Pre-planting microbial treatments for onion growth enhancement

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Abstract. In agriculture, the fight against pests, diseases and weeds is of great importance in the production of food products, obtaining a high-quality, high yield. Carrying out such activities allows to save 30% additional harvest. It has been determined that 40% of agricultural crops are lost annually due to harmful organisms. Only 13.8% of agricultural products and 8.4% of vegetable crops die due to pests. According to scientists' calculations, 3 million tons of vegetable products can be saved every year in the CIS countries alone by timely effective control of harmful organisms. This article provides information on the microbiological analysis of onion seeds when treated with microbiological preparations and the effect of seeds on plant growth, bulb formation, leaf number, leaf length and yield when planted in the ground. The obtained results showed that when onion seeds were planted with microbiological preparations, an additional 1.0-0.7-0.3 t/ha was obtained due to the accelerated development of plants planted without treatment.

1 Introduction

Microbiological preparations and priming techniques can significantly impact onion seed health and germination. Osmopriming and hydropriming generally improve germination rates, but osmopriming may increase seed infestation, particularly by Penicillium spp. [1,2]. Fungicides are more effective than biological preparations like Biozym and Promot in controlling seed-borne fungi, especially when combined with priming methods [1,2]. Pre-sowing treatments with probiotics and eco-organic solutions containing silver nanoparticles can enhance onion bulb production [3]. Coating seeds with Trichoderma viride-based biopreparations may limit rot diseases during germination, while spraying growing plants with biopreparations like Biosept can effectively control diseases such as downy mildew [4]. The efficacy of these treatments varies, and factors such as coating technology, storage duration, and microbiological cleanliness of coat components play crucial roles in the success of biological seed treatments [4].

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2 Materials and methods

Recent studies have demonstrated the positive effects of microbial biostimulants on onion cultivation. Rhizobacteria inoculation can enhance onion growth and bulb yield by up to 48% [5]. Effective microorganisms (EM) significantly improve agronomic parameters, including bulb weight, diameter, and length, as well as root growth in various onion cultivars [6]. Trichoderma album and Bacillus megaterium pretreatment of onion bulbs enhances growth indices, photosynthetic pigment contents, and yield-attributing features, with T. album showing better results at lower doses [7]. The effectiveness of microbial preparations depends on fertilizer systems, with bacterization increasing crop yields on low and medium mineral soil fertility backgrounds, especially when combined with straw and green manure [8]. These findings suggest that microbial biostimulants are promising for improving onion production and quality in sustainable agriculture systems.

After the independence of Uzbekistan, a specific agrarian policy is being implemented in order to further improve agriculture, improve it with the help of modern technologies, and satisfy the population's demand for food and other agricultural products. In recent years, the adoption of various laws, decisions, decrees and programs aimed at deepening economic reforms in agriculture created a solid legal basis for the implementation of reforms. These documents are aimed at increasing agricultural products, fully meeting the needs of the population, and also at selling abroad, and in general, at further stabilizing economic independence. In order to solve these problems, it is necessary to use modern high technologies, to reconstruct agricultural production on a scientific basis.

In our republic, it is not allowed to medicate the seeds of vegetable crops in open fields with (prophylactic) preparations used before planting seeds. Since the seeds grown in the conditions of Uzbekistan are sown without chemical treatment, they lead to the widespread spread of disease in plants and a sharp decrease in productivity.

3 Research results

For the microbiological analysis of onion seeds, 1 g of each sample was measured, crushed in a mortar, and thoroughly mixed in 10 ml of sterilized water for 10 minutes. 1 ml of the prepared solution for isolation of bacteria was placed in a sterilized Petri dish and 10 ml of MPA was poured over it. The incubation period is 2-3 days, grown in a thermostat of 28-30 oC.

1 ml of the prepared solution for the separation of fungi was placed in a sterilized petri dish and 10 ml of artificial ozica Chapik was placed on it. The incubation period is 5-7 days, grown in a thermostat of 28-30oC. 1 ml of the solution prepared for separation of actinomycetes was placed in a sterilized Petri dish and 10 ml of starch-ammonia was poured over it. The incubation period is 5-6 days, grown in a thermostat of 28-30oC. To determine the surface microflora of the seeds, sterilized cups from the above-mentioned artificial ozika were poured into a petri dish, and the incubation period was 3-4 days, at a temperature of 28-30oC.

As can be seen from the obtained results, it was found that the number of bacteria in the seeds of the onion variety "Sumbula" was 10 pieces in MPA artificial food, 4 pieces of fungi in KAA food, 3 pieces of fungi and 2 pieces of bacteria in Chapika agar, 8 pieces of fungal spores (Table 1).

Table 1. Analysis of surface microflora of onion seeds

Crop type	MPA			KAA			Susla agar			Chapik agar		
	Bacteria	Actinamecetes	Fungi	Bacteria	Actinamecetes	Fungi	Bacteria	Actinamecetes	Fungi	Bacteria	Actinamecetes	Fungi
Onion	10	-	2	4	-	3	-	-	-	2	-	8

Preparation of used food is as follows:

MPA: Meat peptone agar (MPA) - Food composition: peptone - 10 g; beef extract - 3 g; sodium chloride - 5 g; agar - 20 g; distilled water - up to 1 l. pH: 6.8–7;

KAA: starch-ammonia nutrient: per liter of water (g/l)(NH4) 2SO4– 2; MgSO4 – 1; K2HPO4 – 1; NaCl - 1; CaCO3 - 3; starch - 10; if- 15-20; rN=6.8-7;

Soy agar: Feed composition (g/l): Malt extract 15.0; peptones 0.75; maltose 12.75; dextrin 2.75; glycerol 2.35; potassium phosphate mono-substituted 0.4; ammonium chloride 1.0; if 20.0. pH: 7.3;

Chapek agar: in preparation for 1 liter of water (g/l): NaNO3 – 3; KH2PO4 – 1; KCl– 0.5; MgSO4– 0.5; NaCl - 0.1; FeSO4–01; sucrose - 30, pH 7.3 ± 0.2.

Onion seeds were soaked with microbiological preparations 30 minutes before sowing and then the effect on their development was studied.

Experimental options for planting onion seeds with microbiological preparations:

1. Control without medication;
2. Trichodermin - (Trichoderma viride) - 1 gr/kg;
3. Sporangin - (Bacillus subtilis, AN 2004) - 5 ml/kg;
4. Microorganism (Trichoderma, Penicillum, Fusarium) – 1.4 ml/kg.

The experiment was planted on March 2 in 0.1 by 4 rows in the open field. Onion variety "Sumbula" was obtained. The effect of microbiological preparations used during onion development on phenological indicators is presented in Table 2.

Table 2. Effect of microbiological preparations used during onion development on phenological indicators

Options	Back	original leaf output		Onion head wrap	
		25 % 10-12 April	75 % 17-19 April	25 % 12-15 may	75 % 17-19 may
Control without drug	1	23	73	24	76
	2	24	76	25	75
	3	25	75	25	75
	4	24	75	23	77
	avarage	24	74,5	24,2	75,7
sporangin – 5 ml/kg.	1	27	76	25	74
	2	28	77	26	72
	3	29	79	28	73
	4	28	79	29	73
	avarage	28	77,8	27,0	73,0

Trixodermin – 1 gr/kg	1	29	78	35	65
	2	30	77	31	68
	3	29	79	33	67
	4	31	76	34	68
	avarage	30,0	77,5	33,3	66,7
Microcontroller – 1,4 ml/kg	1	25	75	23	76
	2	24	76	25	77
	3	23	77	24	76
	4	25	75	24	75
	avarage	24,3	75,6	24,0	76,0

In the experiment, the germination of onion seeds by 10-11 days after planting was 28.0% in Sporangin, 30.0% in Trichodermin and 24.3% in Micro-Grower, and 24% in control during this period. It was observed that onion sprouted 4-6-0.3 times faster than the control in the options where the preparations were used. By the 30th day, in the variant where the preparations were used at the beginning of onion head wrapping, it was 27.0-33.0-24.0%, while this indicator was 24.2% in the control.

The effect of microbiological preparations on biometric indicators during onion development is presented in Table 3.

Table 3. Effect of microbiological preparations on onion biometric indicators

Options	Return	Determined day, date				Productivity, t/ga
		26 may		16 june		
		number of leaves (pieces)	leaf length (cm)	number of leaves (piece)	leaf length (cm)	
Control without medication	1	4	17	5	25	15
	2	4	19	5	25	14
	3	5	21	6	27	16
	4	4	19	5	24	15
	average	4,2	19	5,2	25,3	15,0
LSD_{05} t/ga						0,26
Sx, %						3,27
Sporangin - 5 ml/kg	1	6	21	5	28	17
	2	5	22	6	30	16
	3	6	23	5	28	16
	4	5	23	6	27	15
	average	5,5	21,1	5,5	28,3	16,0
LSD_{05} t/ga						0,27
Sx, %						3,06
Trichodermin - 1g/kg	1	6	21	6	27	16
	2	5	23	5	30	16
	3	6	22	7	29	15
	4	6	23	6	28	16
	average	5,7	22,2	6	28,5	15,7
LSD_{05} t/ga						0,26
Sx, %						3,11
Microbrewery 1.4ml/ga	1	5	21	5	26	15
	2	5	20	6	28	17
	3	5	19	6	26	16
	4	4	18	5	25	14

	average	4,7	19,5	5,5	26,2	15,5
LSD_{05} t/ga						0,28
Sx, %						3,13

During the development of onions, in the case of using microbiological preparations Sporangin - 5 ml/kg, on May 26, the number of leaves was 5.5, 1.3 more than the control, and the length of the leaves was 21.1 cm, 2.1 cm longer than the control. By June 16, the number of leaves was 5.5, 0.3 more than the control, and the length of the leaves was 28.3 cm, 3.0 cm longer than the control.

Trichodermin - 1 g/kg, on May 26, the number of leaves was 5.7, 1.5 more than the control, the length of the leaves was 22.2 cm, 3.2 cm longer than the control, by June 16, the number of leaves was 6. compared to 0.8 more, the length of the leaves was 28.5 cm, compared to the control, it was 3.0 cm longer.

In our version of micro-cultivator - 1.4 ml/kg, on May 26, the number of leaves was 4.7, 0.5 more than the control, the length of the leaves was 19.5 cm, 0.5 cm longer than the control, and by June 16, the number of leaves was 5 .5 pieces were 0.2 more than the control, the length of the leaves was 26.2 cm, 0.9 cm longer than the control. When studying the effect of our experimental options on productivity, when using microbiological preparations Sporangin, Trichodermin and Microustirgich, 16.0-15.7-15.3 t/ha was obtained, which is 1.0-0.7-0.3 t/ha additional yield compared to the control gave.

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