UDC 635:632.7/633.358
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APPLICATION OF PESTICIDES ON CHICKPEA CROPS IN AKMOLA REGION

Abstract

The Lack of high-grade vegetable protein leads to a deterioration in the food supply of the population with food, overexpenditure of feed and an increase in the cost of livestock products. The main source of complete plant protein is leguminous crops (peas, chickpeas, soybeans, beans, lentils, etc.), which also help to preserve soil fertility, reduce the use of mineral nitrogen fertilizers, and produce environmentally friendly products. This is especially important at the present stage because of the parity of prices for industrial and agricultural products, as a result of which little is introduced into the soil of mineral fertilizers. To preserve soil fertility in each soil-climatic zone, it is necessary to expand the crops of leguminous crops.

For the districts of Akmola region, the most promising leguminous crop is chickpeas, which has a high drought resistance, in addition, it is a good precursor for other grain crops. Its yield in many farms remains low. One of the reasons for the low yield of chickpeas is the phytosanitary condition of crops, so the selection of the most effective pesticides in the fight against harmful organisms can significantly increase the yield.

***Keywords**: chickpeas, phytosanitary condition, pesticides, fungicide, insecticide, herbicide, yield.*

Introduction. Chickpeas are one of the few plants adapted to successful growth and development even in arid conditions. Along with a fairly high and stable yield, chickpeas provide a grain rich in protein, balanced in amino acid composition, and can be used both for human food and as a highly nutritious Supplement to feed farm animals. Like the vast majority of members of the legume family, chickpea plants are able to absorb atmospheric nitrogen, and thus enrich the soil with it. So according To G. A. Lavronov (1941), S. Mazurin and R. Alishaeva (1971), on one hectare of sowing, in the roots and crop residues of chickpeas can accumulate up to 50 - 70 kg of biological nitrogen, which is equivalent to 6-8 tons of manure. Due to this, chickpeas are a good precursor for many grain crops, and A. Pylov (1973) in his work even notes an increase in the protein content of spring wheat grain. This is especially important, because the application of nitrogen fertilizers for low-yielding spring crops in our zone is not always economically justified.

In the culture of chickpeas was introduced relatively long ago. As noted by P.M.Zhukovsky (1971), chickpea seeds were discovered during excavations in Palestine, in the 4th Millennium B.C. botanist Theophrastus, a student and friend of Aristotle, writes about this culture: «as for the features of chickpea compared to other pod plants, it is flowering, precocity, explained by a large fortress and woodiness, and also that weeds die from it.».

There is no doubt that there is a great interest in chickpeas as a valuable agricultural crop, not only in ancient times, but also in our days. Currently, chickpeas are sown annually on an area of 9-11 million hectares, mainly in India, Pakistan, China, the countries of Central Asia and North Africa, as well as in other regions where there is a catastrophic lack of precipitation. So, in India, chickpeas are usually cultivated as the second crop after rice, wheat or soy, sowing in October - November with the onset of the dry season, and removing shortly before the start of the rainy season. In countries with a high population density, there has long been a shortage of animal protein, and this problem is very successfully solved by increasing the acreage occupied by legumes and in particular chickpeas.

For the successful production of chickpeas, as well as any other crop, a detailed study of the cultivation technology is necessary. Terms, methods of sowing, seeding rates, precursors, selection of types of fertilizers and doses of their application, and much more. In countries where chickpeas are traditionally sown over large areas, the main methods of cultivation have already been worked out in detail. For example, in India, tests are currently being carried out on the introduction of certain types of fertilizers for new varieties, and the reaction of chickpeas to irrigation is being studied, which is especially important in connection with the ongoing intensification of agriculture. The positive response of chickpea to additional moisture stimulates the selection of works on creation of new high-yielding varieties. The problem of genetic resistance of the crop to ascochitosis is being solved. Research in this area is funded by the Indian government, which is interested in increasing the production of plant-based protein.

I regret to note that in Kazakhstan and the Akmola region in particular, chickpeas have not yet received proper distribution, although in recent years it has been quite successfully popularized. Due to the increase in our country's acreage under this crop, the question of a detailed study of the characteristics of its growth has become acute, but the government of Kazakhstan still does not pay due attention to chickpeas.

The place, objects and methods of research of Experimental studies were conducted from 2017-2019, by laying field and laboratory experiments at the hospital located on the site of Kamenka and D LLP in the Sandyktau district of Akmola region, the laboratory of KATU S. Seifullin. The site was selected for research based on the study of the soil map and agrochemical cartogram, the field history book, and a survey of agronomic personnel regarding precursors, agricultural machinery, and organic and mineral fertilizers.

At the selected experimental site, using traditional technology for the cultivation of leguminous crops, chemical preparations were not used earlier and mineral fertilizers were not applied.

According to the saving technology, a plot with a stubble background was selected. The object of the study was allowed to be sown in Akmola region varieties of chickpeas «Zoovid», with a sowing yield of 96.0% (medium-ripe variety, resistant to drought and cracking, height of vegetation 35-45cm, protein content - up to 25-27%, weight of 1000 seeds-260-310g, average yield of 15-30 C / ha). The repeatability in the experiments is 3-fold, the placement is randomized. The area of the experimental plot is 12 m2, the total area is 1250 m2. The predecessor of spring wheat. Field experiments were laid in the following scheme:

Experience 1. Study of the influence of the drug Angio for protecting chickpea crops from pests and disease.

Scheme of experience:

Factor A. with traditional technology: 1.Control;

2. Angio

Factor B. Inminimum technology. 1.Control;

2.Angio

Experience 2. Study of the effect of the drug Alto super to protect chickpea crops from plant diseases.

Scheme of experience.

Factor A. with traditional technology: 1.Control;

2. Altois super.

Factor B. In minimum technology. 1.Control;

2. Altois super.

The research for each experience was carried out using the following methods:

1.Meteorological conditions are taken from the weather station in the village of Balkashino.

2.The sowing qualities of agricultural seeds were determined according to GOST 12038-84 «Seeds of agricultural crops» in the laboratory of seed science of Katu .S. Seifullina.

3.Records and observations in the experiments were carried out according to the method of conducting experiments and state Sampling of agricultural crops (2002) in the Katu laboratory S.Seifullina.

4.Phytopathological records were conducted using generally accepted methods for determining diseases and pestsofagriculturalplants.The prevalence and development of diseases were calculated using formulas (1) and (2):

$$P=(n\times 100):N, \quad (1)$$

$$R=(\sum a\times b)\times 100:N\times K, \quad (2)$$

Where P- is the prevalence of the disease,%; R- is the development of the disease,%;

n –the number of sick plants (stems, leaves, fruits) in the sample, pieces; N–the total number of sick and healthy plants (stems, leaves,fruit) in the sample, pieces;

∑a×b-the sum of the products of the number of diseased plants (a) by the corresponding lesion score (b), units×score;

K–the highests core of the accounting scale.K=4;

5.The photosynthetic potential of the leaf surface was calculated using the generally accepted method A.Nichiporovich, (1961) formula (6):

The net productivity of photosynthesis (NPF) was calculated using the formula (3) proposed by Kidd, Westomi Briggs:

$$NPF=(L1+L2)\times T, \quad (3)$$

Where BPF is the net productivity of photosynthesis, g / m2 day;

B–the mass of the crop in the subsequent determination, g / m^2; B1-the mass of the crop in the previous determination, g / m^2; L1L2–the area of the leaves in the same time, m;

T–duration of the period, days.

6.Determination of dry matter and moisture in plants was determined by the formula (4)

$$BP=100\ (M1-M2)/M1, \quad (4)$$

Where M1 and M2 are the mass of the rawand dry hitch,g.

7.Accounting for weeds was determined by the method of Moiseichenko F. et al., 1996. Using eye-dimensional, quantitative methods in the phase of germination, branching, bean formation, flowering and maturation by applying a frame of 1.0 m^2 in four places along the diagonal of the plots in a four-fold repetition of each variant;

8. The yield of legumes was determined by the method of the state variety testing of agricultural crops (2002), with its reduction to the standard humidity, followed by the formula (5):

$$X=Y(100-V)/100-SV, \quad (5)$$

Where X- is the standard grain moisture in terms of C/ha; Y -is the grain yield in C / ha; humidity in%;

SV-standard grain humidity, in%.

9. Economic efficiency is calculated on the basis of technological maps with adjustment of actually performed agricultural enterprises.

10. Mathematical processing of the results are processed by the method of variance analysis by Dospekhov B. A.(1979), Duncantest (1968), Statistica (ANOVA).

*Features of the weather conditions of the growing season (precipitation, temperature and humidity):*Sandyktau district is located in the North-Western part of Akmola region with the center in the village of Balkashino. The spring of 2019 was characterized by a lower moisture supply, inthe 10 cm. sown layer of soil moisture reserves were at the level of 10 mm. in the month of may, precipitation fell almost twice below the average annual (17.0 mm), the average daily air temperature (+11.60 ^{0}C) was at the level of the average annual norms, and the relative humidity of the air was 52%. The main amount of precipitation fellduringthe 3rd decade of July (35.0 mm) and the end of August (30.0 mm).A large amount of precipitation in the summer had a positive effect on the growth and development of plants. The temperature regime of the growing season was also uniform and favorable. In the 2-3 decades of July, elevated temperatures had a favorable effect on the growth and development of plants. Precipitation was extremely unstable. In the 3rd decade of August, 197% of normal precipitation fell. Unlike dry July, August was rainy.

Results of research on the Effect of chemical preparation son the phytosanitaryconditionof chickpea crops, dependingonthetechnologiesused.

One of the reserves for increasing the gross harvest of agricultural products is the elimination of crop losses from pests, plantdiseasesandweeds.

Pests of chickpea. During the growing season 2018-2019 years on the experimental site in chickpea crops and more common pest was: chickpea miner (table1).

Chickpeas miner is referred to specific pests of chickpea. Chickpea miner-fly 1.5 mm long, dark color, with a yellow head; larvae-worm-like, legless. Loncoche overwinter in the soil, at a depth of 3 to 6 cm.In the spring, in the second half of may, flies fly out. Females ovipositor make holes in the leaves, in which they lay one, rarely two eggs. The juice that protrudes in places of wounds serves as food for flies. Hatched from eggs, larvae, feeding on parenchyma, lay inside the leaves of narrow cavities (mines), which, gradually expanding, cover the entire leaf.From these injuries, the upper skin of the leaf swells and breaks. The larva lives in the leaf for 5-7 days. When it has finished developing, it falls to the ground and pupates in the surface layer of the soil. The pupal phase lasts about two weeks. During the growing season, chickpea mining flies give 3-4 generations. Leaves damaged by larvae turn yellow, dry up and fall off, which leads to a large shortage of grain harvest.

Table1 – Dynamics of chickpea miner population, average individuals / trap in leguminous crops average for 2017-2019 references

Experience option	Before treatment	After processing
	chickpea	chickpea
Traditional technology		
Control (no processing)	3,0	8,0
Angio	4,0	1,0
Minimum technology		
Control (no processing)	2,0	6,0
Angio	3,0	1,0

The number of pests when using traditional technology is greater than when using minimal technology.Given that individual stages of pests of this genus live in the soil, its density is important.On looser soils (optimal soil density of 1.1-1.2 g/cm^3), where tillage is carried out with tillage tools, pests were more numerous than on compacted soil using conservation technology.

Table 2 - Influence of Enjio on elements of chickpea crop structure depending on the applied cultivation technologies, averagefor 2018-2019

Experience options	Number of plants to be harvested, pc / m^2	Number of beans in 1 plant, pc	Grain weight per 1 plant, g	Weight of 1000 seeds, g	Biological yield, C / ha	Actual yield, C / ha
Traditional technology						
Control (without	37,1	5	2,93	159,9	10,9	10,4
Angio	41,8	5,3	3,62	184,6	15,1	14,3
HCP0,5						1,80
Saving technology						
Control (netseeding)	33,6	4,7	2,65	154,9	8,9	8,5
Angio	38,8	5,3	3,37	171,9	13,1	12,4
HCP0,5						1,70

In applying the minimum biological yield of chickpea in the control amounted to 8.9 t/ha on option with the use of Angio -13,1/ha the Actual yield on the control was 8.5 t/ha, and in the variant with application of Angio -12,4 kg/ha.

Disease of chickpea. The study of chickpea seed infection was carried out under laboratory conditions in a wet chamber in Petri dishes with surface-disinfected seeds and during germination in

sand, simultaneously with the determination of laboratory germination of seeds. As a result, it was found that chickpea seeds are slightly infected with diseases: fusariosis-12.1% and ascochitosis-8.1%.

Until now, it is considered that chickpeas, unlike other legumes, are less affected by diseases. However, in some years, ascochitosis and fusariosis can cause significant damage to the crop.

Anthracnose is the most common disease of chickpea. It is caused by several related fungi that have a conidial stage from the genus Ascohyta. Fungi infect leaves, stems, beans, and seeds. Where the lesions are formed rounded, often with a sharp rim stains containing point sporulation – pycnidia. Affected leaves begin to dry up and fall prematurely. In infected pods have developed shrunken seeds. The disease develops especially strongly in wet years, sometimes appearing on seedlings, especially when sowing infected seeds. In such cases, thinning of seedlings is observed.

Chickpea ascochitosis is caused by two types of pathogens. The main causative agent of the disease is A. rabiei Lib., having the marsupial stage Mycosphaerellarabiei (Kovch).

Ascochitosis is manifested in the form of convex spots of different shapes and colors with a dark border. Spots are covered with small brown dots — the so-called pycnidia, which appear on all aboveground parts of plants. On the stems, the disease manifests itself in the form of small, dotted or elongated ulcers. The most characteristic symptoms appear at the base of the stem and on the branches. The affected tissue quickly shrinks, which leads to the death of the plant. Seeds from diseased plants are puny, light-weight, with yellow or brown spots. More often than other plants, ascochitosis affects the stems and beans of peas, chickpeas, lentils, and beans. If the bean leaves are damaged, the seeds are not formed. Mycelium of the fungus penetrates the walls of the bean and affects the seeds. If the beans are affected during their formation, the seeds do not develop; if the beans are affected during the filling of seeds, the latter are scanty, with low germination. As mentioned earlier, the spread of the disease is favoured by humid and warm weather. Infection of plants occurs at temperatures above 4°C and humidity above 90%. Strong development of the disease is observed when heavy precipitation falls and at a temperature of 20-25°C. When alternating wet and dry weather, the development of the disease slows down, and at a temperature above 35 degrees, it stops. With a strong lesion of ascochitosis, chickpea plants die, with a weak one-their growth is suspended, but then resumed, and therefore the growing season is extended. Mycelium of the fungus penetrates the walls of the bean and affects the seeds. If the beans are affected during their formation, the seeds do not develop; if the beans are affected during the filling of seeds, the latter turn out to be puny and lose their germination.

The experiment scheme included the following treatment options for diseases:

a) processing for vegetating plants-Alto super, CE-0.5 l / ha;

b) control (without fungicides).

The results of the experiments made it possible to identify the most effective way to protect the culture from a complex of diseases on chickpeas, the dominant value of which is ascochitosis.

At the experimental site during the growing season, leaf-stem infections were noted, as ascochitosis noticeably began to appear from the beginning of budding-maturation.

Against the background of the use of traditional technology, the spread of ascochitosis in the control was from 3.9-7.8%, in the variant with the use of Alto super was from 4.2-2.4%. Against the background of the use of minimal technology, the spread of ascochitosis in the control was from 6.2-9.4%, in the variant with the use of Alto super was from 6.9-4.8% (table 3).

Table 3 - Effect of the drug Alto super, CE on the spread of ascochitosis in chickpea crops average for 2018-2019, in%

Experience option	Before treatment	After processing
Traditional technology		
Control (no processing)	3,9	7,8
Alto super, CE-0.5 l / ha	4,2	2,4
Minimum technology		
Control (no processing)	6,2	9,4
Alto super, CE-0.5 l / ha	6,9	4,8

Treatment contributed to a significant reduction in diseases. As can be seen from table 6, the biological effectiveness of the drug Alto super, V. S. K. is relatively high-at the level of 63.7 and 86.5, respectively.

Table 4-Biological effectiveness of the drug Alto super, %

Option	Biologicaleffectiveness		Economic efficiency, %
	Fusarium	Ascochitosis	
Alto super, CE-0.5 l / ha	63,7	86,5	9,9
Control (without treatment)	Disease development, %	Spreading disease, %	
	10,8	33,0	

The length of the growing season and its components is important for chickpeas, especially in the area where droughts are most often observed.

The duration of the shoot-bloom period in 2019 in the duration of the period did not exceed 2-5 days.

The duration of the flowering-maturation period changed significantly. In the dry 2019 year, it ranged from 39 to 40 days for varieties. Depending on weather conditions, the growing season varied significantly, amounting to 73 days.

Elements of the crop structure. Significant fluctuations in yield over the years are the result of a large variability in the elements of the crop structure, depending on the prevailing weather conditions. In this regard, an important task is to analyze external factors that affect individual elements of the crop structure and establish the relationship between them.

As noted by many researchers (K.V.Livanov, 1963; V.V.Balashov, 1986; A.N.Filatov, 1998; N.I.Germantseva, 2002) there is a positive correlation between the yield of chickpeas, the number of beans and grains on the plant and the weight of grain from the plant.

The number of beans on the plant varied more depending on the prevailing weather conditions than on the biological characteristics of the variety. The most favorable conditions for flowering and tying of beans were formed in 2019, when 34 pieces were formed on one plant.

Influence of herbicides on the weediness of sowings and the yield of chickpea.

Tested the following herbicides: Control (without herbicides), Gesagard with a flow rate of 3.0 l/ha.

In the initial phases, chickpeas grow slowly due to the accelerated growth of the root system. As a result, it is highly susceptible to weed infestation, so weed control is of paramount importance for increasing yields. Herbicides play an important role in this regard.

In the years of research, the following weeds prevailed in chickpea crops: annual-a schiritsa (*Amaranthus blitoides*), tilted schiritsa (*Amaranthus retroflexus*), white Mar (*Chenopodium album*), blue bristle (*Setariaglauk*a), perennial - pink osot (*Cirsium arvense*), field osot (*Sonchus arvensis*).

The introduction of Gezagard herbicides after chickpea sowing significantly reduced the number of annual weeds in the crops, without affecting the perennial weeds. So, on average, on the 45th day after applying the herbicide, the number of annual weeds decreased by an average of 11.6 times for the Gezagard herbicide.

Before the chickpea matures, the leaves fall off, the soil surface is lightened, and when precipitation falls, weeds begin to grow intensively, since by this time the action of herbicides stops. The prevailing weather conditions have a great influence on the growth and development of weeds. In a very dry 2019, crops were clogged with sedge, there were few other weeds, and they were poorly developed. In a favorable moisture and temperature regime for the growth and development of chickpeas, there were few annual weeds in the crops.

The height of the plants and the height of the attachment of the lower beans is important when cultivating chickpeas, on which the quality of the harvest depends. Studies have shown that the height of plants is higher than the control variant.

So, in 2019, when applying the herbicide Gezagard, the plant height was 0.35 m, which is 0.03 m higher than the control variant. The same was noted for the height of the lower bean attachment. If

it was an average of 0.19 m for Gezagard, then it was lower for control, and the height of attachment of the lower beans was approximately the same.

Reducing the potential and actual contamination of crops to economically safe levels contributes to a significant increase in the efficiency of production intensification factors. On fields that are clean of weeds, a more complete and productive use of nutrients and moisture is achieved by cultivated plants, and the economic effect of applied agricultural techniques is significantly increased (G.V.Popov, 1999; A.V.Balashov, 2000; N.I.Germantseva, 2002).

The main criterion for evaluating the research is the yield of crops. In studies, it is relatively high depending on the use of pesticides and prevailing weather conditions.

Table 5 - Influence of the chemical preparation Alto super on the elements of the crop structure depending on the applied cultivation technologies, average for 2018-2019.

Experience options	Number of plants to be harvested, pc / m2	Number of beans in 1 plant,	Grain weight per 1 plant, g	Weightof 1000 seeds, g	Biologicalyield, c / ha	Actualyield, c / ha
Traditional technology						
Control	48,2	5,0	2,68	146,3	12,9	12,3
Alto super, CE-0.5 l / ha	50,2	5,0	2,73	147,3	13,7	13,0
Minimum technology						
Control	44,2	5,0	2,50	136,3	11,1	10,5
Alto super, CE-0.5 l / ha	46,2	5,0	2,58	139,6	11,9	11,3

Application of the minimum biological yield in control was -11,1 t/ha, and in the variant with application of Alto super EC -11,9 kg/ha, variants of conventional technology, the control was 12.9 t/ha, and in the variant with application of super Alto, CA– 13.7 C/ha.

In order to determine the nature of the degree of weed infestation and harmfulness in chickpea crops, species-based quantitative methods were taken into account, which allowed a more objective assessment of the impact of agricultural practices.

During the growing season of 2018-2019, the following weed families were observed to be the most common in the experimental area: grass (Graminea), amaranth (Amaranthacea), and convolvulaceae. These perennial and juvenile weeds cause significant damage to cultivated plants, the value of which can be very different – from 10 to 30% and up to complete destruction. Direct damage from weeds is on average 10.3% of the actual crop.

Conclusions: for the First time in the Akmola region, the influence of weather conditions on the phytosanitary condition of chickpeas, especially the formation of elements of the crop structure depending on the use of pesticides was studied. The high efficiency of applying pesticides against harmful organisms in chickpea crops is shown.

Based on the conducted research, it was found that when using the minimum technology, the biological yield of chickpeas in the control was 8.9 C / ha, and in the variant with the use of Engio - 13.1 C / ha. Actual yield on the control was 8.5 t/ha, and in the variant with application of Angio -12,4 kg/ha, the biological effectiveness of the drug Alto super, v.s.k. is set relatively high efficiency - level and 86,5 63,7 accordingly, application of herbicides, Gesagard increased the yield of chickpea by 29% compared to control.

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ТҮЙІН

Ақмола облысында алғаш рет ауа райының ноқаттың фитосанитарлық жағдайына әсері, пестицидтерді қолдануға байланысты өнім құрылымының элементтерін қалыптастыру ерекшеліктері зерттелді. Ноқат егістігінде зиянды организмдерге қарсы пестицидтер қолданудың жоғары тиімділігі көрсетілген.

Жүргізілген зерттеулер негізінде минималды технологияны қолдану кезінде бақылаудағы ноқаттың биологиялық өнімділігі–8,9 ц/га, Энжио қолданылған нұсқада-13,1 ц/га құрады. Бақылаудағы нақты өнімділік 8,5 ц/га құрады, ал Энжио қолданылатын нұсқада -12,4 ц/га Альто супер препаратының биологиялық тиімділігі, сәйкесінше 63,7 және 86,5 деңгейінде салыстырмалы жоғары тиімділік белгіленді, пестицидтер енгізу бақылаумен салыстырғанда ноқаттың өнімділігін 29% - ға арттырды.

РЕЗЮМЕ

Впервые в Акмолинской области изучено влияние погодных условий на фитосанитарное состояние нута, особенности формирования элементов структуры урожая в зависимости от применения пестицидов. Показана высокая эффективность внесения пестицидов против вредных организмов в посевах нута.

На основе проведенных исследований было установлено, что при применении и минимальной технологии биологическая урожайность нута на контроле составила–8,9 ц/га, на варианте с применением Энжио –13,1ц/га. Фактическая урожайность на контроле составила 8,5 ц/га, а на варианте с применением Энжио –12,4 ц/га, биологическая эффективность препарата Альто супер, в.с.к. установлена сравнительно высокая эфективность - на уровне 63,7 и 86,5 соответственно, внесение пестицидов повышало урожайность нута на 29 % по сравнению с контролем.