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The Effect of Azotobacter Strains on the Seed Germination Capacity of Wheat Varieties

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Annotation: This paper examines the influence of the Azotobacter strain on wheat growth; its impact on the biometric parameters of the agricultural crop (wheat) is determined. The selection of active strains isolated from the surface of winter wheat is studied, and their morphological, cultural, physiological and biochemical properties are analyzed. Particular attention is paid to the influence of Azotobacter on wheat growth and its impact on the biometric parameters of this crop.

Keywords: Azotobacter, Grom variety, nutrient medium, soil, fertilizer, Petri dish, gliadin, germination.

Introduction

The microflora of plants, an integral part of the external environment, is constantly influenced by external factors and exerts its own effects on it. These microorganisms (microflora) impact the vital activity of the plant organism throughout the entire vegetation period.

Epiphytic antagonists and other non-antagonistic epiphytic microorganisms proliferate on the plant surface, inhibiting the development of fungal spores, reducing the activity and growth of pathogenic microorganisms, and simultaneously enhancing the metabolic processes in plants, thereby increasing their resistance to diseases. [5, 7].

One of these epiphytes is the Azotobacter bacteria, which possesses various biological activities: synthesizing phytohormones, antibiotics, enzymes, toxins, and other metabolites. The spore-forming ability of Azotobacter, along with its rapid adaptation to external environmental conditions, including abiotic factors, helps it remain competitive in the rhizosphere, phyllosphere,

and within the tissues of the host plant.

Azotobacter is capable of synthesizing indole-3-acetic acid (IAA). This reaction (synthesis) is related to the accumulation of the amino acid tryptophan in plants, which is the ancestral molecule of ISK.

The object of the study and its methods. The subject of the study is Azotobacteria, which are widely distributed in various soils, freshwater and brackish waters, and in relatively extreme natural environments.

The Azotobacter genus includes several species, among which Azotobacter chroococcum and Azotobacter vinelandii have been studied in depth and are widely used in agriculture. Biopreparations prepared based on these bacterial strains have recently seen increasing demand. For instance, some researchers have shown that Azotobacter chroococcum plays an important role in improving the nutrition, yield, and soil fertility of various agricultural crops.

This study assessed the impact of a microbial formulation containing Azotobacter chroococcum on wheat yield in Bulungur District, Samarkand Region, during 2022–2024. Soil samples were collected and analyzed.

Azotobacter chroococcum was used at 2.0–2.5 L and 3 L per 45 kg of seed before sowing (seed treatment), and at 2.0 L/ha during the flowering and yield-formation stages.

Results of the research. Nitrogen fertilizers increase the protein content in cereal crops and, at the same time, help improve their water uptake. We know that the Azotobacter bacterium enriches the soil with nitrogen and creates favorable conditions for seed germination.

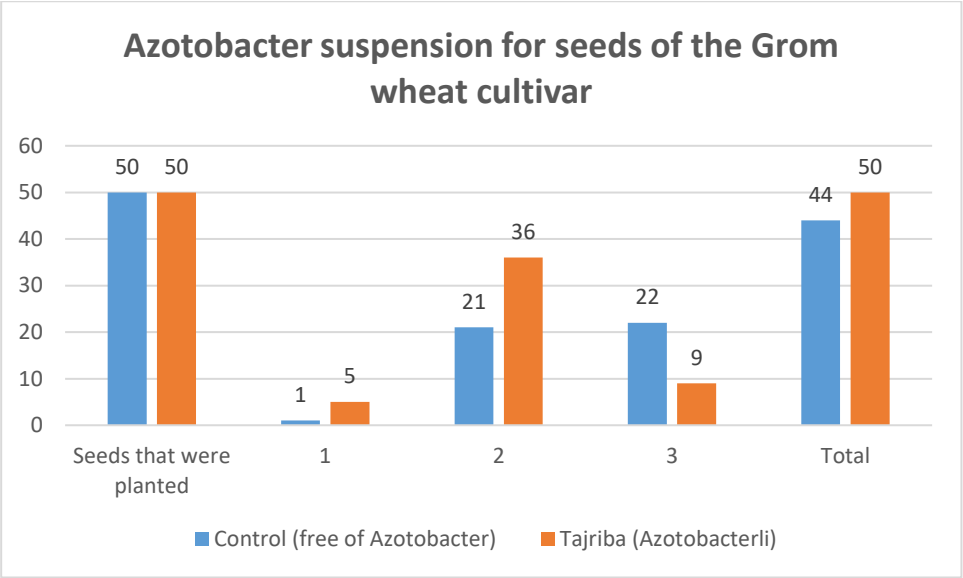
Azotobacter chroococcum strains isolated from soils in the Bulung‘ur district of Samarqand region were cultured in the laboratory on a nutrient medium prepared from Jerusalem artichoke leaf juice, as recommended by Mamadaliyev (2022). The cultures were diluted to obtain a suspension.

In our study, we determined the germinability of wheat seeds under laboratory conditions using Petri dishes. One day before sowing the seeds of the experimental variety, the wheat seeds were treated for 10 minutes with a suspension of Azotobacter chroococcum strain with a titer not less than 10^6 (CFU/mL). The control samples were soaked in plain water. Then the seeds were placed on filter paper in Petri dishes, and germination energy was determined over three days.

According to the data shown in Table 1, the germination energy of wheat seeds treated with a suspension of Azotobacter chroococcum on the third day was 100%.

Table 1. Azotobacter suspension for seeds of the Grom wheat cultivar.

Variants	Seeds that were planted	Testing days			Total	Seed viability, %
		1	2	3		
Control (free of Azotobacter)	50	1	21	22	44	88
Experiment (Azotobacter-containing)	50	5	36	9	50	100

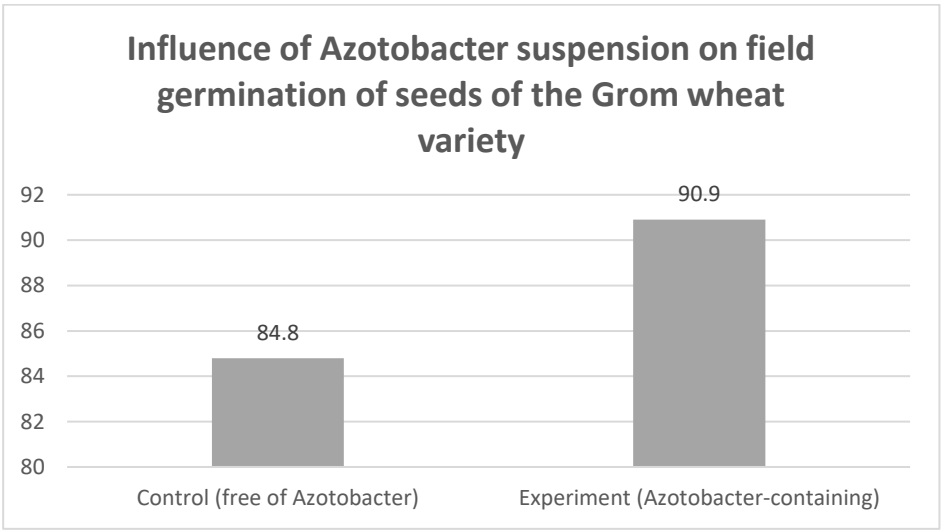


According to the results of our experiments conducted in 2022–2024, under the conditions of loamy-sandy soils for winter wheat at Grom Naviga in Bulungur District, Samarqand Region, at the Mamatov Fahriddin Valley Farm, when annually treated with Azotabacter sushenziyasi, grain yield varied from year to year (Table 2).

Field germination of autumn wheat seeds varied with temperature, soil moisture, and seed viability. For the Grom variety, in the control variant the seedling emergence was 424 per m², i.e. 84.8%. In the experimental variant (Azotobacter-inoculated), these indicators were 451 per m² and 90.9%, i.e., about 6.1 percentage points higher.

Table 2. Influence of Azotobacter suspension on field germination of seeds of the Grom wheat variety.

№	Variants	Emerged plant count per m² (plants/m²)	Field germination of seeds, %
1	Control (free of Azotobacter)	424	84,8
2	Experiment (Azotobacter-containing)	451	90,9



Conclusion

Field emergence of autumn wheat seeds depended on temperature, soil moisture, and the seed's germinability. In the Grom variety, emergence in the control variant was 424 plants per square meter, accounting for 84.8%. In the experimental variant (Azotobacter-inoculated), these figures were 451 plants per square meter and 90.9%, i.e., 6.1 percentage points higher.

The autumn–winter period's cold- and precipitation-tolerance of wheat crops is also strongly influenced by the effect of mineral fertilizers. Overall, in both studied variants, the wheat's tolerance exceeds 90%. Additionally, in the suspension-treated variant, it was found to be somewhat higher (by 3.6%) than the control.

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