizing, harvesting and transportation costs, crop forecasting and sales volume.</td>
</tr>
<tr>
<td>Low-intensity optical radiation of seeds</td>
<td>Increases the level of germination, yields and shelf life.</td>
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Conservation agriculture is a long-term form of resource conservation. With its rational implementation, it is possible to minimize costs, reduce damage to the economy and the environment. Production efficiency and labor results can be improved [7]. The costs can be reduced through the use of precision farming methods using special equipment that reduces the cost of chemicals, fuel, time, and can enhance capabilities for working at night and in bad weather conditions [11].

One of the rational ways to use land resources is zero tillage. This is a system of crop production, in which the optimization of production processes is of key importance. As a result, the crop industry becomes predictable, manageable and economically viable [6].
4 Discussion

Technologies have evolved, and technology companies began to pay attention to agriculture which has learned to control the full cycle of crop or livestock production through the use of smart devices that transmit and process parameters of each object and its environment (equipment and sensors measuring the parameters of soil, plants, microclimate, animal characteristics, etc.) [11].

Agriculture is on the verge of the Second Green Revolution. Experts estimate that thanks to IoT-based precision farming technologies, there could be a surge in the yields that humanity has not seen even when the first tractors appeared and herbicides and genetically modified seeds were invented.

Technologies have become cheaper and it is possible to obtain data on each agricultural object and its environment, accurately calculate an algorithm of actions and predict the result [13].

Based on international practice, it is possible to identify a variety of initiatives in the agro-industrial field, which have been able to grow into a strong and durable business. A special place in this list is given to technologies that increase the efficiency of planning and farming:

- Software and online support.
- Aerial survey navigation techniques.
- Sensor-tracking controllers.
- Technological equipment.

Through agro-industrial innovation projects there is an opportunity to increase the impact, develop and change the basic perceptions of the agro-industrial industry.

International practice has already developed a sufficient number of projects that have been successfully implemented in agriculture, here are some of the key ones:

- BrightFarms project, which helps to organize modern greenhouses in urban areas. The advantage is the close proximity of the greenhouse to the future points of sale. Products grown in environmentally friendly conditions are shipped to local markets in the next 24 hours.
- The Uber farm project allows everyone to get organic products (fruits and vegetables) through an Internet resource. The user has access to a specialized calculator.
- Sample6 program - this innovative system software allows to test growing crops. With this program the farmer can monitor his crops and test crops for foodborne pathogens.
- Precision seed drill. Healthy plant growth requires keeping a certain distance between plants when sowing. The agricultural industry already has devices that can maintain a specified distance when seeding.
- The CropX system, a project for intelligent irrigation-irrigation. It is an innovative solution from developers in Israel. It helps to minimize future energy and irrigation water consumption with a special algorithm. The system divides all the territory of a field into separate sections, zones, and, taking into account soil conditions, calculates the ideal irrigation scheme.

Modern agriculture is gaining popularity and is becoming a fashionable direction. Growing interest to this sphere is explained by growing profitability. And the use of modern technologies helps to gather the highest possible yield. It can be noted that the Russian Federation over the past 20 years has ranked among the top countries that offer a large number of innovations with maximum return.

It is impossible to say which of the technologies is better, as each cropping system has advantages and disadvantages. Only a rational choice of a farming system taking into
account soil properties, species composition of the crop rotation and agricultural machinery can ensure the stability of yields. It is difficult to describe a variety of modern tillage equipment by types of technological operations. Each agricultural producer can choose an optimal set of machines, both for pre-sowing tillage and soil treatment after harvesting in order to maintain and even revive the fertile properties of complex agricultural backgrounds [10].

5 Conclusion

The use of technology makes any process faster, more convenient and of higher quality. Thanks to the use of various innovative platforms in agriculture, there is not only an increase in the quantity of products, but also an improvement in their quality.

Currently, the domestic agricultural industry experiences numerous problems that prevent it from implementing new technologies: degenerated natural resources, the lack of funding, qualified specialists and national development strategy for the innovation area.

Nevertheless, the reconstruction of the industry through the use of engineering technologies aimed to provide the population with agricultural products can be promising. New technologies are being implemented within development programs for the agricultural industry: new production methods and forms are being identified to achieve results in land cultivation and management of natural resources.

References


