NEW MEANS OF COMBATING *PHYTOPHTHORA INFESTANS* AND *ALTERNARIA SOLANI* FUNGI IN POTATO CROP

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Abstract

Potato growing technology, along with agro-technical methods, well known and appreciated, includes a lot of new items. Permanent is performed adding new varieties possessing diverse resistance to pests and diseases, requiring a corresponding special suspension related to pesticide use. In this connection, it is necessary to develop an integrated complex of measures to protect potato crop pests, diseases and weeds. From the whole complex of diseases of potato, the most common and the most dangerous are: blight, caused by *Phytophthora infestans* fungus phytopathogenic and brown staining of leaves of potato - phytopathogens fungus *Alternaria solani*. Attack frequency and intensity of these diseases depends largely by the hereditary peculiarities of the variety, plant capacity to resist and environmental conditions. Therefore, it is not coincidences that in wet years or on the irrigated plots, the development of these diseases often take on a epifitotic character. In this context the above mentioned diseases require multilateral study, being constantly in the scientists' attention in Moldova.

Key words: potato, diseases, testing, insecticides

Over the past two decades in Moldova were intensified the scientific investigation related to the study of potato cultivation and the feeding argumentation of republic's population with this product. In this connection, in republic were essential expanded the areas cultivated with potato. At the same time it was necessary to study various technological elements relating to the cultivation of this crop (Busuioc M., 2006). Potato growing technology, along with agro-technical methods, well known and appreciated, includes a lot of new items. Permanent is performed adding new varieties possessing diverse resistance to pests and diseases, requiring a corresponding special suspension related to pesticide use. In this connection, it is necessary to develop an integrated complex of measures to protect potato crop by pests, diseases and weeds (Croitoru N. *et al*., 2010). From the whole complex of diseases of potato, the most common and the most dangerous are: blight, caused by *Phytophthora infestans* fungus phytopathogenic and brown staining of leaves of potato – phytopathogens fungus *Alternaria solani*. Attack frequency and intensity of these diseases depends largely by the hereditary peculiarities of the variety, plant capacity to resist and environmental conditions. Therefore, it is not coincidence that in wet years or on the irrigated plots, the development of these diseases often take on a epifitotic character. In this context the above mentioned diseases require multilateral study, being constantly in the scientists' attention in Moldova (Кроитору Н., Пануца С, 2012). In connection with the intensification of potato crop in Moldova creates conditions for the spread mass and a more intensive development of phytopathogenic fungi. The complex of potato integrated protection involves the use of all preventive measures, starting with the crop rotation system, use of healthy planting material, soil preparation at a high level, the terms of planting and ending with the harvesting of this crop. But the restriction to the agro-technical methods often compromise the quality and quantity of the harvest. Therefore, together with various methods of prevention, it is necessary to use the chemical method. It is through proper use of fungicides, chemical treatments in optimally fulfilling and recommended dosages, which provides a highly efficacy of the chemical method of potato protection by diseases. These objectives could be achieved also through the practical implementation of an integrated potato protection, scientific argued, that a special place is offering the use of new fungicides with different mechanisms of action. Proceeding from the above, the purpose of current research was to study the biological effectiveness of product

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Axiom 720 SC in controlling phytopathogenic fungi *Ph. infestans* and *A. solani*.

MATERIAL AND METHOD

Scientific research related to the State approval of the Axiom 720 SC fungicide were performed in 2015. The experiments were organized on irrigated potato fields, at "Costeşti" household farm from Ialoveni district. The fields landscape is very diverse, irregular with multiple exhibitions of South Western and South-Eastern slopes. This configuration of household territory provides a variety temperatures that influence the creation of special microclimate conditions. The soil is sandy loam mold type. Three sides of the experimental group was bordered by fields of potato production, and in the East were vegetable crops. The rows and plots direction was from East to West. The potato was planted half-mecanized in late March - early April. Scheme planting was 70 x 25 to 30 cm. In experiment were included four versions: control, untreated; standard, Bravo 500 SC- consumption norm 1.8 l/ha; Axiom 720 SC, with consumption norm - 1.5 l/ha; Axiom 720 SC, with consumption norm - 2.0 l / ha. The experiment was organized in four repetitions. The location of parcels in the experimental group was compact, randomized. In each plot were included 4 rows, each with a length of 15 m. Thus, the plots were rectangular, with a surface of 42 square meters. In each plot were included 180-200 plants. Until the beginning of chemical treatments application, each plot was marked with special nameplates, hung on a peg with a height of 40-50 cm. In each of these it has been included information about numbers of variants, their content and the number of repetitions. The consumption of products and the volume of water required to treat a plot and the each variant repetition was calculated based on the consumption norm per 1 ha. In order to deal with differences and to prevent the burns emergence on plants, the treatments were done on the same day, in the morning on quiet time. Observations and records the occurrence and development of disease have been carried out periodically, in every decade and before harvesting, as required of methodical elaboration for pesticides approval. In the experimental group were performed three chemical treatments, using portable sprayer (Centrul de Stat, 2002).

RESULTS AND DISCUSSIONS

Meteorological data analysis showed that weather conditions during the vegetation period of 2015 were unfavorable for the development of late blight phytopathogen. As previously mentioned, the experimental group was irrigated five times, which allowed to maintain accelerated growth and intensive development of the potato. In bud stage - beginning of flowering the potato plants were united, covering total space between rows. Considering the biological peculiarities of the fungus *Phytophthora infestans*, which is characterized to appear in this particular period of development of potato and environmental conditions that have been created, it was agreed that in 2015 the first treatment to be done on May 16. It deserves to be emphasized that in our research, the growth and development of potato plants bore a character much faster and so the first chemical treatment was done relatively ahead of the traditional terms (June 1 to 10). Records and observations on the emergence and development of late blight and other diseases of potato were performed before treatment and at the end of plant vegetation. To do this, from the middle of each plot were taken of 50 plants that have investigated the presence of lack of leaves attacked by late blight. To calculate the intensity of the attack was used 8-point scale. Between these two basic records, permanent observations were done on the emergence and development of disease. Performed records before treatment showed that in the experimental group plants attacked by late blight are missing. But in the period from May 25 until June 25 experimental group was irrigated, after that in control variant were detected first symptoms of late blight. Also during this period was marked a spread and a further development of other diseases. Therefore on May 26 it was achieved the second treatment. The 3rd treatment was carried out on 5 June. Results records are shown in Table 1. As shown in the table at the end of vegetation, or before harvest, late blight has become highly developed, reaching 100% attack frequency in control variant and the intensity of disease development slightly exceeded 30 % (30.56%). From the treated variants, the best results were acquired in the fourth variant which constituted 70.50% attack frequency and intensity of development of the disease has reached 5.31%.

Comparing the results obtained in this variant with standard is seen as the final fail shortly after the attack frequency, but these deviations are not essential. Analyzing the report of results obtained in the third variant with the control can be observed that the preparation Axiom 720 SC, with the consumption norm 1.5 l/ha has reduced the frequency of attacks with 20.50% and disease development intensities of 2.59 times but this variant essentially gives both standard and variant fourth.The calculation of the biological effectiveness has given us the opportunity to find that the maximum value of this index was acquired in the fourth variant

(82.62%). In standard variant the biological effectiveness was reduced to 0.41%, but this is not essential deviations. So in spite of that, in 2015 the late blight had a relatively low development, it was found that the most effective in combating this disease is Axiom720 SC fungicide with consumption norm 2.0 l/ha, which provided a biological efficacy of 82.62%. The same product, with consumption norm 1.5 l/ha, after the index gives both standard variant and fourth variant.

Table 1

The biological efficacy of the Axiom 720 SC fungicide, in *Phytophthora infestans* fungi combating (2015)

No.	Variants	Consumption norm, l/ha	Attack frequency, %	Development intensity, %	Biological efficacy, %
1	Control	untreated	100.0	30.56	0.0
2	Standard, Bravo 500 SC	1.8	71.00	5.44	82.21
3	Axiom 720 SC	1.5	79.50	11.81	61.35
4	Axiom 720 SC	2.0	70.50	5.31	82.62
	DEM, 95%		2.54	0.74	3.10

It is well established that the presence of the late blight on leaves have an adverse effect on the quantity and quality of tubers. Therefore, while determining the biological effectiveness of product Axiom 720 SC on disease development on the leaves were carried records on yield and tuber attack level with the late blight. The results are shown in Table 2. The results shown in the table demonstrates that the highest yield was acquired in the fourth variant (25.365 t/ha), where the addition from the control reached 12.561 t, which accounts for 49.52%. Comparing the fourth variant with the standard is observed that after this last yields indicate diversion but is not essential. From the late blight biology we know that the damage caused by this disease is expressed not only by reducing the yield due to premature drying of the leaves, but by attacking the tubers

Table 2

The results of yield in experimental plot for the product Axion 720 SC testing, in the late blight combating (2015)

No.	Variants	Consumption norm, l/ha	Yield t/ha	Including						The results of the analysis of tubers after 2 months of storage			
				planting material		for consumption		fodder		the tubers mass, kg	in which		
				t/ha	%	t/ha	%	t/ha	%		healthy, kg	infected, kg	%
1	Control	untreated	12.804	2.217	17.31	10.062	78.58	0,525	4.10	10.2432	10.0482	0.195	1.90
2	Standard, Bravo 500 SC	1.8	25.191	1.824	7.24	22.969	91.18	0,398	1.58	20.1528	20.1528	0.0	0.0
3	Axiom 720 SC	1.5	16.015	2.647	16.53	12.868	80.35	0,5	3.12	12.8120	12.709	0.103	0.80
4	Axiom 720 SC	2.0	25.365	1.79	7.06	23.004	90.69	0,571	2.25	20.2920	20.2920	0.0	0.0
	DEM, 5%		0.11										

In the result of fraction analysis for the fodder has been found that it is composed only of small size tubers. Tuber attacked by the late blight were not detected in the 4th variant and in standard variant, and in 3rd variant were detected only unique specimens. As mentioned above, the pedo-climatic conditions of the vegetation period of 2015 were relatively favorable for the development of potato brown staining. These conditions were created by making five irrigation experimental group. The first symptoms of the disease were scored in the bud stage. Special attention deserves that chemical treatments in 2015 were more than necessary and effective counter the early blight than the late blight. Therefore, while we recorded the late blight, we made observations of potato brown staining. The results are shown in Table 3. The results shown in the table gave us the opportunity to state that the attack frequency in control variant constituted 100% and intensity of development of the disease reached 37.5%. From all variants treated the best results were achieved in the fourth variant, which made up 61.5% of attack frequency and intensity of development of the disease, no exceeded more than 10% (6.13%).

The calculation of the biological efficacy demonstrated that this index has reached the maximum values in the fourth variant (83.65%) and it is on the level with the standard. In the third variant this figure is much lower (62.99%) and essentially gives both standard also fourth variant.

So it can be concluded that Axiom 720 SC fungicide with consumption norm of 2.0 l / ha, provides biological efficacy in combating the fungus *A. solani*, of 83.65%. The same product, with consumption norm 1.5 l/ha, does not provide a satisfactory effectiveness.

Table 3

The biological efficacy of Axiom 720 SC fungicide, in Alternaria solani fungi combating (2015)

No.	Variants	Consumption norm, l/ha	Attack frequency, %	Development intensity, %	Biological efficacy, %
1	Control	untreated	100.00	37.50	0.00
2	Standard, Bravo 500 SC	1.8	62.50	6.19	83.49
3	Axiom 720 SC	1.5	76.50	13.88	62.99
4	Axiom 720 SC	2.0	61.50	6.13	83.65
DEM, 95%			3.09	1.26	4.41

CONCLUSIONS

1. In the experimental year (2015) were created relatively favorable conditions for the development of the phytopatogenic a. solani fungus and less favorable for the development of late blight.
2. The axiom 720 sc fungicide with the consumption norm 1.5 l/ha, do not provide satisfactory protection of the potato fungus a. solani and ph. infestans.
3. The most effectively to combat the late blight and brown staining of leaves of potato is axiom 720 sc fungicide, with the consumption norm 2.0 l/ha, which provides biological efficacy of 82.62 and 83.65% respectively.
4. Based on research conducted and the results obtained are recommended to be included in the integrated protection of potato diseases as potato fungicide for combating phytopathogenic fungi ph. infestans and a. solani, the product axiom 720 sc with consumption norm 2.0 l/ha, by performing 2-3 treatments).

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