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PURIN ASOSIDAGI BIOFAOL BIRIKMALARNING MAKKAJO‘XORI O‘SISHIGA VA DON HOSILDORLIGIGA TA’SIRI HAMDA SELEKSION AFZALLIKLARINI BAHOLASH

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Abstract: *This study investigates the influence of bioactive compounds based on purine derivatives on the growth, development, and grain productivity of maize (Zea mays L.). Experimental results showed that the application of purine-based compounds in optimal concentrations significantly stimulated seed germination, improved chlorophyll synthesis, and enhanced photosynthetic activity. Moreover, treated maize plants exhibited better resistance to abiotic stress factors such as drought and temperature fluctuations. Grain yield increased by 12–18% compared to the control, confirming the growth-promoting and adaptive potential of purine derivatives. The findings suggest that these bioactive compounds can be effectively used in maize breeding programs to develop high-yielding, stress-resistant cultivars suitable for sustainable agriculture.*

Key words: *purine derivatives, maize, bioactive compounds, growth stimulation, productivity, selection, adaptation.*

Introduction. In modern agriculture, one of the most important directions is the development of biologically active substances that can regulate plant growth, improve productivity, and enhance resistance to environmental stress factors. Among such compounds, purine-based derivatives are of particular interest due to their close structural relationship with natural plant growth regulators such as cytokinins, adenine, and guanine. These nitrogen-containing heterocyclic compounds play a crucial role in various biochemical and physiological processes, including cell division, nucleic acid synthesis, and enzymatic activity regulation. Recent studies have shown that synthetic purine derivatives can exhibit high biological activity, promoting seed germination, root development, and chlorophyll formation, thereby improving plant adaptability to unfavorable conditions[1-5].

Maize (*Zea mays L.*) is one of the world’s most important cereal crops and serves as a vital source of food, feed, and industrial raw materials. In Uzbekistan, maize cultivation is expanding, but its productivity is often limited by abiotic stresses such as drought, salinity, and nutrient deficiency. These challenges necessitate the development of innovative and environmentally safe methods for

improving plant growth and yield potential. One promising approach is the use of purine-based bioactive compounds that can act as plant growth stimulators and protective agents against environmental stress.

The application of purine derivatives in plant growth regulation is based on their ability to influence cellular metabolism. For instance, compounds such as 6-benzylaminopurine (BAP), adenine, and their halogenated or alkylated analogues have been widely studied for their cytokinin-like activity. These molecules participate in the regulation of photosynthetic pigments, protein metabolism, and hormonal balance in plants. Furthermore, they can modulate antioxidant enzyme activity, which is crucial for protecting plants against oxidative stress induced by drought and temperature fluctuations.

In maize breeding and cultivation, the use of purine-based compounds can have several advantages. Firstly, they can accelerate the early stages of seedling development, leading to uniform plant emergence. Secondly, they can increase chlorophyll content and improve photosynthetic efficiency, which ultimately enhances biomass accumulation. Thirdly, the application of such compounds contributes to better nutrient uptake, particularly nitrogen and phosphorus, which are essential for high grain yield formation. Finally, purine derivatives may serve as valuable tools in the selection of stress-tolerant and high-yielding maize genotypes.

The present study was conducted to assess the effects of selected purine-based bioactive compounds on the growth, physiological parameters, and grain productivity of maize under field conditions. The main objectives were:

1. To evaluate the influence of purine derivatives on seed germination and early plant development.
2. To determine their impact on chlorophyll synthesis and photosynthetic activity.
3. To analyze changes in growth dynamics and grain yield.
4. To identify selection advantages and potential applications in maize breeding programs.

The study contributes to the ongoing efforts to enhance crop productivity through eco-friendly and scientifically grounded approaches. The obtained results are expected to support the development of purine-based biostimulants for sustainable maize production, particularly in regions affected by abiotic stress conditions such as Uzbekistan.

Table 1. Morphological parameters of maize under the influence of purine-based bioactive compounds

Treatment variant	Average plant height (cm)	Root length (cm)	Number of leaves	Grain yield (g/plant)	Increase compared to control (%)
Control (no treatment)	112 ± 2.4	21.6 ± 0.8	11	135 ± 4.2	—
6-Benzylaminopurine (0.01%)	125 ± 2.8	26.4 ± 0.9	13	152 ± 5.0	12.6
Adenine derivative (0.02%)	128 ± 2.5	27.1 ± 1.0	13	156 ± 4.8	15.5
2-Methylaminopurine (0.03%)	132 ± 3.0	28.3 ± 0.7	14	160 ± 4.5	18.1

Conclusions. The conducted research proved that purine-based bioactive compounds have a significant positive impact on the growth, physiological development, and grain productivity of maize (*Zea mays L.*). Experimental data revealed that the use of 2-methylaminopurine and 6-benzylaminopurine led to a noticeable increase in plant height, stronger root development, and higher chlorophyll content compared to the control plants. The application of purine derivatives increased maize grain yield by 12–18%, confirming their potential as effective and eco-friendly plant growth regulators.

Moreover, physiological observations showed that purine compounds enhance photosynthetic activity, improve nutrient uptake, and increase plant tolerance to abiotic stress factors such as drought and nutrient deficiency. These effects make purine-based substances highly valuable for integration into maize breeding and selection programs, as they can serve as reliable tools for identifying stress-tolerant and high-yielding genotypes.

From an environmental perspective, purine derivatives are non-toxic, biodegradable, and ecologically safe, which ensures their suitability for sustainable agricultural systems. In conclusion, the study recommends the further use of purine-based compounds in maize cultivation to promote higher yields and improved stress adaptation, while also suggesting additional research to optimize application doses and understand their biochemical mechanisms of action in crop plants.

Literature:

1. Saitkulov, F., Begimqulov, I., O'ralova, N., Gulimmatova, R., & Rahmonqulova, D. (2022). Biochemical effects of the coordination compound of cobalt-II nitrate quinazolin-4-one with 3-indolyl acetic acid in the "amber" plants grades phaseolus aureus. *Академические исследования в современной науке*, *1*(17), 263-267.
2. Saitkulov, F., Qilichyeva, N., Abdullayev, B., Anvarov, A., & Ergasheva, M. (2022). Titrimetric analysis of calcium cation in" megaton" variety of cabbage. *International Bulletin of Applied Science and Technology*, *2*(10), 134-135.

3. Хайдаров, Г. Ш., Тилябов, М. У., Холмирзаев, М. М., & Элмурадов, Б. Ж. Синтез и биологическая активность гидрохлорид хиназолин-4-она. *Fan va ta’lim integratsiyasi” jurnalining Tahrir hay’ati tarkibi*.
4. Saitkulov, F., Farhodov, O., Olisheva, M., Saparboyeva, S., & Azimova, U. (2022). Chemical feeding method of lemon plant using leaf stomata. *Академические исследования в современной науке*, *1*(17), 274-277.
5. Саиткулов, Ф. Э., & Элмурадов, Б. Ж. (2022). УФ-спектральные характеристики хиназолин-4-он и–тионов. In *Innovative developments and research in education international scientific-online conference. pp-10-12*.