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EFFECTS OF AZOTOBACTER GENERATION BACTERIA ON PLANT GROWTH AND DEVELOPMENT

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Abstract. *The study examined the effect of microbiological biofertilizer based on bacteria of the genus Azotobacter on the germination of seeds in the laboratory and in the field. The results of the study showed that based on the strain Azotobacter chroococcum -XN2018, it is important not only to germinate seeds, but also to limit their contamination by disease-causing phytopathogenic microorganisms.*

Keywords: *Azotobacter chroococcum, Andijan-36, microorganism, bacteria, biopreparation, cassette morphology, strain.*

ВЛИЯНИЕ БАКТЕРИЙ, ОБРАЗУЮЩИХ АЗОТОБАКТЕРЫ, НА РОСТ И РАЗВИТИЕ РАСТЕНИЙ

Аннотация. *В ходе исследования изучено влияние микробиологического биоудобрения на основе бактерий рода Azotobacter на всхожесть семян в лабораторных и полевых условиях. Результаты исследования показали, что на основе штамма Azotobacter chroococcum -XN2018 важно не только проращивание семян, но и ограничение их контаминации болезнетворными фитопатогенными микроорганизмами.*

Ключевые слова: *Azotobacter chroococcum, Андижан-36, микроорганизм, бактерии, биопрепарат, кассетная морфология, штамм.*

INTRODUCTION

The climatic conditions of the republic are very favorable for the growth of harmful microorganisms. This in turn leads to more damage to cultivated crops. With this in mind, about 1,000 different chemicals are currently used in various countries around the world to protect plants. [11].

Although the method of chemical protection of plants has several advantages, it is not without its shortcomings (A., 2021.). That is, chemicals are toxic to humans and warm-blooded animals; increased food poisoning with pesticide residues; poisonous to beneficial insects; resistance of pests to pesticides increases rapidly; examples such as economic value can be cited (Abdugafurovich R. B., 2021.).

The purpose of this study is to increase soil fertility, maintain plant immunity, and grow organic products based on microbiological biopreparations to combat existing phytopathogenic microorganisms in the soil.

MATERIALS AND METHODS

Ashby nutrient medium was used to isolate bacterial strains belonging to the *Azotobacter* family from soil samples and to study their biological properties; [g/l] sucrose 20 g; K2HPO4 - 0.2, MgSO4 7H2O - 0.2; NaCl - 0.2, CaCO3 - 5.0, distilled water 1.0 [9]. Bacterial colonies morphologically compatible with azotobacteria (brown-brown, black colonies, in some cases the formation of mucus) grew in the nutrient medium. As a result of replanting, bacteriologically purified *Azotobacter chroococcum -XN2018* strains were isolated.

During the growth of strains on days 3 and 6 formed light yellow, yellow, brown and dark brown pigments, and the morphological and cultural characteristics of the isolates (size, cell shape, movement) were determined using Berdji determinants using generally accepted microbiological methods [1,8,9].

The microbiological biopreparation based on the isolated strains was studied first by laboratory and then by field exposure by wetting the seeds [7,5]. Laboratory calculations of the effect of *Azotobacter chroococcum -XN2018* strain on disease and seed germination rate were performed [4].

At the same time, sterile seeds were sown in sterile sand in the Kox apparatus, artificially contaminated with phytopathogenic fungal spores in special tin seed sowing equipment required for laboratory performance. Based on three repetitions of the experiments, 300 seeds were obtained and the temperature was incubated at 25–27ºC.The experiments were performed in a small greenhouse for 30 days. In the experiment, we used cassettes designed for growing special seedlings measuring 54x28x0.9 cm. There are 72 place for seeds in each cassette. Fifteen cassettes with a width of 33x33 mm and a height of 55 mm and a bottom width of 19x19 mm, ie 39x55x19 mm, were used in each seed cell. We used seed *Andijan-36* variety. In order to be correct in the calculation, since the number of cells in 15 cassettes was 1080, experiments were also performed on the number of seeds in the number of 1080 yellow seeds. The bottom of the cassettes was covered with 10 cm thick rice husks, and a film was drawn under the seeded cassettes to prevent pathogenic microorganisms from penetrating the soil, along with water absorption during irrigation. In the laboratory, the seeds were observed for 30 days with 4 repetitions based on wetting of the seeds [3,7,8]. In studying the effects of phytopathogenic fungi on seed, sterile seeds were artificially infused with Fusarium oxysporum f.sp. vasinfectum was planted in decontaminated sand in the Kox apparatus, infested with fungal spores. We used 5 options

1- Experimental seeds with suspension liquid prepared on the basis of strain Azotobacter chroococcum -XN2018;

2- 2- Pseudomonas fluorescens is inoculated with a suspension fluid prepared on the basis of a bacterial strain;

3- 3. VITAROS s.sus.k. seeds treated with a seed drug.

4- 4. Azotobacter chroococcum XN2018 + Pseudomonas fluorescens when mixed with bacterial strains.

5- As a control option, observations were made by sowing artificially damaged seeds soaked in plain water.

Study of soil fertility by wetting seeds in the laboratory.

Options	The total number of damaged seeds	Seed germination in the soil	
		Quantity indicator	Percentage
Control (soaked in plain water)	300	243	81
Template (Pseudomonas fluorescens)	300	63	21
Template	300	57	19

VITAROS s.sus.k. (198 г/л *carboxin* + 198 г /л *thiram*)			
Experience (Azotobacter chroococcum -XN2018)	300	48	16
Azotobacter chroococcum *XH2018*+*Pseudomonas fluorescens*	300	48	16

The results of the experiments show that the fertility of seeds treated with the bacterial strains *Azotobacter chroococcum -XN2018* in the experimental variant ***84 %,*** *Pseudomonas fluorescens* in the bacterial strain, this is the figure 79 %, VITAROS s.sus.k. 81 %, **Azotobacter chroococcum *XH2018*+** *Pseudomonas fluorescens* bacterial strains also retained 84% viability as a result of concomitant use.

For this experiment, biohumus (rotten manure) and cassettes measuring 54x28 cm or 33x55x19 mm were studied for 30-35 days. During this period, the seedlings produced 3–4 leaves. The bottom of the cassettes (with rice husks) caught the temperature at 18-20 oC at night, 28-30 oC during the day, and 65-70% humidity. Each cassette was numbered separately and moistened 3 repetition with the tested drugs. In this case, 3-4 hours after the 1st wetting, 4-5 hours after the 2nd wetting, 5-6 hours after the 3rd wetting. Moistening seeds were treated 16 hours before sowing.

Fusarium oxysporum f.sp. observation of seed germination in special cassettes when infested with vasinfectum fungus.

№	Options	The norm of drug consumption	Cassette number	Number of cotton seeds (pieces)	Germination periods (26.03.2021)			Biological effectiveness %		
					Initial 01.04.2021	public 03.04.2021	Complete 06.04.2021	Initial 01.04.2021	public 03.04.2021	Complete 06.04.2021
1.	Control (soaked in plain water)	25-30л/т	1 2 3	72 72 72	27 21 23	36 30 34	46 42 47	37,5 29.2 31.9	50 41.7 47.2	63,8 58,3 65,3
all of them			**3**	**216**	**71**	**100**	**135**	**32,9**	**46,3**	**62,5**
2.	Template (Pseudomo-nas fluorescens)	Density in special LB nutrient medium 10^9kl/ml 25-30 l/t	4 5 6	72 72 72	35 36 30	45 48 46	53 60 56	48,6 50 41,7	62,5 66,7 63,9	73,6 83,3 77,8
all of them			**3**	**216**	**101**	**139**	**169**	**46,7**	**64,3**	**78,2**

3.	Template VITAROS s.sus.k. (198 г/л *carboxin* + 198 г /л *thiram*)	1 ton of hairy cotton seeds in suspension 25-30 l/t	7 8 9	72 72 72	37 39 31	52 54 48	58 61 56	51,3 51,2 43,1	72,2 75 66,7	80,6 84,7 77,8
all of them			**3**	**216**	**107**	**154**	**175**	**49,5**	**71,3**	**81,2**
4.	Experience (Azotobacter chroococcum - XN2018)	Density in special Ashbi nutrient medium 10^9kl/ml 25-30 l/t	10 11 12	72 72 72	37 32 36	58 54 62	61 58 64	51,4 44,4 50	80,6 75 86	84,7 80,5 88,9
all of them			**3**	**216**	**105**	**174**	**183**	**48,6**	**80,6**	**84,6**
5.	**Azotobacter chroococcum *XH2018*+*Pseudomonas fluorescens***	Density in the specified nutrient medium 10^9kl/ml 25-30 l/t	13 14 15	72 72 72	36 35 31	49 54 63	60 59 64	50 48,6 43,1	68,1 75 87,5	83,3 81,9 88,9
all of them			**3**	**216**	**102**	**166**	**183**	**47,2**	**76,8**	**84,7**

RESULTS

Subsequent studies were conducted on individual variants of Andijan-36 variety as seeds in natural field conditions. When sowing seeds, sowing was carried out on 01.04.2021 in the scheme 76x15x2 to a depth of 4 cm using SFOGGIA 6 pneumatic seeders. Experimental options and returns in the field were arranged in a systematic manner using the Latin square method [3]. Calculations on the number of germination of seeds were made in 3 terms with a length of 13.2 (1 pagonameter) meters;

- The first germination;
- Mass germination;
- Calculations were made on the full germination periods. First, the seeds that fell 8-10 meters from the drill were studied. During the observations, taking into account the number of seeds sown per hectare, which is lost in germination for various reasons, the seeds were separated by calculating the consumption of 2 seeds per hectare;
- 100*100/0,76=13,158
- For each meter of area with a row spacing of 76 cm 100/15=6,7
- - 100/15 = 6.7 nests were planted per meter area when row spacing was 76 cm;
- Seed consumption (quantity (1m / piece))
- 6,7*2=13,4

13,158*13,4=176,3172 formed a thousand hives.

Seeds were used at the rate of 19.1-19 kg / ha.

At the time of observation, taking into account 132 nests for each variant, the appearance of the seed at the top and the seedlings with the seed coat sticking were also calculated. A total of 132 * 2 = 264 seeds germinated.

DISCUSSION

When complete seedlings were obtained, the distribution of seeds in the hive was calculated. Plantless (%) (the reason for the absence of seedlings - unplanted, root rot, rotten seeds, seeds in dry soil) were considered seedling nests.

Effect of drugs used in the field on seed germination%

Options	Experimental area	Чигитни униб чиқиши % 76x15x2 in the scheme, the date of planting 01.04.21					
		The first sprout		Mass emergence		Full sprout	
		06.04	09.04	11.04	13.04	15.04	17.04
Control (soaked in plain water)	0.1 ha	21 7.95%	44 16.66%	118 44.69%	151 57.19%	196 74.24%	215 81.43%
Template (Pseudomonas fluorescens)	0.1 ha	25 9.46%	56 21.21%	143 54.16%	181 68.56%	236 89.39%	249 94.31%
VITAROS s.sus.k. (198 г/л *carboxin* + 198 г /л *thiram*)	0.1 ha	31 11.7%	62 23.48%	161 60.98%	208 78.78%	241 91.28%	261 98.86

Experience (**Azotobacter chroococcum - *XH2018)***	0.1 ha	29-10.98%	59 22.35%	156 59.09%	198 75 %	262 99.24%	263 99.6%
Azotobacter chroococcum *XH2018*+*Pseudomonas fluorescens*	0.1 ha	32 12.12%	61 23.10%	158 59.84%	201 76.13%	259 98.10%	261 98.86%

*** Note - the total number of sown seeds was 264, on the basis of which the percentage was calculated.*

Experiments on the percentage of seedlings germinated on April 17 The total germination of seeds in the variant *A.chroococcum -XN2018* was 99.6%, *P.fluorescens*-94.31%, *Vitaros 34% sus.k* 98.86%, in the control variant fertilized with ordinary water 81.43%, In the *A.chroococcum XN2018 + P.fluorescens* variant, the figure was 98.86%. This indicates that the germination rate is 18.17% higher than the control option.

CONCLUSIONS

In summary, seed germination of *Azotobacter chroococcum XN2018* strains when inoculated with culture fluid increased by 99.6% compared to the control variant by 18.17%. In addition, the formation of vegetative mass and healthy growth of roots, the use of microbiological biopreparation in extreme conditions was observed to be highly effective, and the additional yield was 8.7 ts / ha.

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