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Influence of insecticides on the harvest and quality of potato tubers in the conditions of West Kazakhstan region

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Abstract. The article presents the results on the yield of potatoes, on the starch content in the tubers, which determined a certain degree of damage to the tops of the Colorado potato beetle. The lowest yield was obtained in the control, and in the variants with the use of insecticides against the Colorado potato beetle, compared with the control, it increased in all experimental variants, depending on the chemical preparation used, in 2017 by 1.8-4.5 times, the lowest indicator by the variant with the preparation cytkor, in 2018 the yield showed a difference of 1.8-4.05 times, it was also the smallest on the variant with cytkor, in 2019 the yield increased 1.81-4.41 times and here the lowest indicator was also when using cytkor. Potato yield on average for 3 years with the use of insecticides in the fight against the Colorado potato beetle was obtained in the range of 12.6 - 16.9 t / ha in the variants of cytkor, aktara, akar, confidor, bankol, kinmix. A high yield (25.4 t / ha) was obtained when potato plantings were treated with fastacprofi, 28.8 t / ha - in the variant using karate zeon and 29.6 t / ha when decis expert was used. The starch content in potato tubers in the control untreated variant was 10.1 - 10.3%, and in the variants with pesticides - 15.0 - 16.4%, or 4.9 - 6.1% more than in the control. Potato yield and starch content in tubers depend directly on damage to potato plants by the Colorado potato beetle.

1. Introduction

The protection of potatoes from the main pest, the Colorado potato beetle, is always based on the use of preparations of various chemical groups. But there is always a difficult task - when, how and with the help of which insecticide it is possible to quickly and effectively protect the planting of potatoes by exterminating the pest, since the recommendations may not always coincide with the proposals.

Some researchers recommend using insecticides fury and aktara against the Colorado potato beetle and, accordingly, processing the tops during the period of maximum hatching of larvae, which, after spraying, these preparations could provide a reduction in the number of the pest by 96-97%. Others recommend using Aktara and Actellic to combat the Colorado potato beetle. But they recommend alternating these drugs with each other so that insects do not get used to them. These authors [1] point out that the cultivation of potatoes is impossible without the use of pesticides.

According to the authors [2-4], one of the main problems in the fight against the Colorado potato beetle *Leptinotarsa decemlineata* (Say) is its remarkable ability to develop resistance to almost all insecticides that have ever been used against it and were [5] more effective in the fight against *L. Decemlineata* larvae than natural preparations.

The development of recommendations of many researchers allows you to effectively grow potatoes in small-scale production and the issues of economic management of production are brought to the



fore, which can make it possible to use the achievements of scientific and technological progress, technology and material resources with great effect.

The aim of the research is to study the effect of insecticides on the yield and quality of potato tubers when used in the fight against the Colorado potato beetle.

2. Materials and methods

In connection with the urgency of the problem in 2017-2019, studies were carried out to identify the effectiveness of insecticides on potatoes in the fight against the Colorado potato beetle and to increase the resistance and productivity of potato agrophytocenosis in the West Kazakhstan region. The studies tested insecticides with the optimal application rate as the most effective against the Colorado potato beetle and identified effective insecticides that affect the yield and quality of potato tubers.

The research was carried out on the experimental field of the NJSC "West Kazakhstan Agrarian-Technical University named after Zhangir Khan "in the farm" Desumbaev B.K. " in 2017-2019 agricultural years. The object of the study was the mid-early variety "Nevsky" (zoned). The soil of the study area is dark chestnut. The predecessor is black steam. In the arable layer, the humus content is 3.1%, total nitrogen - 0.3 and phosphorus - 0.14%.

Potatoes were grown under irrigation conditions. Winter plowing was carried out to a depth of 27-30 cm and superphosphate (120 kg / ha a.i.) and potassium chloride (60 kg / ha a.i.) were added under it, and in the spring with cultivation, ammonium nitrate (60 kg / ha etc.).

From tillage: early spring cultivation, moldless loosening by 27-30 cm and harrowing directly before planting.

Planting scheme of potatoes 70 × 35 cm with a mass of tubers 50-80 g at a planting depth of 6-8 cm. During the growing season of potatoes in the field, weeds were destroyed and the soil was in a loose state. Irrigations were carried out as needed with an irrigation rate of 450 m³ / ha. Irrigation dates changed annually, which was caused by unstable water balance. Soil moisture remained at the level of 75-85% HB and at the beginning of tops wilting it was 70-75% HB.

Planting and harvesting of potatoes was carried out mechanically, in order to comply with the plant placement scheme (70 × 35 cm).

During the field experiment, the following scheme was used, which included the following options:

1 - plants without insecticide treatment, 2 - plants were treated with insecticides during the germination, budding, tuberization phases with various chemicals with the recommended consumption rate for potatoes.

The criterion for evaluating any technology for cultivating a crop is the harvest, and at the same time it must always be economically justified.

3. Results

The results of the studies showed that the yield of potatoes and the starch content depend on the damage to the tops of the Colorado potato beetle. All the drugs used had a different effect on the death of the Colorado potato beetle and its harmfulness was reflected in the degree of damage to plants, which was reflected in the formation of the crop (table 1).

The yield of potato tubers according to the options was in 2017 from 6.5 to 29.8 t / ha, in 2018 - from 7.3 to 29.6 t / ha, in 2019 - from 6.6 to 29.4 t / ha. The lowest yield was obtained under control (without the use of insecticides) and amounted to 6.5 t / ha in 2017, 7.3 t / ha in 2018, 6.6 t / ha in 2019, or just from the maximum in 2017 21.7%, in 2018 - 24.3%, in 2019 - 22.1% and on average over 3 years - 22.7%.

The yield for all variants with chemical preparations increased 1.8-4.5 times compared to the control in 2017, the lowest indicator was for the variant with the preparation cytcor, in 2018 the yield in variants with insecticides showed a difference of 1.8-4 , 05 times, it was also the smallest on the variant with cytcor, in 2019 the yield in the variants with insecticides increased by 1.81-4.41 times, and here the lowest indicator was on the variant when using the drug cytcor. Potato yield on average for 3 years when using insecticides in the fight against the Colorado potato beetle was obtained in the

range of 12.6 - 16.9 t / ha, this is in the variants of cytkor, aktara, akarin, confidor, bankol, kinmix. A high yield (25.4 t / ha) was obtained when potato plantings were treated with fastacprofi, 28.8 t / ha were obtained using the karate zeon preparation and 29.6 t / ha when decis expert was used.

Table 1. Potato yield when using drugs against the Colorado potato beetle, t / ha.

Variants	2017	2018	2019	Average over 3 years
1. Control (without insecticide treatment)	6.5	7.3	6.6	6.8
2. Tsitkor, EC (0.16 l / ha)	12.1	13.4	12.3	12.6
3. Aktara, EC (0.3 l / ha)	14.6	16.9	15.3	15.6
4. Akarin, EC (1 l / ha)	12.5	13.8	13.3	13.2
5. Confidor, VRK (0.5 l / ha)	14.4	16.8	15.0	15.4
6. Bankol, SP (0.5 kg / ha)	15.0	16.8	16.2	16.0
7. Fastakprofi, KS (0.07 l / ha)	24.5	26.3	25.4	25.4
8. Kinmix, EC (0.2 l / ha)	16.4	18.8	15.6	16.9
9. Karate Zeon, KE (0.2 l / ha)	28.9	28.7	28.8	28.8
10. Decis Expert, EC (0.05 l / ha)	29.8	29.6	29.4	29.6
HCP ₀₅	0.43	0.40	0.65	0.49

The largest yield increase was obtained in the variant with the use of the drug decis expert, by 23.3 t / ha more than in the control, in the variant with the drug karate zeon 22.4 t / ha and in the variant with the drug fastacprofi 18.0 in comparison with others variants in 2017, decis expert by 22.3, karate zeon by 21.4 and fastacprofi by 19.0 t / ha, respectively in 2018 and on variants with the same preparations by 22.8, 22.2 and 18 , 8 t / ha in 2019, on average over 3 years - on the option with decis expert at 22.8, on the karate zeon option at 22.0 and on the fastacprofi option at 18.8 t / ha.

Some researchers [6] believe that the starch content is the main indicator of the quality of potato tubers. The starch contained in potato tubers is most used in food, chemical-pharmaceutical, perfumery, textile, paper and other industries. According to many researchers [7-10], many factors affect the starch content of tubers, including fertilizers, pesticides, and the composition of the soil on which potatoes are grown. According to [11-12] a number of authors, the starch content in varieties of different maturation groups varies from 9.0 to 23% and even higher.

In our studies, the starch content in potato tubers in the control variant was 10.1 - 10.3%, and in the variants with pesticides - 15.0 - 16.4%, or 4.9 - 6.1% more (table 2).

The starch content in tubers in the control variant was actually at the same level. Only in 2017, it was 0.1% higher than in 2018 and 0.2% in 2019. In variants with pesticides fluctuated on average - 15.1-15.2%. In variants with highly effective insecticides (fastakprofi, karate zeon, decis expert), the starch content in tubers in 2018 was higher than in 2017 and 2019 by 0.1-0.3%.

The starch content in tubers on average over 3 years, where plants were treated with Zeon and Decis Expert preparations, was 16.2-16.4%, and fastakprofi - 16.0%, which is 5.8-6.2% higher than in the control, and in comparison with other options - by 0.9-1.2%.

4. Discussion

The Colorado potato beetle *Leptinotarsa decemlineata* Say (Coleoptera, Chrysomelidae) is a very dangerous pest of potatoes. Yield losses from the Colorado potato beetle determined by the destruction of potato tops can reach 40-50 and even 100% at a relative density of the beetle of 25 individuals per 1 potato bush.

The harmfulness of the Colorado potato beetle is determined by its biological feature, i.e. resistance to plant protection products or beetle resistance to chemicals and this is observed with prolonged and haphazard use of them. To effectively combat the Colorado potato beetle, insecticide treatments should be carried out at the optimal time and this is due to the peculiarities of the development of the pest in specific conditions.

Table 2. The starch content of potato tubers, depending on the applied insecticides, %.

Test insecticides	2017	2018	2019	Average over 3 years
1. Control (without insecticide treatment)	10.3	10.2	10.1	10.2
2. Tsitkor, EC (0.16 l / ha)	15.0	15.1	15.2	15.1
3. Aktara, EC (0.3 l / ha)	15.2	15.3	15.1	15.2
4. Akarin, EC (1 l / ha)	15.2	15.2	15.2	15.2
5. Confidor, VRK (0.5 l / ha)	15.0	15.1	15.2	15.1
6. Bankcol, SP (0.5 kg / ha)	15.2	15.1	15.3	15.2
7. Fastakprofi, KS (0.07 l / ha)	15.9	16.1	16.0	16.0
8. Kimmix, EC (0.2 l / ha)	15.1	15.2	15.3	15.2
9. Karate Zeon, KE (0.2 l / ha)	16.1	16.4	16.1	16.2
10. Decis Expert, EC (0.05 l / ha)	16.3	16.4	16.4	16.4

The chemical method of plant protection is the most effective method for controlling the Colorado potato beetle, because insecticide treatment with the appearance of larvae and adults has a positive effect both on the safety of the tops and on increasing the yield of potatoes. The quality of potato tubers is greatly influenced by the degree of damage to the tops and this is reflected in the results of our studies on the starch content in tubers on the control was 10.1-10.3%, and on an insecticidal background - 15.0-16.4%, or on 4.9-6.1% more.

5. Conclusion

Based on the results of the studies, it was shown that the yield of potatoes and the starch content in the tubers to a certain extent depend on the damage to the tops of the Colorado potato beetle. On average, over 3 years, the highest yield was obtained when processing plantings of fastakprofi (25.4 t / ha), karate zeon (28.8 t / ha) and decis expert (29.6 t / ha). The starch content in tubers on average for 3 years, where plants were treated with Zeon and Decis Expert preparations, was 16.2-16.4% and with Fastakprofi - 16.0%, which is 5.8-6% higher than in the control. , 2%, and in comparison with other options - by 0.9-1.2%.

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