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EFFICIENCY OF THE APPLICATION OF FUNGICIDES AND THE PREPARATION OF TRICHODERMA IN A COMPLEX WITH A CROP ROTATION IN THE POTATO DISEASES CONTROL

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ABSTRACT

The article notes that in the Tashkent region there is a wide prevalence of diseases of late blight and rhizoctonia stem canker of potatoes, as a result of which the growth and development of potatoes, as well as yield, decrease. Treatment of seed potato tubers against these diseases before sowing with Acc-Forte (Tiram 800 g/t) preparations is 80% WP, - 2.5 kg/t and Vitavax 75% WP, at a dose of 2.5 kg/t, the biological effectiveness ranged from 91.0% to 96.0%. Also, data are presented on the biological effectiveness of the application of the introduction of Trichoderma into the soil and the change in crop rotation in the fields of the experimental site of the Tashkent State Agrarian University against fusarium wilt of potato and eggplant. On the basis of the data obtained, crop rotation and the introduction of the antagonist fungus Trichoderma into the soil at the rate of 100-120 kg/ha have a positive effect on the susceptibility of potato plants to fusarium wilt. The smallest susceptibility to fusarium wilt on potatoes and the highest biological effectiveness were observed in the variant where cereals and onions were used as potato previous crops.

KEYWORDS: potato, susceptibility to diseases, late blight, Rhizoctonia, Fusarium wilt, Trichoderma, fungicide, tubers, biological efficacy, crop rotation.

1. INTRODUCTION

Potatoes in terms of production in the world ranks second after cereals. In Uzbekistan, in terms of production volume, potato ranks first among vegetable crops.

Potatoes are one of the main cash crop, “second bread”, and are also a raw material for industry. It possesses high taste, contains mineral salts, vitamins and other biologically active substances necessary for human. Its consumption level is 120 kg per person per year.

A number of certain abiotic and biotic environmental factors limits obtaining high and stable potato yields. In particular, the development of a complex diseases, the total loss of tubers from damage by which in some years reaches 35%.

Potatoes are among the crops heavily affected by diseases that often cause a sharp decline in yield. Diseases affect potatoes, both during the growing season and during storage. Fungi, bacteria, viruses, and mycoplasma organisms cause potato diseases. In particularly, significant damage to the economy of many potato-growing countries of the world is caused by such widespread diseases as late blight, early blight, rhizoctonia stem canker, actinomycetes diseases and others.[3,6]

The shortage of crops due to late blight, dry spotting, rhizoctonia stem canker and black scurf, bacteriosis and other diseases averages 30% of the gross harvest. Removal of tubers due to rot during storage increases by 5-20% or more.[7]

Planting material, weakly affected by the pathogen and planted in the soil, causes significant plant loss and a decrease in potato yield.[9]

Potato late blight is the most devastating disease. The causative agent of late blight is the fungus Phytophthora infestans ((Mont.) de Bary). In Uzbekistan, potato late blight was first noted at the end of the last century.

Researchers of the causative agent of root rot have established that the main pathogens of the disease are the fungi *Rhizoctonia*, *Fusarium*, *Pythium* and others in the complex.

Nowadays, late blight and Rhizoctonia diseases does not cause such significant damage, but it is the most common and damaging disease of potatoes. The main cultivated varieties are currently heavily affected by the tubers damage, where 20-30% of the yield is lost.[12]

A number of certain abiotic and biotic environmental factors limits obtaining high and stable potato yields, in particular, the development of complex diseases. The total loss of tubers from the damage reaches 29% in some years.

Despite the centuries-old history of pest control, plant infectious diseases are highly prevalent and harmful, causing significant losses in crop yields throughout the world.[5,8]

Based on the foregoing, the protection of potatoes from plant pathogens is an indispensable link in the technology of cultivation of crops, which should include scientifically grounded methods that help suppress pathogens or limit their development.

According to the literature, it is known that Muminov et al. (1978) found that with a potato crop rotation the number of fungi were 263 thousand, in particularly in air-dry soil, and 137 thousand g for monoculture. When determining the toxicity of fungal strains from under various crops with crop rotation, it was noted that the highest degree of toxicity is characteristic of melons and watermelons affected by fusarium wilt.[4]

In the works of A.S. Volovik, V.I. Glez (1988), great damage to potatoes caused by the disease is noted. To obtain a high yield of potatoes, it is necessary to clear the soil from infection as much as possible. Important methods include crop rotation, in particular, depending on the cultivation zone, winter cereals are good predecessors; perennial grasses, legumes, cereal mixtures, rapeseed, lupine, flax, soybeans, corn, beets and others.[11]

These measures reduce the concentration of infection in the soil. Plant residues of the aforementioned precursors are a good substrate for the reproduction of microorganisms such as fungi, in particular Trichoderma and Penicillium, as well as actinomycetes and bacteria.[2,10]

In this connection, the task was set to use various methods, in particular, new fungicides in the control against potato diseases in Uzbekistan.

The goal of our task was to test the new drug Ass-Forte 80% WP (Tiram, 800 g/kg) against late blight and rhizoctonia diseases on potatoes with the rate of 2.5 kg/t.

2. MATERIALS AND METHODS

The study was carried out in the field of LLC "Mekhnat", Tashkent district, Tashkent region against late blight and *Rhizoctonia* diseases on potatoes crops.

Potato tubers were treated on February 24, 2018. Inspection of potato seedlings for infestation by late blight and rhizoctonia was carried out during the period of development of the second pair of leaves and mass flowering. On the surveyed area, 10 samples were taken along the diagonal of the field.

Experience design

1. Ass-Forte 80% WP (Tiram 800 g / kg) - 2.5 kg/t
2. Vitavax 75% WP (Standard) - 2.5 kg/t
3. Control - no treatment (unsprayed).

Determination of biological efficacy of preparations against the disease. Decrease of contamination rate of infected potato plant by pathogens in the variants treated with fungicides and biological preparations is defined in percentage comparing to control variant, and biological efficacy of preparations has been found according to the following formulae:

$$Bef = \frac{(a-b)}{a} \times 100,$$

Where:

B_{ef} – biological efficacy of fungicide, %;

a – severity of diseases in control variant, % ;

a – severity of diseases in experimental variant, %.[1]

3. RESULTS AND DISCUSSION

Ass-Forte 80% WP (Tiram, 800 g/kg) fungicide was used in the control of late blight and Rhizoctonia stem canker disease of potatoes as a tuber dressing.

The conducted counts for the susceptibility to late blight of potatoes show that in control the susceptibility was 45.7%, with the development of the disease 7.8%. The best result was shown by the fungicide Ass-Forte 80% WP (Tiram, 800 g/kg) at the rate of 2.5 kg/t, where the biological efficiency was 92.3%, with a plant damage rate of 2.5%, disease development of 0.6% (Table 1).

The conducted counts for the susceptibility of potato Rhizoctonia stem canker show that in control the susceptibility was 31.9%, with the development of the disease 7.6%. The best result was shown by the fungicide Ass-Forte 80% WP at the rate of 2.5 kg/t, where the biological efficiency was 94.7%, with a plant damage of 1.1%, the development of the disease 0.4%.

In the experimental variants, significant difference were observed between treated and control.

The biological efficiency of the reference fungicide Vitavax 75% WP at the rate of 2.5 kg/t for late blight was 91.0%, with a plant damage of 2.1%, the development of the disease 0.7%, and for Rhizoctonia stem canker it was 96.0% , with a plant damage rate of 0.9% and disease development of 0.3%.

In small-plot experiments, we studied the effectiveness

of precursors in combination with a biological preparation Trichoderma against Fusarium wilt of potatoes and eggplant.

Small-plot experiments were carried out on the field of the experimental base of the Tashkent State Agrarian University, Kibray district, Tashkent region, on potatoes, variety Rosaro and on eggplants, variety Yerevanskiy.

The results of our experiments are presented in Table 2. The data in the table show that in the experimental variant with the predecessor of 2-year-old alfalfa, potatoes were planted with the introduction of Trichoderma, where the infestation of potatoes by fusarium wilt in the first year was 14.1% and in the second year 9.7%.

Table 1: Biological efficiency of the fungicide Ass-Forte 80% WP (Tiram 800 g/kg) against late blight and Rhizoctonia stem canker diseases of potatoes (Tashkent region, Tashkent district, LLC "Mekhnat", 2018)

№	Experience options	Consump-tion rate, kg/t	Damage to plants,%		Plant disease development,%		Biological efficiency,%	
			late blight	Rhizoc-tonia stem canker	late blight	Rhizoc-tonia stem canker	late blight	Rhizoctonia stem canker
1	Ass-Forte 80% WP (Tiram 800 g/kg)	2,5	2,5	1,1	0,6	0,4	92,3	94,7
2	Vitavax 75% WP (Standard)	2,5	2,1	0,9	0,7	0,3	91,0	96,0
3	Control - no treatment (unsprayed)	–	45,7	31,9	7,8	7,6	–	-

Table 2: Influence of previous crops and Trichoderma on the susceptibility of potato and eggplant to Fusarium wilt. (Experimental base of Tashkent State Agrarian University, 2016-2019)

Preceding crops by year				Severity of Fusarium,%.		Biological efficiency, %.	
2016	2017	2018	2019	2018	2019	2018	2019
Potato variety -Rosaro							
Alfalfa	Alfalfa	Potatoes + Trichoderma	Potatoes + Trichoderma	14,1	9,7	64,1	77,7
Potato	Potato	Potatoes + Trichoderma	Potatoes + Trichoderma	36,4	31,3	7,3	28,0
Tomato	Potato	Potatoes + trichoderma	Potatoes + Trichoderma	29,3	24,5	25,4	43,6
Cereals	Onion	Potatoes + Trichoderma	Potatoes + Trichoderma	12,1	8,3	69,2	80,9
Control tomato	Potato	Potatoes + Trichoderma	Potatoes + Trichoderma	39,3	43,5	0,0	0,0
Eggplant variety - Yerevanskiy							
Tomato	Potato	Eggplant + Trichoderma	Eggplant + Trichoderma	20,2	17,4	48,6	60,0
Cereals	onion	Eggplant + Trichoderma	Eggplant + Trichoderma	13,4	9,8	65,9	77,4

In the variant where potatoes were planted for 4 years, but with the use of Trichoderma in the last two years, in the first year the attack by Fusarium was 36.4%, and in the second year it was 31.3%.

In the variant: two years tomato and potatoes and the last two years potatoes with Trichoderma, the first year the incidence of Fusarium disease was 29.3%, the second year - 24.5%.

In the variant, cereals, onions and potatoes with Trichoderma in the last 2 years as previous crops, the damage rate in the first year was 12.1%, in the second year - 8.3%.

The next stage of our research was to study the effect of Trichoderma on the susceptibility of potatoes to Fusarium in permanent plots.

The data of the observations showed that in the variants of the experiment where potatoes were grown for two years, and then in the next two years the biological

preparation Trichoderma was used, the susceptibility of potatoes to Fusarium in the first year was 36.4%, and in the second year 31.3%.

We also studied the influence of other crops from the Solanaceae family on the susceptibility of potatoes to Fusarium wilt. For this purpose, we carried out a record of the affection of potatoes with this disease, where tomatoes were planted in the first year, and potatoes in the second year, in the next two years potatoes with the introduction of Trichoderma. The account of the susceptibility to Fusarium diseases was 29.3% in the first year, and 24.5% in the second year.

In the variants of the experiment where cereals and onions were used as predecessors, and in the next two years, Trichoderma was introduced into this soil and potatoes were grown in these fields, it was shown that the infectivity of potatoes by fusarium in the first year was 12.1%, and in the second year 8,3%.

In the control variant where tomato grew in the first year, and in the next three years potatoes without Trichoderma, its susceptibility in the first year was 39.3%, and in the second year it was 43.5%.

4. CONCLUSIONS

Biological effectiveness of the fungicide Ass-Forte 80% WP when processing potato tubers at the rate of 2.5 kg/t, in the fight against late blight of potatoes it was 92.3%, in the control against Rhizoctonia stem canker the biological efficiency was equal to 94.7%. Ass-Forte 80% WP fungicide showed high efficiency when processing potato tubers at the rate of 2.5 kg/t. Ass-Forte 80% WP fungicide showed high efficiency when processing potato tubers at the rate of 2.5 kg/t.

Based on the experimental data obtained, it can be concluded that the crop rotation and the introduction of the antagonist fungus Trichoderma into the soil at the rate of 100-120 kg/ha have a positive effect on the susceptibility of potatoes to Fusarium. The smallest susceptibility to Fusarium on potatoes and the highest biological effectiveness were observed in the variant where cereals and onions were used as potato

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