https://doi.org/10.48047/AFJBS.6.12.2024.863-874

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

УДК: 63.632.931.34.37.

Methods of integrated control of rodent and sucking pests in maize and sorghum crops

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Article History

Volume 6 Issue 12, 2024

Received: 25 May 2024

Accepted : 25 June 2024

doi:

10.48047/AFJBS.6.12.2024.863-874

Annotation

In the article, the results of the scientific work on the damage of rodent pests that cause severe damage to maize and sorghum grown on farms in the territory of Karakalpakstan and the methods of application, technologies and the biological efficiency of the methods used in order to carry out effective integrated control measures against them are presented.

Key words: *biocenosis, station, biotope, sucker, rodent, pest, egg, worm, pupa, imago, agrotechnics, biology, entomophagus, parasite, predator, chemistry.*

Introduction

The importance and necessity of the work. Today, improving the melioration of irrigated lands, increasing soil fertility, and taking effective measures to control pests and diseases of crops are among the most important issues in increasing the quantity and quality of products obtained from agricultural crops in our country.

Maize and sorghum crops are the most widely cultivated grain and fodder crops on earth, and today, maize and sorghum crops areone of the crops grown for the purpose of satisfaction people's demand for food, livestock for fodder, and raw materials for production.

According to the results of the scientific works of N. Atabaeva, J.B. Khudaykulov [2018], Kh. Atabaeva, T. Oserbaeva [2018], maize-sorghum crops are resistant to drought and saline soils, and alcohol and starch from its grain is taken. These scientific data correspond to the data of scientist D.Yormatova [2000], who conducted scientific work in this direction. According to the author, maize and sorghum plants have a low moisture requirement compared to other grain crops. Due to the low transpiration coefficient of the maize plant, its roots penetrate deep into the soil and absorb the moisture contained in it. The sorghum plant gives a high yield on gray soils. But it has been fully studied that it can develop in infertile and saline soils.

Maize grain, blue mass, silage and flour are very nutritious fodder for livestock. 1 kg of plant grain contains 1.34 nutritional units and 78 g of absorbable protein. In Uzbekistan, maize is grown on large areas as a second crop after grain, vegetables and potatoes on irrigated lands.

According to scientific data [Khojaev, 2015; 2019] every year, 35% of the crops grown in the world die, 14% of which are caused by pests. There are about 200 pests of maize and sorghum, and 15-20 of them are the main pests of maize and sorghum. Among them: during the young germination period of the plant, root-gnawing autumn earworm, cockchaferand wireworms cause damage, and later the leaf pest caradrina, the stem pests are maize stemworm, leucanian earworm, the sucking pests are maize aphid, tobacco thrips, spider beetle and plant bugs cause damage. Due to the damage caused by these pests, the plant lags behind in growth, the leaves do not fully develop, the damaged stems break, and the quantity and quality of the grain decreases.

The purpose of the work. It consists in identifying the types of pests that develop in maize and sorghum agarobiocenosis, including the dominant ones, using integrated methods of controlling them, and studying their effectiveness.

Tasks of the work:

- determination of species composition of sucking and rodent pests found in maize and sorghum agarobiocenosis;
- determining their bioecology by distinguishing the dominant species among pests;
- application of biological and chemical methods against dominant species of pests, determination of their biological effectiveness.
- recommending the production of options that have achieved a high result.

In the conditions of the Republic of Karakalpakstan, a number of large-scale measures are being taken to meet the people's demand for maize products. In particular, as a result of the scientific research conducted in order to carry out measures against the pests of the maize crop, the products destroyed by the pests in grain crops are preserved. Therefore, it is one of the main and necessary tasks of today to determine the species composition of the group of pests in the maize crop, their dominant species and the degree of damage, and to carry out methods of controlling them based on modern technologies.

Methodology of the experiment. Conducting field experiments based on the methodology of Sh.Nurmatov, Q.Mirzajonov, A.Avliyokulov and others [2007]; identification of types of pests based on the methodological manual of A.Sh.Khamraev, H.U.Bekchanov, I.I.Abdullaev and others [2008]; the method of determining the number of pests in plants in field conditions based on the method of F.M. Uspensky [1973]; methods of calculating entomophages in field conditions based on V.A. Shapiro, V.A. Shepetelnikova's methodology [1976]; methods of using and storing entomophages recommendation ofV.P. Adashkevich, E. Shiyko [1983] and use of a chemical method against pests based on methodical instructions for testing insecticides, acaricides, biologically active substances and fungicides ofSh.T. Khujaev [2004] and Sh.T.Khujaev's [2020] methods of pesticide application and experimentation in agriculture.

Place of experiment and agroclimatic conditions. Defining types of rodent and sucking pests that develop in maize-sorghum agarobiocenosis, their density in the plant during the growth period, the damage they cause and the measures used against them was conducted in maize fields of the farm "Barzu" of Kungrad district and sorghum-planted areas of "Biybazar" farms of Beruni district, and the agroclimatic conditions of the experimental site were studied (Table 1).

As can be seen in the table, the agroclimatic conditions in the experiment area are very variable, the average air temperature in March is around 15.2ºC, the maximum is 33.1 and the minimum is around 8.0ºC, and the temperature of the soil during this period is - 9.0ºC, and the average monthly precipitation was 4.7 mm. Precipitation in March was mainly observed in the first 10 days of the month.

Since April, the average air temperature is 16.5, the upper is 38.0 and the lower is -1.2ºC, and the lower temperature was 4.2ºC in the first 10 days of the month, and in the second and third 10 days, it was relatively low, at night decreased to -1.2 and -1.0 ºC respectively. In the first and third 10 days of the month, about 11.9 mm of precipitation was observed.

In May, the air temperature became normal and increased to 22.0ºC on average, 37.3ºC in the afternoon, and 7.4ºC at night. In the second 10 days of the month, 16.7 amounts of precipitation took place. This indicates that favorable conditions have been created for the normal development of pests in crops.

The average air temperature in June, July and August is 27.7; between 30.1 and 26.7ºC, and the amount of precipitation was around 1.0-3.2 mm, a full opportunity was created for pests to feed.

Table-1

Agroclimatic conditionsof the place of experiment (in decades) March-August,2023

Months	***Air temperature***			***Soil temperature***			***Comparative air moisture***		***Wind speedm/s (max)***	***Precipitation mm***
	Average	***max***	***min***	Soil temperature	**5 cm**	**10 cm**	***Average***	***min***		
March	9,2	21,8	-2,5	-9,0	8,8	8,5	54	28	12	4,7
	11,0	27,1	0,2	-2,4	12,7	12,1	56	16	13	0,0
	15,2	33,1	8,0	-3,8	15,0	14,3	37	10	12	-
Average in month	**11,8**	**33,1**	**2,5**	**-9,0**	**12,2**	**11,6**	**49**	**10**	**13**	**4,7**
April	13,2	26,7	4,2	-1,0	16,4	16,1	64	20	13	11,9
	14,9	38,0	-1,2	-5,0	18,4	18,2	41	11	20	0,0
	21,7	38,0	-1,0	-5,0	18,9	18,4	45	11	20	11,9
Average in month	**16,5**	**38,0**	**-1,2**	**-5,0**	**18,9**	**18,4**	**45**	**11**	**20**	**11,9**
May	20,6	34,4	7,4	1,5	22,7	21,7	39	12	12	0,0
	20,3	34,7	10,8	8,4	23,3	22,7	56	16	13	16,7
	25,2	37,3	13,9	9,8	27,6	26,9	33	13	10	0,0
Average in month	**22,0**	**37,3**	**7,4**	**1,5**	**24,5**	**23,8**	**46**	**12**	**13**	**16,7**
June	28,8	41,2	15,3	9,9	30,8	30,3	32	12	8	0,0
	28,1	39,7	16,1	11,0	31,2	30,5	32	14	12	0,0
	26,3	37,0	14,8	8,7	30,8	30,1	34	14	12	0,0
Average in month	**27,7**	**41,2**	**14,8**	**8,7**	**30,9**	**30,3**	**33**	**12**	**18**	**0,0**
July	30,2	41,4	20,2	15,0	33,9	33,1	35	13	12	-
	28,3	44,5	17,2	11,4	32,9	32,5	40	15	13	1,1
	31,7	44,0	19,4	15,5	35,1	34,3	35	14	9	-
Average in	**30,1**	**44,5**	**17,2**	**11,4**	**34,0**	**33,3**	**37**	**13**	**13**	**1,0**

month										
August	29,8	40,6	20,0	17,0	33,3	33,0	39	15	12	1,7
	26,3	39,5	11,0	6,5	30,1	29,9	39	14	12	-
	24,0	39,2	10,2	5,4	29,4	28,9	43	17	13	1,5
Average in month	**26,7**	**40,6**	**10,2**	**5,4**	**30,9**	**30,6**	**40**	**14**	**13**	**3,2**

That is why the damage of pests in maize and sorghum crops has increased, and rodent pests have caused some damage to the stem, leaves and grain of the plant.

Results of the experiment: During the scientific experiment, i.e. in 2021-2022, the species composition of pests in the agrobiocenosis of maize and sorghum was studied, and the dominant species were identified. As a result of the observation work it was considered that, in the maize-sorghum agrobiocenosis in the conditions of Karakalpakstan, from the rodent pests, cockchafers, wireworms, autumn earworm, caradrina, cotton earworm, maize stem butterfly, leucanian earworm and from sucking pests maize aphids, thrips, and spider mite pests develop in maize and sorghum crops from May and cause severe damage (Table 2).

Table-2

The species composition of pests in the agrobiocenosis of maize and sorghum in the conditions of Karakalpakstan

Name in English	Name in Latin	Plant damaging degree
Cockchafer	GryllotalpagryllotalpaL.	+
Wireworm	Agriotes meticrlosus Cond.	+
Autumn earworm	Agrotis segetum	++
Caradrina	Spodoptera exigua Hb.	++
Cotton earworm	Heliothis armigera Hb.	+++
Maize stem butterfly	Ostrinia nubilalis Hb.	+++
Leucanian earworm	Leucania vitellina Hb.	+
Maize aphid	Sipha maudis Pass.	+++
White sorghum thrips	Anaphothrips flavicinctus Karny.	+
Spider beetle	Tetranychus urtucae Koch.	++

Note: + - damages less, ++ - damages average, +++ - damages most

From the sowing of the seeds of the maize-sorghum plant, during the germination period, the cockchafers and wireworms damage the planted seeds, their roots, and the worms of the autumn earworm pest cause damage by gnawing on the roots and vascular stems of the germinated seedlings. The height of the plant is 30-40 cm, and from the period when it produces 5-6 leaves, maize stem butterfly and caradrina pests fall and damage the leaves and stems of the plant. During the fruiting period, especially during the milking-fermentation periods of the seeds in the sod, the cotton earworms fall and gnaw on the main and feed on the tasty grains, causing a decrease in the yield. During this period, maize aphids, thrips and spider beetle pests appear in the stem and leaf axils of the plant and have a negative effect on the normal growth and development of the plant.

Among the pests that develop in the maize-sorghum agrobiocenosis, the dominant species during the vegetation period were studied separately, and their number during the growth period of the plant was determined. The density of dangerous pests in the plant during the growing season is presented in Table 3.

Table-3.

The density of dangerous pests in maize-sorghum agrobiocenosis

№	Names of pests	Damaging phase of the pest	The average number on one damaged plant ($1m^2$), piece
1	Autumn earworm	Worms	0,2 - 0,3
2	Caradrina	Worms	0,6 - 0,8
3	Cotton earworm	Worms	0,3 - 0,4
4	Maize stem butterfly	Worms	0,3 - 0,4
5	Maize aphid	Worms	98 - 132

As can be seen from the table, the average number of worms of the autumn earworm pest is 0.2-0.3 pieces per one square meter of land, and on average one piece corresponds to every 3-5 plants.

As a result of the observation work, it was found out that the caradrina pest appeared in the maize agrobiocenosis this year. The number of worms of the pest is on average 0.6-0.8 pieces, which means that one piece corresponds to 0.5-1.0 plants. The development of 2-3 caradrina worms was taken into account in 1 infected plant. It was also determined that cotton earworms are present in maize plants, and their average number per plant was studied. At the end of the observation work, on average, 0.3-0.4 cotton earworms per 1 plant were found on maize plants, and 0.3-0.4 on average 1 plant of the pest of maize stem butterfly, as well as 98-132 maize aphids feeding on each axil, stem, and leaf of a maize seedling leaf were counted.

So, in the agrobiocenosis of maize, the pests include cockchafers, wireworms, autumn earworm, caradrina, cotton earworm, maize stem butterfly,leucanian earworm, and from sucking pestsmaize aphids, thrips, spider beetles damage the plant. Among them, the dominant species are autumn earworm, karadrina, cotton earworm, maize stem butterfly and maize aphid.

In order to reduce the level of harmfulness of the pests identified above, the effectiveness of integrated control measures against them was studied.

Agrotechnical methods. In order to direct agrotechnical methods against pests in the maize crop, it is appropriate to start cleaning the field from plant residues after harvesting the crop. The reason is that most of the pests overwinter in the remains of this plant. Therefore, in the conducted experimental work, 3 fields of 3 hectares were selected, the cultivated areas were cleared of plant residues, leveled, and rotted manure was removed at the rate of 10 tons per hectare. The field was plowed and watered. Before early planting, 100 kg of nitrogen, 70 kg of phosphorus and fertilizers were applied to the soil and planted.

When the seeds of the corn plant fully germinated and were 20 cm tall, the initial treatment was carried out between the rows. As a result of these works, the growth and development of the plant accelerated, and the nests of pests in several villages were damaged and their development was delayed. During the vegetation period, agrotechnical treatments were carried out on the crop, and normal conditions were created for the growth of the plant.

Biological method. Maize crops grown on all farms and private farms in the territory of our republic are damaged to some extent by cotton earworms every year. The reason is maize, which attracts pests after cotton and has high nutritional value. Uzbek scientists have developed integrated control measures and their application technologies to control pests in the cotton plant. However, scientifically based recommendations on the use of biological methods in the maize plant in the conditions of Karakalpakstan have not been developed.

Therefore, in the conditions of Karakalpakstan, an experiment was conducted on the use of a biological method against maize pests, and the effectiveness of the work was studied by using the Trichogramma parasite against the eggs of the cotton earworm pest.

By using trichogram against plant pests, environmental pollution due to the effects of toxic chemical pesticides is prevented.

The most useful time to use trichogram against earworm eggs is to distribute trichogram from the time when this pest starts laying eggs. Therefore, they begin to reproduce in the

distributed fields and create new generations. For this purpose, it is recommended to propagate trichogramma generations, grown to be resistant to unfavorable conditions in the field.

Trichogramma is an entomophagous parasite belonging to the Trishogrammatidae family of the Hymenoptera group. 67 species are known in terrestrial fauna, and it is considered that there are 11 species in agrobiocenoses of the territory of Uzbekistan. In our conditions, the species Trichogramma euproctidis Gir., T. evanescens Westw. and Trichogramma pintoi Voegele, which depend on their hosts, meet, and these three species are bred in biolaboratories and distributed to the fields against earworm.

In order to study the effectiveness of the Trichogramma parasite against the eggs of cotton earworm butterflies, the period of time of the required number of eggs from the parasite was measured on an electronic scale and revived in biolaboratory conditions. After the trichogram was completely revived, in option 1, 180 thousand pieces were applied 3 times in 60 thousand increments, the interval between each application was 3 days after the first, 5 after the second, and 7 days after the third distribution of the trichogram works were carried out.

In each variant, the biological efficiency of the method was determined 5, 10 and 15 days after the application of the trichogram. Table 4 presents the information obtained on the application of trichogram in the specified amount according to the options and determining its biological effectiveness.

Table - 4.

The biological effectiveness of the Trichogramma parasite against the eggs of the pest cotton earworm in maize

№	Variants The amount of applied trichogramma on 1 hectare	The number of eggs on average 100 plants, piece				Biological effectiveness, %		
		Until applying the parasite	The number of pests after applying the parasite					
			5	10	15	5	10	15
1	60-60-60 thousand pieces	8	6	4	7	25	30	46
2	60+80-60 thousand pieces	12	4	3	2	30	33	54
3	80+80+80 thousand pieces	14	4	3	2	32	52	62

As shown in the table, against the eggs of the cotton earworm pest, in the 1st option, a total of 180,000 pieces of trichogramma in the amount of 60-60-60,000 pieces per hectare is applied 3 times, in the 2nd option, in the amount of 60-80-60,000 pieces 3 times in total 200 thousand units and 80-80-80 thousand units in the 3rd option, a total of 240 thousand units of trichogram, after 15 days, the biological efficiency is comparatively 46; 54 and 62% according to the options.

So, 62% biological efficiency is achieved as a result of using trichogram in the 80-80-80 scheme against the eggs of cotton earworm butterflies in the maize crop. The reason is that there are 80,000 trichograms in 1 gram of the trichogram pupa, and it is effective to apply 1 gram per hectare 3 times.

In our next experiment, the biological efficiency of the bracon parasite was studied depending on the amount of use.

Bracon is a parasite slightly larger than a trichogram with a body size of 0.4-0.5 mm. The main difference between Bracon and Trichogramma is that it is an ectoparasite that damages the larvae of earworms and moths. Bracon lays its eggs in the body of the worm. The larvae that hatch from the eggs enter the pest worm and feed on its nutrients, eventually killing the worms.

The larvae of the bracon, fed up with food, turn into pupae in the body of the dead worm, and mature species of the roach fly out of them.

An experimental scheme of the bracon parasite against mid- and adult-aged worms of cotton earworms was developed in the maize plant. As it can be seen from it, quantities of the parasite of the bracon 5:1; 10:1; 15:1 and 20:1 are used to determine their effectiveness. In the reference option, the amount of 10:1 recommended to be applied to one hectare against the cotton earworm parasite is used, and the effectiveness of 5:1; 15:1 and 20:1 ratios is compared on days 3; 7 and 14.

After that, the biological efficiency of bracon was conducted in entomological studies. The reason is that other entomophages or predators can damage cotton earworms in natural open areas. Therefore, in order to determine the exact biological effectiveness of the bracon entomophagus, in the 1st version of the experiment, 5 bushels of maize were entomologically covered with an entomological bag, and 5 earlworms and a pair of bracon were sent into it. In the 2nd variant, a pair of parasites was sent to 10 worms, and in the 3rd variant, a pair of parasites was sent to 15 worms. The results of the observation work are presented in Table 5.

Table – 5.

The biological efficiency of bracon entomophages in controlling worms of cotton earworm in maize
(entomological studies)

№	Variants	The number of pests until applying the bracon, piece	The number of pests after applying the bracon, piece in days		Biological effectiveness % in days	
			3	7	3	7
1	5:1	5	2	-	60,0	100,0
2	10:1	5	3	1	40,0	80,0
3	15:1	5	4	2	25,0	40,0
4	20:1	5	4	3	25,0	35,0

As can be seen from the table, on the 7th day, all the worms were bitten by the poacher in the option where poachers were sent with a score of 5:1. In the 2nd version, 1 piece and in the 3rd version, 2 pieces of poaching were not bitten.

Therefore, it is correct that poachers are sent against the pest in closed places and open places with a score of 5:1.

An experimental scheme for the use of the bracon parasite against middle-aged and adult worms of the cotton earworm pest was developed in the open field. As it can be seen from it, the parasite of the bracon quantities of 5:1; 10:1; 15:1 and 20:1 are used to determine their effectiveness. In the standard version, the recommended 10:1 ratio for one hectare against the earworm parasite is used, and the effectiveness of 5:1; 15:1 and 20:1 ratios is compared on days 3; 7 and 14.

The exact result after using Bracon entomophage against cotton earworms, i.e. before spreading Bracon in the field, the average number of worms in 100 plants was determined according to the methodology indicated in the above sections, and after spreading Bracon the number of worms is determined on the 3rd, 7th and 14th days. Determination of biological efficiency is determined by the simple percentage extraction method.

If, on average, there were 6 worms in 100 plants in the field before sending the bracon, and after sending the bracon, 4 out of 6 worms were bitten by the bracon, then we calculate the biological efficiency as follows.

6=100 % $x = \frac{4 \cdot 100}{6} = 66{,}6\%$,

4=x

Therefore, the biological efficiency is considered equal to 66.6%.

The biological efficiency of Bracon entomophage is determined for each individual after distributing Bracon in each repetition. In this case, the determined amount of biological efficiency is reduced to a certain table.

As it can be seen in the table, in the 1st option, before sending the bracon, on average there were 7 worms per 100 plants, and after 4 days, 4 worms and after 7 days, 6 worms were bitten by the bracon (6 -table). The biological effectiveness of bracon was determined as follows.

7=100 %

4=x

$$x = \frac{4 \cdot 100}{7} = \frac{400}{7} = 57{,}1\%$$

After 7 days, 6 worms were bitten

7=100 %

6=x

$$x = \frac{6 \cdot 100}{7} = \frac{600}{7} = 85{,}7\%$$

So, biological efficiency was 85.7%.

Table – 6.

Biological effectiveness of bracon entomophages in controlling cotton earworm (In an open field)

№	Variants	The number of pests until applying the bracon, piece	The number of pests after applying the bracon, piece in days		Biological effectiveness % in days	
			4	7	4	7
1	5:1	7	4	6	57,1	85,7
2	10:1	6	3	5	50,0	83,3
3	15:1	6	2	4	33,3	66,6
4	20:1	7	2	3	28,5	42,8

Based on the appropriate methodology, biological efficiency was determined in the following variants. That is, in the 2nd option it was 50 - 83.3%, and in the 3rd option it was 33.3 - 66.6%.

So, it was found that spreading Bracon entomophagus at a ratio of 5:1 and 10:1 gives a good result. When 15:1 is used, its biological efficiency is 66.6% from 33.3%, which is completely comparable to the previous options. But the method of reproduction of poached in biolaboratory conditions, using 1:1 ratio when fed to worms, accelerates their reproduction, and in field conditions, as we can see in the table, using 5:1 and 10:1 ratio gives high results.

In terms of number and damage, maize aphid dominates among the sucking pests in maize and sorghum crops. As a result of the conducted observation work, it was found that the maize aphid has fallen from the third ten days of June, when the maize and sorghum plants have 5-6 leaves (when the height of the plant is 65-70 cm). In the first ten days of July, their number reached an average of 175-226 pieces. During this period, the top of the plant was covered with

an entomological bag, and the larvae of the golden entomophagus against aphids were sent to it in the ratio of 5:1, 10:1 and 15:1 (pest:entomophagus) and the result was studied on 3; 7 and 14 days (Table 7).

Table – 7.

Biological effectiveness of golden eye predatorin controlling maize aphid in sorghum(In an open field)

№	Variants	The number of pests until applying the golden eye predator, piece	The number of pests after applying the golden eye predator, piece in days			Biological effectiveness % in days		
			3	7	14	3	7	14
1	5:1	172	82	54	32	46,6	68,2	71,2
2	10:1	176	90	62	44	45,2	63,4	69,8
3	15:1	184	96	74	58	42,3	60,6	63,2

So, when using the golden eye predator against maize aphid in the above mentioned amount, according to the options, 71.2; 69.8 and 63.2% biological efficiency was achieved.

Economic effectiveness of the biological control method against the cotton earworm in the maize crop.

In our conducted experiment, the economic efficiency of the biological method used to protect the maize plant from the cotton earworm pest was determined. In the experiment, the trichogram entomophagus was used in the scheme of 60x80x60 per hectare in the standard variant, 60x60x60 and 80x80x80 in the experimental variants. According to the obtained data, the biological efficiency against the eggs of the cotton earworm pest in the maize plant in the 60x60x60 scheme using 180,000 units is 67%, and in the 80x80x80 and 240,000 units of Trichogramma parasite, the biological efficiency is 74%. organized.

In the reference option, when a total of 200,000 pieces of Trichogramma entomophage were used per hectare against cotton earworm eggs in a scheme of 60x80x60, the biological efficiency was 70%.

Economic efficiency of Trichogramma entomophagus used in these options was calculated.

1. In this case, in the control option, 76 quintals of harvest were obtained from one hectare, and only 2,400,000 soums were spent on harvesting and transporting it;

2. In the reference option, 72 centners of harvest was obtained, and 180,000 units of Trichogramma parasite were used per hectare in a scheme of 60x80x60, and the total cost per hectare was 2,600,940,000 soums;

3. In the experimental version, 98 quintals were harvested, and a total of 2,040,000 pieces of Trichogramma parasite were used per hectare in an 80x80x80 scheme, and the total cost per hectare was 2,646,000 soums;

4. The price of the harvest from one hectare was 38,000,000 soums in the first option, 45,000,000 soums in the second option, and 49,000,000 soums in the third option;

5. The obtained conditional net profit was 35,600,000 soums in the first control option, 42,306,000 in the second option, and 46,354,000 in the third option;

6. In the 2nd and 3rd options compared to the control option, the price of the additional product was 6,706,000 and 10,754,000 soums;

7. Compared to the reference the economic efficiency of the experimental option was 10,754,000 soums;

8. The reimbursement of 1 soum spent was equal to 1.2 times in the standard version and 1.3 times in the experimental version;

The obtained data are presented in Table 8.

Table-8.

Economic effectiveness of using trichogramma parasite in controlling eggs of cotton earworm in the maize crop

№	Indicators	Control Entomophage was not used	Reference Tr. was used in the scheme 60x80x60	Experiment Tr. was used in the scheme80x80x80
1	Productivity, q/ha	76	90	98
2	Saved product, q/ha	0	14	22
3	Total price of Tr. used for 1 hectare, soum	0	164 000	94 000
4	The cost ofprotecting 1 hectare, soum	0	50 000	50 000
5	The cost of collecting and transporting additional crops, ha/soum	0	80 000	100 000
6	The total cost ofprotecting, ha/soum	0	214 000	146 000
7	Thetotalcostofprotectingplants,collecting and transporting additional crops, ha/soum	0	294 000	246 000
8	The total cost for producing products, ha/soum	2 400 000	2 400 000	2 400 000
9	Total cost, ha/soum	2 400 000	2 694 000	2 646 000
10	Thepriceofproductreceived from 1 hectare, soum	38 000 000	45 000 000	49 000 000
11	Conditional net profit sum, soum	35 600 000	42 306 000	46 354 000
12	Economicaleffectivenesscomparingto control, ha/soum	0	6 706 000	10 754 000
13	Economicaleffectivenesscomparingto reference, ha/soum	0	0	4048000
14	Reimbursement of used 1 soum, times	0	1,2	1,3
15	Effectiveness of the used method (rentability), %	0	120	130

But when the number of pests has increased too much, entomophages will not be able to reduce the number of pests. In this case, it was observed that the number of pests in some fields exceeds the amount of economic damage. In order to prevent this, it is advisable to use a chemical method against pests.

Chemical method. Chemical control methods pose a threat to crops when the number of pests in agricultural crops increases and exceeds the level of economic damage. At this time, it is considered as one of the measures aimed at mass destruction of pests, and it creates an opportunity to save the crop from pests.

In order to determine the efficiency level and norms of chemical preparations in the maize fields, when the worms of the cotton earworm, caradrina and maize stem butterfly were on average 3 pieces per 1 infected plant, the chemical treatment was 5.7% s.d.g. of the drug in the amount of 0.3-0.4 liters per hectare, the original 10% of emamek s.d.g. 0.06-0.07 liters of drug per hectare, according to the standard drug, fufanon, 57% em.c. an amount of 0.6 liters per hectare of the drug was selected and used against pests and the result was determined.

The biological effectiveness of drugs belonging to the group of pyrethroid drugs against rodent pests in the maize crop, which have little effect on warm-blooded animals, was high. Before applying the drugs, the average number of pests in the affected plants was determined,

and the drugs listed in the options were used in selected amounts. After using the drugs the surviving worms were counted on days 3;7 and 14, and biological efficiency was determined using Abbott's formula. The results of the experiment are presented in Table 9.

As can be seen from the table, in option 1, 5.7% s.d.g. after 14 days, the biological efficiency was 96.1% when the emamek drug was applied in the amount of 0.3 liters per hectare. In option 2, when 0.4 liters per hectare was used, it was 97.6%. 10% s.d.g. the original preparation of emamek gave 98.1% and 99.0% biological results when 0.06 liters were used per hectare, and 99.0% when 0.07 liters were used. 57% em.k. used in the standard version. 0.6 liters per hectare of fufanon drug was 96.5% effective after 14 days.

So, 5.7% s.d.g. studied against rodent pests in maize crops. The norm of 0.3 liters of emamek preparation per hectare gave a result 0.4% lower than the standard. The norm of 0.4 liters is 2.1% higher than the standard. It was found that when 0.06 liters of the original preparation of emamek 10% s.d.g. is used per hectare, biological efficiency is 1.6% higher than the standard, and 0.07 liters is 2.5% higher.

Table – 9

Biological effectiveness of the preparations in controlling cotton earworm, caradrina and maize stem butterfly in maize
(Beruni region «Biybazar» farm 2023)

№	Variants	The amount of preparation, ha/l	The average number of pests on 1 plant, piece				Biological effectiveness, %		
			Until applying the preparation	After applying the preparation			3	7	14
				3	7	14			
1	Emamek 5,7% s.d.g.	0,3	3	2	1,3	0,5	36,6	73,4	96,1
2	-//-	0,4	3	2	1,1	0,4	36,6	73,4	97,6
3	Original of emamek10% s.d.g.	0,06	3	1,5	1,0	0,3	50,0	74,3	98,1
4	-//-	0,07	3	1,2	0,5	0,2	66,4	80,8	99,0
5	Fufanon, 57% em.k. (control)	0,6	3	1,8	1,2	0,5	40,0	72,3	96,5
6	Control	-	3	3	4	5	-	-	-

5.7% s.d.g. applied in the maize field when chemical control methods against the maize stem butterfly were carried out in the sorghum crop. 0.3-0.4 liters of emamek preparation per hectare, 10% s.d.g. 0.06-0.07 liters of the original preparation of emamek and standard 57% em.k. 0.6 liters of fufanon drugs were studied. As a result, 98-99% biological result was obtained.

So, in the results of the above-mentioned scientific experiments, it was found that the studied preparations give high results against rodent pests in maize and sorghum crops.

Conclusion

1. In the conditions of Karakalpakstan, in the maize-sorghum agrobiocenosis, among the gnawing pests are the common cockchafer, wireworm, autumn earworm, karadrina, leucanian earwormand the maize stem butterfly, and from the sucking pests are maize aphid, white sorghum thrips and common spider beetle pests. Among them, the dominant species are karadrina, cotton earworm and maize stem butterfly.

2. In order to increase the immunity of plants and increase their resistance to pests, the fields saturated with water before planting are cleaned of plant residues, leveled, rotted manure is removed at the rate of 10 tons per hectare, deep plowed and 100 kg of nitrogen, 10 kg of phosphorus fertilizers are applied to the soil. This gives a high result.

3. 240,000 pieces of Trichogramma parasite against the eggs of the cotton earworm and maize stem butterfly from rodent pests are applied three times in a ratio of 5:1, and 62% biological efficiency is achieved.

4. Against mid- and adult-aged worms of cotton earworm and maize stem butterfly, Bracon parasite is 85.7% effective when applied at a ratio of 5:1, 83.3% when applied at a ratio of 10:1.

5. Biological efficiency was 71.2 and 69.8% when using golden entomophagus against maize aphid in ratio of 5:1 and 10:1 in sorghum crop.

6. 98-99% biological result was obtained when 0.3-0.4 liters of 5.7% s.d.gemamek preparation per hectare, 0.06-0.07 liters of the original preparation of emamek 10% s.d.g. was used in controlling gnawing pests in maize-sorghum crops. This standard 57% em.k. was 1.6-2.5% higher than the variant when thefufafon drug used in amount of 0.6 liters.

Used literature

1. Adashkevich V.P., Shiyko E. Breeding and storage of entomophages Tashkent: Uzbekistan, 1983.-P.47-62.

2. Atabaeva H.N., Oserbaeva T. Plant science.-Tashkent: Science and technology, 2018.-P.99-109.

3. Atabaeva H.N., Khodaykolov J.B. Plant science.-Tashkent: Science and technology, 2018.-P.133-138.

4. Yormatova D. Plant science.-Tashkent DITAF printing house.-55p.

5. Methodological manual on defining and counting the number of entomophages of pests of agricultural crops. V.F.Shapiro, V.A.Shepetelnikova M.Kolos, 1976.- 16 p.

6. Nurmatov Sh., Mirzajonov Q., Avliyokulov A. and others. Methods of conducting field experiments. - Tashkent, UzPITI, 2007. -147 p.

7. Uspensky F.M. Determination of the number of pests.-T.: 1973.

8. Khamraev A.Sh., Bekchanov H.U., Abdullaev I.I. and others. Methodological guide on the table of identification of insects.-Urganch, 2008.-B.3-4.

9. Khojaev Sh.T. Methodological guidelines for testing insecticides, acaricides, biologically active substances and fungicides, II edition-T.: Kochli-nur, 2004.-p.4-23.

10. Khojaev Sh.T. Modern methods and means of integrated protection of plants from pests.-Tashkent: Navruz publishing house, 2015.-p.213-220.

11. Khojaev Sh.T. Basics of general and agricultural entomology and integrated protection system.-Tashkent: OOO New Edition Publishing House, 2019.-p.144-148.

12. Khojaev Sh.T. Methods and conditions for the use of agricultural pesticides and research-Tashkent: "Zilol bolog" publishing house-2020-140-p.