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The Use of New Fungicides for Controlling Potato Late Blight in Uzbekistan

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Abstract: *The article discusses the development of a late blight disease that was not previously characteristic in the conditions of Uzbekistan. In 2015-2017 years in the territory of Tashkent district and in the small training farms of Tashkent state agrarian university the presence of the late blight was recorded in the potato plants and the rate of the disease was 27.9% – 36.3%. In order to provide a research in combating against late blight disease new fungicide, like Banjo Forte SC, Tanos, Zeroks, Antrakol 70% were used. For comparison the fungicide Ridomil Gold 68% was taken. A good result for suppressing the disease the fungicide which has 85,7% biological effect is Zeroks (3000 mg/l colloidal silver), the next one is Antrokol - 70%-85,6% in leaves and 82,9% in stems, Tanos – 84,6% in leaves and 87,5% in stems.*

Keywords: *potato, late blight, Phytophthora infestans, disease, pathogen, zoospores, extension, increasing harmfulness, fungicide, biological effectiveness.*

1. INTRODUCTION:

Vegetable, in particular potato, is one of the most important branches of agriculture, because it provides food for population, which the agriculture has a connection and major tasks for a significant improvement in the improvement of vegetable products and the industry of raw materials. In Uzbekistan, in terms of production, potato is ranked as the first vegetable among other crops.

One of the most important tasks, in improving the quality and quantity of agricultural products, is to reduce the losses from harmful organisms, in particular from the development of various plant diseases.

According to the literary data, currently there are about 30 most common potato diseases, which include: root rot, various wilting, spotting, and lately in Uzbekistan late blight has been joined by, the causative agent is the fungus *Phytophthora infestans* (Mont.) De Bary.

According to A.V. Filipov (2012), the emergence in recent years of more aggressive strains of the pathogen *Phytophthora infestans* led to a reduction in the infectious cycle and an earlier and rapid development of epiphytotics. Another wave of sharp increase in the risk of late blight was recorded in the 1980s [5].

At that time almost in all potato-growing countries previously distributed clone *Ph. infestans*, which was denoted as US-1, has been extruded by new, previously unknown clones. The pathogen has become less dependent on temperature and humidity. Thus, isolates of "new" populations are capable of infecting potato plants at 3–27 ° C; for "old" populations, this interval was 8–23°C. At equal temperature, the infection of plants with isolates of "new" populations require almost double period of droplet-liquid moisture on the leaves. In connection with this, the number of possible generations of the pathogen were increased during the vegetative season. Nowadays, late blight disease is detected rather early in potato crops. The rate of the development of the disease is increased during the vegetation season. The risk of severe infection of tubers is increased significantly. In connection with those changes, the possibility of pathogen penetration has been occurred in Uzbekistan.

According to the traditional view on the spread of late blight, the disease is found in the European part of the former Soviet Union and in the Far East, in regions which have a hot climate with abundant dews and mists. It was believed that the regions of the southern part of Central Asia are the zones that have an absence of this disease. However, it should be noted that currently the pathogen of late blight is noted in the territory of Uzbekistan. The first mention of the presence of late blight of potatoes was noted by [10].

Additionally, the presence of late blight in Uzbekistan was mentioned by [6, 9].

According to H. Buriev et al. (2002) in Uzbekistan due to the development of late blight 30-40% of the potato crop is lost [1].

Since 2015, late blight has been observed in potato crops in the Tashkent region, and the degree of disease development was 19.3-36.3% [7, 8].

2. GOALS AND TASKS OF THE RESEARCH:

Currently, among the measures aimed at reducing potato crop losses from late blight, the main ones are the chemical method of protection, i.e. the use of fungicides.

Fungicides registered in Uzbekistan against diseases of vegetable crops, in particular potatoes, are relatively few. Great importance should be given to the presence in the country of a sufficiently wide range of highly effective and registered fungicides with different active ingredients, so that agricultural workers have the opportunity to use them to avoid the development of resistance of pathogens to certain pesticides.

In this connection, the goals was set to use new fungicides in the control of potato late blight.

The goal of our task was to test the fungicide, including; Banjo Forte SC, Thanos WDG, Zeroxxe®, Antracol 70% WP, against late blight on potatoes. For comparison, the fungicide Ridomil Gold MC 68% WP was taken.

3. MATERIALS AND METHODS:

The experiments on the control of potato late blight were carried out in the conditions of the Tashkent region, the farm "Zhamol-Fayz Baraka" of the Tashkent region, in a small research station of the Tashkent State Agrarian University of the Kibray district. The survey of crops began with blossoms during the development of the second pair of leaves.

To account for the intensity of the development of diseases, the total number of affected plants was detected and a plant damage scale was used (Velikanov et al., 1980), where the percentage of affected organs or plants is calculated (0 point - no lesions; 1 point - up to 1/5 of the total plant area is affected or up to 10% of the leaf surface; 2 - affected up to 1/3 of the plant area or up to 25% of the leaf; 3 - affected up to 2/3 of the plant surface or up to 50% of the leaf surface; 4 - affected over 2/3 of the plant or more than 50% of the surface sheet) for each point of a 4-point scale according to the formula:

$$R = \sum \frac{(AB + AB2 + AB3 + AB4)}{K};$$

Where:

R - the intensity of the disease
A - the number of plants
$B_1; B_2; B_3; B_4$ - scores from 1 to 4
$\sum(AB)$ - the sum of the products of the number of plants for their corresponding score
K - the highest score on the lesion intensity scale.

The calculation of the biological effectiveness of fungicide produced by the formula:

$$B = \frac{a-b}{a} \times 100;$$

Where:

B - biological effectiveness;
a - the development of the disease in control;
b - development of the disease in the experience.

4. RESULTS AND DISCUSSION:

The results of the study when using pesticides against late blight on potatoes in Uzbekistan given in table.

The table shows that the best result of suppressing the disease was shown by Zeroxxe® (3000 mg / l colloidal silver), the biological effectiveness of which was 85.7% on the leaves and stems, then, Antracol 70% WP- 85.6% on leaves and 82.9% on stems, Thanos (famoxadone + cymoxanil) - 84.6% on the leaves and 87.5% on the stems, Banjo Forte SC (fluazinam + dimethoform) -81.8% on the leaves and 84.1% on the stems. The fungicide Ridomil Gold MTs 68% EG (mefenoxam+mancozeb), this indicator was 80.4% and 82.5% on the leaves and stems, respectively.

As a result, it can be said that Antrokol preparations are 70% WP and Tanos WDG showed better results rather than the other compared fungicides.

The chemical method plays an important role in the integrated potato protection program. For optimal use of fungicides, it is important to know the principle action and the type of activity of the active substances that make up the fungicides for protecting potatoes against fungi and oomycete: effectiveness in protecting leaves, stems and tubers, the ability to protect new plant growth [3, 4].

Table
Biological efficacy of the studied fungicides against late blight potato

№	Fungicides	Usage rate, kg/ha, l/ha	Leaves			Stems		
			Plant affliction, %	The development of plant diseases, %	Biological effectiveness, %	Plant affliction, %	The development of plant disease %	Biological effectiveness, %
1	**Banjo Forte SC**	1,0	3,5	1,.5	81,.8	2,4	1,0	84,1
2	**Tanos WDG.**	0,6	5,5	1,2	84,6	2,9	1,0	87,5
3	**Antrocol 70% WP**	2,0	5,8	1,3	85,6	2,5	1,1	82,9
4	**Zeroxxe® (3000 mg/l of colloidal silver)**	3,0	3,0	1,2	85,7	2,0	0,9	85,7
5	**Ridomil Gold m.c, 68,0% EG**	2,5	6,6	1,5	80,4	4,0	1,4	82,5
6	**Control – without processing**	–	19,3	8,4	–	14,2	6,3	–

Analysis of active substances and effect on fungi is given by the works of Filippov and Derenko [2, 5].

Of those registered for use on potatoes, some pesticides are outdated and have a number of disadvantages and limitations on their use. It is necessary to expand the range of pesticides to protect potatoes from late blight and therefore this work was planned.

Phenylamide fungicides, such as mefenoxam (metalaxyl-M), are specialized active ingredients aimed at controlling oomycetes. These compounds inhibit the ribosomal RNA of the pathogen and are able to control the development of oomycete practically at all stages of its life cycle. Phenylamides are used in combination with active substances from other chemical classes in order to expand the spectrum of fungicide activity. The most common partner for phenylamides (about 50% of phenylamide-containing preparations), as a rule, is the representative of the dithiocarbamate class - mancozeb. This group includes the fungicide Ridomil Gold MC.

Another reason for using phenylamide-based mixed fungicides is an increase in the overall effectiveness of the pesticide. The third reason is to prevent or slow down the development of pathogen resistance. However, even when using phenylamides, the frequency of their use during the season should not exceed 2-3 treatments [5].

Phenylamides have a strong inhibitory effect on the formation of zoosporangia and the growth of mycelium inside plant tissues. They are characterized by high mobility inside the leaf and from leaf to leaf, so they are most appropriate to use during the period of active plant growth.

Representative of the class of cyanoacetamides, the active ingredient is cymoxanil, which, in combination with famoxadone, is part of the preparation Tanos, widely used to control oomycetes on vegetables, potatoes, grapevines and some other crops. Cymoxanil has a protective and therapeutic effect, as well as local-systemic movement within the plant. Cases of a significant decrease in the efficacy of pesticides based on cymoxanil in hot weather conditions have been noted.

The mode of action of cymoxanil is the inhibition of the synthesis of nucleic acids and amino acids, and the disruption of other processes associated with cell formation. Nowadays, no strains resistant to cymoxanil have yet been detected [5].

The composition of the pesticide Banjo Forte SC includes active ingredients of the dinitroaniline group, the only representative of this class of compounds allowed to protect potatoes against late blight, is contact fungicide fluazinam and cinnamic acid amides - dimethomorph, which affects the processes involved in the formation of the cell wall, namely, inhibits synthesis fibrillar components of the cell wall of the pathogen, causing their lysis. The biochemical mechanism of action of fluazinam is a violation of the process of oxidative phosphorylation in fungal cells. Fluazinam acts on sporulation, the release of zoospores from zoosporangia, the germination of conidia, the mobility of zoospores. Effective for using in the early periods of the development of potato plants and to protect the tops and tubers in the later stages of crop development.

The only thing that we did not find information on colloidal sulfur preparations to which Zeroxxe® is a pesticide, but in our work it showed the best result.

All of the above confirms that the fungicide, which we studied, are effective and can be recommended in the practice of potato growing in Uzbekistan.

5. CONCLUSION:

The late blight of potato in the climate of Uzbekistan is widely spread in the central regions of the country, with the degree of disease development being 19,3-36,3% and continuing to grow.

Preparations Antrokol 70% WP and Tanos WDG. gave good results and they can be used against the late blight of potatoes in the practice of agriculture in Uzbekistan.

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