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Evaluation of the Efficiency of the Organic Biofertilizer "Unumdor" on Grain Crops

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A B S T R A C T

This study addresses the environmental and agronomic challenges of poultry manure disposal by developing a new organic biofertilizer, "UNUMDOR." The product was obtained through the bioconversion of chicken manure using plant waste (stevia and licorice) and the "TERIA-S" strain of soil bacteria. Under laboratory conditions, the combined application of UNUMDOR biofertilizer (into the soil) and "TERIA-S" (as a seed treatment) significantly improved the biometric growth and development of 30-day-old wheat, rice, and corn seedlings. Field trials confirmed the combination's high effectiveness, with improved soil quality and a significant increase in crop productivity. Yield increases amounted to 1.3 t/ha for garlic and 1.0 t/ha for silage corn. The new biofertilizer is rich in humus and readily available forms of nitrogen, phosphorus, and potassium. The results demonstrate the high potential of the combined use of UNUMDOR and TERIA-S preparations for safely increasing crop yields.

Introduction

Modern intense agricultural practice faces numerous challenges that pose a serious threat to global food security. However, the unwise use of agrochemicals has led to environmental pollution, which has led to threats for health population. Microbes related with plants, with their plant growth promoting traits, have enormous potential to address these problems and play a crucial role in increasing plant biomass and crop yields (Parul *et al*., 2022). The agricultural sector accounts for a third of the world's gross domestic product. However By measure growth numbers population, V world according to estimates increases to 9.5 billion to 2050 years, what will lead to the top demand on food (Parul *et al*., 2022). Significant progress has been made recently in the development of effective biofertilizers for various crops.

Biofertilizers derived from beneficial microorganisms offer a promising alternative traditional fertilizers, increasing soil fertility, crop productivity and overall ecosystem health, which increases agricultural yields, improves soil health and the development of nutrient-rich crops, which consequently contributes to a more sustainable and nutritious global food system (Pei *et al*., 2025).

Reliance on chemical fertilizers has greatly increased food production in China, but has also led to soil degradation, pollution surrounding Wednesday And

decided promotion biofertilizers as effective alternatives for increasing soil fertility and softening pollution surrounding environment. Biofertilizers contribute crop growth by providing or enhancing essential nutrients, suppressing plant pathogens, improving soil health, and increasing resilience to abiotic stress. Growing implementation biofertilizers V China reflected V more 10,000 products with an annual production of over 35 million tons and a market value of over $5.5 billion in the United States, which shows on significant transition to sustainable method conduct agriculture (Pei *et al*., 2025).

The use of microbes as biofertilizers is being explored as a partial alternative to chemical fertilizers in the agricultural sector. In China, biofertilizers have demonstrated the potential to reduce the use of chemical fertilizers by 20-50% without reducing crop yields. Biofertilizers can provide or activate nutrients, producing active substances that promote crop growth (Priyadarshini *et al*., 2021). By introducing beneficial microorganisms into the soil, biofertilizers play a crucial role in restoring soil productivity and improving soil health. From an environmental perspective, biofertilizers help decrease leaching nutritious substances and water pollution, reductions dependencies from chemical fertilizers, those the most promoting ecological balance (Priyadarshini *et al*., 2021).

Biofertilizers often struggle to survive in soil conditions due to competition with local microbiomes, which reduces their persistence and effectiveness. Such factors how pH soils, temperature and content Moisture conditions can affect the survival and activity of introduced microorganisms. Furthermore, interactions with native soil microbes can impact the performance of biofertilizers. To address these issues, researchers are creating microbiomes, which consist of several beneficial microbial strains derived primarily from plant microbiomes.

In India, where is the countryside farm is main source income, especially V arid regions, farmers come running To excessive The application of chemical fertilizers, which further degrades soil health, offers promising solutions by increasing soil fertility, nutrient availability, and crop resilience (Petrova, 2021).

Biofertilizer is any substance, which often applies V soils and provides one or more essential nutrients for growth and development plants (Petrova. 2021). Biofertilizers there are 2-x main form m- solid and liquid. Liquid formulations offer significant advantages due to their ease of production and lower cost. General methods of using dry and liquid biofertilizers include processing seeds, immersion roots, spraying leaves and application in soil. Processing Seed application is a widely practiced method of applying biofertilizers, especially to enhance plant growth and development. This approach involves the creation of inoculant suspensions, carrier substances and then evenly are applied sterilized seeds. After coating, the seeds are left to air dry before sowing. IN basically is used *Rhizobium* cultures, processing Seed biofertilizers facilitate the establishment of symbiotic relationships between plants and beneficial microorganisms during the early stages of plant development. This symbiosis promotes nutrient absorption and enhances overall plant health. Furthermore, it has been noted that the use of biofertilizers in crops reduces the incidence of rot and root enlargement, while simultaneously increasing plant survival (Kuznetsova, 2022).

Biofertilizers consist of beneficial microorganisms that increase soil fertility, improve the availability of nutrients and enhance stability agricultural cultures to various stress. This highlights the importance of biofertilizers in mitigating soil degradation, increasing crop productivity, reducing reliance on chemical fertilizers, and strengthening long-term soil health, as well as the economic benefits, making them a sustainable option for organic and low-input agriculture (Kuznetsova, 2022).

Main Paths Solutions Food Problems

- ✓ application minimal processing soils;
- ✓ increasing soil fertility through the use of organic matter biological fertilizers;
- ✓ the use of biological methods in the fight With diseases and pests of agricultural crops;
- ✓ withdrawal new varieties agriculture cultures;
- ✓ increase mechanization And automation rural farms.

Today, innovative solutions and modern biotechnologies based on the use of environmentally friendly, resource-saving new-generation bioagrotechnologies play a key role in strengthening food security.

A literature review conducted on the topic of the study reveals some scientific data on various methods of fermenting chicken manure. However, comprehensive information on biotechnology for processing it using

medicinal plant waste and soil microorganisms (bacteria) was not found in the available literature.

Materials and Methods

Objects research

Seeds grains (wheat, rice, corn) cultures.

Methods microbiological analyzes soils and substrates

Microbiological analyses of soils were carried out using generally accepted methods in soil microbiology (Zvyagintsev, 1991; József Szegi, 1996; Methods of agrochemical, agrophysical and microbiological research in irrigated cotton areas. Tashkent: Publishing House of the Academy of Sciences of the UzSSR, 1999 *(in Russian)*; Large practicalum on microbiology, 1962 (Ed. by G.L. Seliber).

Methods agrochemicals analyzes soils and substrates

Agrochemical soil analyses were carried out using generally accepted methods in agrochemistry (Methods of chemical soil analysis used in mass analysis laboratories. Tashkent, 2005, *in Russian).*

Methods definitions elemental composition soils And substrates

Contents microelements V soil And V organs cotton plant varieties C - 6524 was determined with help instrumental neutron activation analysis. The IAEA standards (IAEA-SL-3, LakeSediment, IAEA-Soil-5, IAEA-Soil-7) and some complex standards prepared in the laboratory by applying known solutions to filter paper were used as standards. An HPGe detector (180 keV resolution at the 1332.5 60 Co line) with a charge-sensitive preamplifier and a DSA-1000 analyzer with Genie 2000 software (Canberra) were used to measure and process the gamma spectra.

Methods statistical processing Data

Statistics was used in experiments to determine mean values and their errors. Currently, mathematical statistics is an important tool in experimental design and data processing. It allows one to extract maximum information from the source data, assess the significance of differences between variants, and establish correlation coefficients and regression equations. Statistical processing of experimental data was carried out using standard methods for calculating errors, mean values, confidence intervals, standard deviations; when choosing a suitable method of mathematical analysis related to the results of a specific experiment, recommendations set out in the relevant literature were applied . To determine the statistical significance of the results, the Student t -test was calculated. When selecting the appropriate method of mathematical analysis applicable to the results of a specific experiment, recommendations provided in the relevant literature were followed. To determine the statistical significance of the results, the Student t-test was calculated.

Results and Discussion

Development formulas organic Biofertilizers

Currently, the issue of poultry farm waste disposal is acute, both from an environmental and economic perspective. The accumulation of chicken manure leads to environmental pollution, while local residents, using fresh liquid chicken manure, contaminate the soil and plants with pathogens. mushrooms And pathogenic bacteria V view coli. All of this could ultimately have a negative impact on agricultural produce. present time V republic are being developed some types of organic fertilizers based on humates - potassium humate, vermicompost - based on Californian worms, organic fertilizers based on cattle manure, various types of compost, etc. However, when applied to the soil, these organics become ballast, since the organic substances contained in them cannot be fully absorbed by plants. Therefore, conducting scientific research on the development of technological lines for industrial. The production of organic fertilizers is a pressing scientific problem requiring a practical solution. To develop a technology for producing a new organic fertilizer, we selected chicken manure, as it has a richer composition and higher potency than cow and pig manure. To ensure the chicken manure is readily absorbed by plants, we bioconverted it with plant waste from medicinal plants (stevia and licorice) and effective local strains of soil bacteria from the next-generation bacterial fertilizer TERIA-S. This resulted in the development of the new organic biofertilizer UNUMDOR.

Table.1 The influence of bacterial fertilizer TERIA-S and organic biofertilizer UNUMDOR on biometric indicators 30- daytime wheat sprouts
(laboratory experience, n=5, average on 1 plant)

Biometrics indicators	Options experience		
	Control, soil without fertilizers	Experience - soil no fertilizers, processing wheat seeds TERIA- S	Experience-soil+ UNUMDOR+ processing seeds TERIA-S wheat
Height plants, cm	28.0±0.24	34.0±0.12*	38.5±0.2*
Length root, cm	7.5±0.2	9.0±0.24*	11.0±0.28*
Height sprout, cm	20.5±0.16	25.0±0.2*	27.5±0.2*
Wet weight roots, G	0.18±0.01	0.48±0.05*	0.66±0.2*
Wet weight stems and leaves, G	1.88±0.01	3.03±0.01*	3.68±0.01*
Dry weight roots, G	0.09±0.02	0.12±0.28*	0.22±0.03*
Dry weight of stems and leaves, g	0.23±0.02	0.33±0.01*	0.44±0.02*

Note: * P ≤ 0.05 - reliably By relation To control

Table.2 Influence organic biofertilizers UNUMDOR and bacterial fertilizer TERIA-S and on the biometric indicators of 30-day seedlings rice (laboratory experience, n=6, average on 1 plant)

Biometrics indicators	Options experience		
	Control, soil without fertilizers	Experience is the soil without fertilizers, seed treatment rice TERIA- S	Experience-soil+ UNUMDOR+ processing rice seeds TERIA- S
Height plants, cm	16.8±0.1	20.4±0.22*	23.3±0.2*
Length root, cm	4.3±0.02	6.5±0.02*	8.5±0.06*
Height sprout, cm	12.5±0.2	13.9±0.35*	14.8±0.3*
Wet weight sprout, G	0.90±0.04	1.45±0.01*	1.95±0.01*
Note: * P ≤ 0.05 - reliably By attitude towards control			

Table.3 The influence of bacterial fertilizer TERIA-S and organic biofertilizer UNUMDOR on biometric parameters of 30-day seedlings corn (laboratory experience, n=5, average on 1 plant)

Biometric indicators	Options experience		
	Control, soil without fertilizers	Experiment - soil without fertilizers, seed treatment TERIA- S corn	Experience-soil+ UNUMDOR + processing TERIA- S corn seeds
Height plants, cm	23.0±0.2	25.0±0.24*	31.0±0.3*
Length root, cm	10.0±0.24	12.0±0.12*	13.0±0.36*
Height sprout, cm	13.0±0.2	13.0±0.36*	18.0±0.4*
Wet weight roots, G	5.57±0.04	6.75±0.02*	6.81±0.21*
Wet weight stems and leaves, G	4.82±0.4	6.23±0.03*	6.41±0.02*
Dry weight roots, G	1.0±0.04	1.04±0.02*	1.12±0.04*
Dry weight stems and leaves, G	0.5±0.01	0.64±0.02*	0.66±0.02*

Figure.1 The influence of biofertilizers UNUMDOR and TERIA-S on the development of root systems and sprouts wheat through 30 days laboratory experiment

Figure.2 Influence biofertilizers UNUMDOR and TERIA-S on development of the root system and seedlings rice through 30 days of laboratory experiment

(1-Control, soil without fertilizers 2-Experiment - soil without fertilizers, Rice seed treatment with TERIA-S; 3-Experiment-soil+UNUMDOR + treatment seeds rice TERIA-S)

Figure.3 The influence of biofertilizers TERIA-S and UNUMDOR on the development of root systems And sprouts corn through 30 days laboratory experiment

Laboratory evaluation efficiency organic biofertilizer "UNUMDOR " on grains crops

The objective of our research was to conduct tests of the organic biofertilizer we created. UNUMDOR on various agricultural crops under laboratory conditions. We studied the effect of the bacterial fertilizer TERIA-S (seed treatment) and the organic biofertilizer UNUMDOR (soil application) on biometric parameters. Growth indicators and development sprouts wheat and corn after 30 days of laboratory experiment. From data, presented in Table 1 and Figures 1. It is visible, what at application V soil with organic biofertilizer UNUMDOR and treatment of wheat seeds with bacterial fertilizer TERIA-S improves the biometric indicators of 30-day sprouts wheat compared with option, where it was used only processing seeds TERIA- S and with control. So, average height 1 plants was on 10.5 cm above the control and 4.5 cm above the variant with application only processing TERIA-S seeds. Average The wet weight of 1 wheat sprout was 2.28 g higher than the control and 0.84 g higher than the variant with only TERIA-S seed treatment. The average dry weight of 1 wheat sprout was 0.34 g higher than the control and 0.21 g higher than the variant with only TERIA-S seed treatment.

Us studied influence bacterial TERIA-S fertilizers (seed treatment) and organic biofertilizer UNUMDOR (applied to the soil) for biometric indicators growth and development rice sprouts through 30 days of laboratory experience (table 2, Fig. 2). At application in Soil treated with UNUMDOR organic biofertilizer and rice seed treatment with TERIA-S bacterial fertilizer improved the biometric parameters of 30-day-old rice seedlings compared to the treatment with TERIA-S alone and the control. The average height of a single rice seedling was 6.5 cm higher than the control and 2.9 cm higher than the treatment with TERIA-S alone. Average wet weight 1 sprout rice was more control on 1.05 G and 0.5 g more than the option using only TERIA-S seed treatment.

Us studied influence bacterial fertilizers TERIA-S (processing seeds) and organic biofertilizer UNUMDOR (applied to the soil) on the biometric indicators of growth and development of corn seedlings after 30 days of the laboratory experiment (Table 3, Fig. 3).

When applying the organic biofertilizer UNUMDOR to the soil and treating corn seeds with the bacterial fertilizer TERIA-S, the biometric indicators of 30-day-old corn seedlings improved compared to the variant where only the TERIA-S seed treatment was applied and the control. Thus, the average height of 1 corn sprout was 7 cm higher than the control and 5 cm higher than the variant using only TERIA-S seed treatment.

Average wet weight 1 sprout wheat was more control 2.28 g and 0.84 g more than the variant using only TERIA-S seed treatment. Average dry weight 1 sprout wheat was more control 0.34 g and 0.21 g more than the variant using only TERIA-S seed treatment.

Based on the research conducted, we can conclude that the new organic biofertilizer UNUMDOR that we have created is rich in humus, gross forms of nitrogen, phosphorus, potassium, Thanks to the addition of beneficial macro- and microelements to plants and the

effective soil bacteria with a range of beneficial properties, the TERIA-S bacterial fertilizer provides a high level of mobile, plant-available forms of nitrogen, phosphorus, and potassium. Application of the UNUMDOR organic biofertilizer to the soil and TERIA-S bacterial fertilizer as a seed treatment in laboratory conditions resulted in improved biometric growth and development indicators for 30-day-old wheat, rice, and corn seedlings.

Good results were obtained using the UNUMDOR and TERIA-S biofertilizer complex in small-plot and field trials on garlic and silage corn. Positive results were obtained in improving soil quality and garlic yield, as well as biometric indicators of garlic plant growth and development over a seven-month small-plot field trial. Garlic yield increased by 1.3 t/ha compared to the control when using the UNUMDOR and TERIA-S biofertilizer complex.

In Conclusion, Positive results were obtained in improving soil quality and crop yield. silo corn, biometric indicators growth And development of silage corn plants during a 3.5-month field experiment. Productivity silo corn By comparison With control The yield increased by 1 t/ha when using the UNUMDOR and TERIA-S biofertilizer complex. Therefore, there is potential for using our new organic biofertilizer UNUMDOR in combination with the bacterial fertilizer TERIA-S in growing the studied crops.

Data Availability

All data generated or analyzed during this study are inclu

Author Contributions

Zilolakhon Kh. Pulatkhodjaeva: Investigation, formal analysis, writing—original draft. Gulnara I. Djumaniyazova: Validation, methodology, writing—reviewing.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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