

ANNOTATION

on the dissertation work Makenova Meruert Meiramovna on the topic: «Development of technology for processing bird droppings into organic fertilizer and its application on crops in the conditions of steppe and dry steppe zones of Northern Kazakhstan» for the degree of Doctor of Philosophy PhD in D131 - Crop production, group 8D08103 “Scientific Basis of Plant Nutrition and Fertilizer Application”

The general nature of the dissertation work. The dissertation work examines the results of microbiological processing of bird droppings into organic fertilizer and its application in the fields of various crops in the conditions of steppe and arid steppe zones of Northern Kazakhstan.

Relevance of the research topic. The preservation and improvement of soil fertility for many regions of Kazakhstan is one of the main problems of agricultural production. Currently, the amount of fertilizers applied per 1 ha is about 2.5 kg, and compared with 1986-1990, this figure has decreased by 20 times. Under human anthropogenic influence, there is a decrease in the humus content in the soil, acidification of the soil environment, deterioration of physical, biological and phytosanitary properties. The decrease in humus content in the soils of arid steppe and steppe zones of the Akmola region by 10-23% over the past 7-10 years is especially noticeable. This is due to the increase in prices for mineral fertilizers, the weak economic situation of farms and the lack of advanced technologies for processing organic fertilizers. To form soil fertility, it is necessary to introduce environmentally friendly types of fertilizers into production, which contain a high content of protein, fat, vitamins and trace elements. To do this, it is advisable to use all organic reserves. In connection with the above problems, the relevance of using organic fertilizers within the framework of the concept of transition of the Republic of Kazakhstan to a "Green economy" is increasing.

According to scientifically based standards, only 23% of mineral and 1.2% of organic fertilizers are applied to the soil. The largest reserves of organic matter include poultry waste, that is, bird droppings. Currently, there are 59 poultry farms in Kazakhstan, of which 34 are working in the direction of obtaining eggs, the remaining 25 in the direction of obtaining meat. On average, 1 poultry farm with a capacity of about 40 thousand chickens and 10 million produces broiler chickens. Of these, 35-83 thousand tons of bird droppings and 400 thousand m³ of wastewater with highly concentrated organic compounds are formed annually. However, bird droppings cannot be used without recycling. Because an unpleasant odor is released from fresh bird droppings, it contains toxic gases such as ammonia, hydrogen sulfide, weed seeds, helminth eggs, pathogenic microorganisms. However, bird droppings are rich in nutrients and are a valuable organic fertilizer. It contains nitrogen (1.3–1.7%), phosphorus (0.6–0.9% P₂O₅), potassium (0.5–0.8% K₂O), and reserves of trace elements.

Every year, the environmental situation in Kazakhstan worsens as the production volumes of poultry farms increase. The disposal of bird droppings has

become an unsolvable problem for many poultry farms. Analyzing the technologies of processing bird droppings in Kazakhstan and abroad, it was found that most of them require significant finances, the availability of a power source or a special installation. This is not available for many households with a weak economy. Currently, relatively affordable technologies include redundancy using aerobic microorganisms, vermicorization using earthworms, and processing under anaerobic conditions to produce biogas.

In this study, based on the soil and climatic conditions of Northern Kazakhstan, to increase the effectiveness of bird droppings and eliminate the negative impact on the environment, pathogenic microflora, the processing of droppings by microbiological method was chosen. For this purpose, effective strains of microorganisms with properties of decomposing cellulose, stimulating growth, nitrogen fixing, etc., have been isolated from bird droppings, soils of the North Kazakhstan regions, and biologics have been developed based on them.

In Kazakhstan, especially in the conditions of Northern Kazakhstan, the chemical composition of bird droppings, the technology of using crops and the effect on soil fertility have not been sufficiently studied. In this regard, it becomes relevant to determine the chemical composition of bird droppings, the optimal doses for crops grown in various natural climatic conditions, and the study of the influence of soils on agrochemical properties.

Research objectives:

1. Creation of a biological product based on effective strains of microorganisms and development of technology for processing bird droppings into organic fertilizer;
2. Determination of growth-stimulating properties and toxicity of oilseed flax and barley seeds of various concentrations of organic fertilizers;
3. Determination of the effect of different doses of organic fertilizers on the biological activity of soils;
4. Determination of the species composition of phytopathogens found in the soil and affected parts of the plant, depending on the doses of organic fertilizer;
5. Determination of the effect of different doses of organic fertilizer on the agrochemical composition of the soil;
6. Determination of optimal doses of organic fertilizers that ensure maximum yield and quality of crops in arid steppe and steppe conditions of the Akmola region.

The scientific novelty of the results obtained. For the first time in Kazakhstan, methods of processing bird droppings by microbiological method into organic fertilizers have been developed. The optimal doses and timing of application of the resulting organic fertilizer to various crops were selected. The dynamics of agrochemical indicators has been studied and an assessment of changes in the state of soil humification has been given. Damage to crops by pathogenic microorganisms has been investigated and optimal options have been identified that can reduce the spread of the disease. Various groups of microorganisms, biological activity of soils of steppe and arid steppe zones of Akmola region have been comprehensively studied. This made it possible to

determine the mineralization coefficients of organic substances. The optimal amounts of organic fertilizers aimed at improving the technological qualities of agricultural crops (wheat, barley, oilseed flax) have been determined. Practical recommendations have been developed to increase crop yields and soil fertility in the northern regions with organic fertilizers based on bird droppings.

Practical and theoretical significance of research. Practical recommendations were prepared on the microbiological technology of processing bird droppings into organic fertilizer. These practical recommendations made it possible to eliminate waste near poultry farms. The dynamics of changes in the nitrogen, phosphorus and potassium regimes of the southern chernozems of the Akmola region under the influence of various amounts of organic fertilizers based on bird droppings has been revealed. Based on the analysis of the results of the study, when cultivating agricultural crops (wheat, barley, oilseed flax) in the conditions of the steppe and arid steppe zone of Northern Kazakhstan, the optimal doses of organic fertilizer based on bird droppings in the spring period before sowing in the amount of 10 tons / ha, and in the autumn period -in wheat crops in the amount of 30 tons/ha.

The materials of the dissertation can be used as a lecture material on agrochemistry, soil science, ecology.

The object of research: wheat, barley, oilseed flax, bird droppings.

Methodology and methods of research. The scientific and methodological basis of the research was based on generally accepted methods of soil science, soil microbiology, agrochemistry and agronomy. The dissertation work used mathematical and statistical processing along with the methods of classical microbiology, studying the chemical composition and biological activity of soils, the isolation of microorganisms from soil and bird droppings, and their biological features.

The main provisions submitted for protection:

- Technology of processing bird droppings by microbiological method into organic fertilizers;
- Patterns of the influence of various doses of organic fertilizer based on bird droppings on agrochemical soil parameters, biological activity, yield and its quality, the spread of diseases.

Personal contribution of the author. The purpose, objectives, research method and conduct of research work, compilation, generalization of the main provisions of the dissertation were performed by the applicant himself.

The relationship of work with the state program plan. Research on the dissertation work was carried out within the framework of the project of the Ministry of Science and Higher Education of the Republic of Kazakhstan for 2018-2020 "Development of technology for processing bird droppings into organic fertilizers using new domestic biological products and their introduction into crop production" within the framework of financing by the World Bank (registration number № 0221RKK0001) and the project of the Ministry of Agriculture for 2021-2023 "Development of methods the use of biological fertilizers in order to obtain

environmentally friendly agricultural products and increase the natural soil fertility in the Northern regions of Kazakhstan" (registration number №BR10764907).

The degree of reliability and approbation of the results of the study. The results and main provisions of the dissertation work were presented and discussed at the following international scientific and practical conferences: International Scientific and Practical Conference "XIV Global Sciences and Innovations 2021": Central Asia (Astana, 2021); International scientific and practical conference "Seifullin Readings - 18: Youth and Science—a look into the future" (Astana, 2022); International scientific and practical conference "Seifullin readings – 18(2): Science of the XXI century-the era of transformation" (Astana, 2022); International Scientific and practical Conference "Adaptation of crop production to the conditions of global climate change: problems and solutions" (Almaty, 2022); International scientific and practical conference "Seifullin Readings–19" dedicated to the 110th anniversary of M. A. Handelman (Astana, 2023).

Also in 2021-2023. Discussed and approved at a meeting of the Department of Soil Science and Agrochemistry of the S. Seifullin KATSU, the Academic Council of the Faculty of Agronomy, the Scientific and Technical Council of the University.

Publication of the results of the work. The main results of the dissertation were presented in 13 publications, including 2 articles in the Pakistan Journal of Botany (percentile 52%) and 1 article in the SABRAO J. Breed. Genet. (percentile - 38%) included in the international Scopus database, control in the field of education of the Ministry of Education of the Republic of Kazakhstan 3 articles were published in publications presented by the Committee, 1 article included in the R&D (RINC) database, 5 articles in the collection of international conferences were published.

The structure and scope of the dissertation. The dissertation work consists of a 138-page A4 computer text written in the state language: 41 tables, 37 figures, an introduction, a literature review, the object and methodology of the study, research results, conclusions, a list of references and appendices. The number of references is 260, including 140 literature in a foreign language.