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METHODS OF BIO-FARMING WHEN INTRODUCING DEPOSITS INTO AGRICULTURAL CIRCULATIO

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Abstract. The paper analyzes the problem of significant areas of unclaimed agricultural land in Russia, which, according to the Federal Register for 2021, amount to 44.5 million hectares. Special attention is paid to the potential of ecological and biological (organic) agriculture as a strategic model for the development of the agro-industrial complex based on a new legislative framework. The prospects of using nanotechnologies and nanopowders of biogenic metals as effective biostimulators of plant growth are being investigated. It is concluded that the integration of the principles of organic farming with modern biotechnologies and nanotechnologies is a scientifically sound way to solve the problem of unused land and sustainable development of the Russian agro-industrial complex.

Keywords: unused lands, agricultural lands, organic farming, food security, biologics, biofertilizers, nanotechnology, fertility reproduction.

Introduction

According to official data provided by the Federal Service for State Registration, Cadastre and Cartography (Rosreestr) as of January 1, 2021, there is a significant resource potential of unclaimed agricultural land in the Russian Federation. Analysis of statistical information shows that the total area of such unused land reaches a massive 44.5 million hectares. As a percentage, this figure is 11.7% of the entire country's territory allocated for agricultural needs, which underlines the importance of the problem.

A more detailed examination of the structure of these lands reveals that directly unused agricultural land, that is, land that is not systematically involved in agro-industrial production, occupies 33.0 million hectares. This figure is an even more alarming indicator, equal to 16.7% of all available farmland in the country. Of particular concern within this category is the condition of arable land, the most valuable resource for crop production. The area of unused arable land, that is, land that was previously cultivated but has now been withdrawn from circulation, reaches 18.8 million hectares, which is 16.1% of the total arable land in Russia.

Such a significant scale of unused agricultural potential indicates the presence of systemic problems in land management and indicates the need to develop comprehensive measures to

involve these territories in agricultural turnover. The current situation not only leads to direct economic losses, but also creates risks for ensuring the country's food security, as well as contributes to the degradation of valuable land resources, the restoration of which in the future will require significant financial and time costs. In this regard, the problem of rational use of agricultural land requires urgent solutions at the state level with the involvement of scientific potential and modern agricultural technologies.The majority of such lands, including abandoned arable land, are concentrated in the Volga, Siberian and Central Federal Districts. These regions, together with the Southern District, are among the top 4 in terms of farmland area in the country, accounting for a total of 77.3% of the national figure.:

Volga Federal District – 51.3 million hectares (25.9%);

Siberian Federal District – 41.0 million hectares (20.7%);

Southern Federal District – 31.4 million hectares (15.9%);

Central Federal District – 29.4 million hectares (14.8%) [1].

In 2021, the Ministry of Agriculture of the Russian Federation approved a large-scale state program aimed at effectively involving unused land in agricultural turnover and the integrated development of land reclamation. The adoption of this document at the highest level underlines the Government's strategic approach to solving the fundamental task of strengthening food security and increasing the country's self-sufficiency.

Ecological and biological farming, also known as organic farming, is an agricultural system that uses fertilizers of organic origin, such as various compost, siderates and bone meal, and focuses on methods such as crop rotation and associated planting.

On January 1, 2020, the law "On Organic Products and on Amendments to Certain Legislative Acts of the Russian Federation" entered into force in the Russian Federation, which defines the meaning of organic agriculture. - a set of economic activities that are defined by Federal Law No. 264-FZ of December 29, 2006 "On the Development of Agriculture" and in which methods, methods and technologies are used to ensure a favorable state of the environment, promote human health, preserve and restore soil fertility, and establish requirements for the production of organic products. products, including bans on the use of agrochemicals, pesticides, hydroponic method of growing plants, and the like.

The fundamental principle of organic farming is based on the modeling of a closed ecosystem integrating the livestock and crop sectors. Within the framework of this model, a waste-free cycle is carried out, where by-products of one direction serve as a resource for another: animal husbandry provides agriculture with organic fertilizers, and crop production, in turn, creates a fodder base for livestock. The legal basis for this approach is Federal Law No. 248-

FZ dated 07/14/2022 "On By-products of Animal Husbandry and on Amendments to Certain Legislative Acts of the Russian Federation", which entered into force on March 1, 2023. The purpose of this federal law is to increase the efficiency of involving by-products of animal husbandry in agricultural production, including to solve the problem of ensuring the reproduction of fertility of agricultural land. In this regard, the search for ways to implement ecological and biological agriculture is currently of great importance [2-4].

Ensuring food security and increasing agricultural production in the Russian Federation require an integrated approach to land management. A key element of this strategy is the preservation and reproduction of soil fertility, which is an indispensable condition for the sustainable and effective development of the entire agro-industrial complex. In addition to the rational use of land, it is necessary to actively restore degraded and unproductive territories. Effective involvement of the latter in economic turnover requires the introduction of an integrated system of land reclamation measures aimed at enhanced reproduction of fertility through the targeted restoration of their agronomically valuable properties

The use of mineral fertilizers is becoming less and less relevant, therefore, agricultural producers prefer to use biofertilizers and biological products to form a high and high-quality crop. Fertilizers fill the soil with additional structuring material, and biologics ensure effective mobilization of organic matter and biota.

Biological processes in agrocenoses can be controlled through the introduction of agronomically valuable strains of microorganisms into the plant rhizosphere, which enhances the beneficial or reduces the negative effects of undesirable phenomena for realizing their potential. Today, based on numerous experiments, it can be argued that the symbiosis and association of microorganisms with plants is the basis of the vital activity of the latter.

The use of biostimulants changes the metabolic processes in plants, creates favorable conditions for plant growth, including under the influence of stress. Unlike chemicals, biologics have a more pronounced selectivity of action, they are also recognized as harmless to humans and animals, and decompose rapidly in the soil.

The All-Russian Research Institute of Reclaimed Lands (VNIIMZ) has developed high-quality biofertilizer KMN (multipurpose compost). The value and advantage of KMN as the main fertilizer lies in its high nutritional value, physiology, environmental friendliness and biogenicity. KMN is a valuable fast–acting organic fertilizer produced by accelerated composting of manure, bird droppings and other substrates in biofermenters. It contains, in an easily accessible form, a complete set of nutrients necessary for the normal growth and development of plants.

In parallel with traditional methods, innovative approaches, in particular, nanotechnology and technologies using biological products, have been actively developed and implemented in recent years to increase the efficiency of agricultural production by increasing yields and improving product quality. Numerous scientific studies and experimental data convincingly demonstrate that the integration of bio- and nanotechnology can have a comprehensive positive impact on the agri-food sector. Their use makes it possible to minimize the negative environmental consequences of agricultural practices, such as soil and water contamination with agrochemicals, as well as reduce the risks to human health associated with residual amounts of pesticides in products. Ultimately, these technologies contribute to strengthening food security and sustainable productivity growth in the agricultural sector [5-7].

However, the use of traditional trace elements as plant growth stimulants faces objective limitations related to the established maximum permissible concentrations (MPC) of their content in soils and products. Exceeding these standards carries a direct risk of toxic environmental pollution and accumulation of heavy metals in food chains. In this context, the use of nanocrystalline metal powders as micro-fertilizers has recently become a particularly promising area.

The unique properties of nanoscale particles, such as high specific surface area and increased biological activity, open up new possibilities. For example, the use of iron, copper and cobalt nanopowders as biostimulants demonstrates encouraging results. These metals are biogenic, that is, vital for plants: iron is part of the enzymes of the respiratory chain, copper is a cofactor of a number of redox enzymes, and cobalt plays a key role in metabolism. Being in a nanoform, they are more easily absorbed by plants, effectively participating in redox processes and activating enzymatic systems. Their use contributes to a significant improvement in the sowing qualities of seeds – increasing the energy of germination and germination, strengthening the root system in the early stages of development, which, in turn, naturally leads to an increase in crop yields [8].

Thus, organic farming is established as a strategically significant model for agriculture, the main value of which is the principles of sustainability and eco-security. The development of the legislative framework, including legal acts in the field of organic agriculture and the disposal of livestock waste, creates the necessary prerequisites for the transition to closed-loop production systems.

Biological technologies are a key tool for increasing agricultural productivity. Biologics and biofertilizers (such as KMN) provide not only increased yields, but also restoration of soil fertility, being safe for ecosystems. The variety of the latest developments of Russian

scientists, adapted to various soil and climatic conditions (from arid southern regions to temperate latitudes), creates a solid foundation for technological food security of the country.

Nanotechnology opens up new perspectives in overcoming the limitations of traditional micro-fertilizers. Metal nanopowders demonstrate high efficiency as biostimulants due to improved digestibility and activation of plant physiological processes. At the same time, as practical tests show, maximum efficiency is achieved not by completely replacing chemicals, but within the framework of integrated plant protection systems, where biological, chemical and digital methods complement each other.

The integrated implementation of the principles of organic farming in combination with modern biological and nanotechnology is a scientifically sound way to solve the problems of involving unused land in the turnover, ensuring food security and the transition to sustainable development of the Russian agro-industrial complex.

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