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NOCUITY OF THE ANSILOPIA AUSTRICA IN SEED WHEAT SOWS AND MEASURES TO FIGHT WITH THEM IN CONDITIONS OF WESTERN KAZAKHSTAN

Abstract. The article presents the results of researches for 2017-2019 on the nocuity of the anisoplia austriaca and the protective measures carried out on the spring wheat sowings. It is determined that the level of grain losses because of cereal chafer depends on the phase of grain formation in the ear of wheat. During feeding in the phases of the formation of milk and milk-wax stage of ripeness, grain losses consist of grains eaten from inside by the beetle, and in the phase of wax and full ripeness the weight of the eaten grain is added to the mass of bruchids knocked out by the beetle in the process of feeding. The data, which we have received on the nocuity of cereal chafer in spring wheat crops are important for production, because they allow to determine the economic thresholds of nocuity of the phytophagan. The use of economic thresholds for the nocuity of cereal chafer should contribute to the solution of the main task - to preserve the quantity and quality of spring wheat yield. The most dangerous is feeding of adult specimen - imago of cereal chafer on wheat in the period of formation-ripening of grain, when plants can no longer compensate for the damage caused by beetles. In the indicated period, the number of beetles reached from 5.5 to 7.0 specimens/m^2, which exceeded the economic threshold of damage and, therefore, the chemical treatment of crops was carried out.A reliable rise of productivity of seed of spring-wheat was received from the use of such agents as Enzhio 247, with a consumption rate of 0.15 l/ha -1.5 c/ha and Danadim Expert, a. with a consumption rate of 1.0 l/ha - 1.4 c/ha compared to the control without treatment.

Key words: Anisoplia austriaca, Nocuity threshold, Loss of grain, Control measures, Insecticides, Biological, Economic efficiency.

Introduction. Spring-wheat has a primary value in gross grain harvest in Western Kazakhstan. Features of the development of spring wheat in the period of formation- ripening of grain are the final growth cessation of vegetative overground and underground organsand a fully completed system for their mutual provision with water, nutrients, etc. Plants are ready for a productive process to yield; therefore, they form generative organs of grain. This period begins and continues with the accumulation of storage compounds in the form of assimilates, which transforms into organic substances - proteins, fats and carbohydrates, which are the main elements of human nutrition and all living organisms. However, beginning with the formation and till the maturation of wheat grain in the head, it is influenced by various dam ages by phytophagan. Damage caused by phytophagan at a certain stage of the ontogeny of wheat is no longer compensated by the growth and development of plants. Therefore, protection of plants belongs to the measures of rise of grain production and improvement of its quality. Protection of plants from pests in farming systems is the most important link in limiting the effect of factors that retain the productivity of green crops.

In the Republic of Kazakhstan, 50 species of polytrophic and over 100 species of specialized pest, more than 70 kinds of diseases and about 120 species of weed plants make harm to the agricultural crops and range lands. In Western Kazakhstan, the most common and most harmful grain pests are larvae of a eurygaster integriceps, of wheat thrips (Haplothrips tritici) and imago of cereal chafers. Their number, and respectively, nocuity are increasing lately [1].

Turganbaev *et al.* (2013) write that that according to the scheme of the life cycle of wheat and its relationship with the most dangerous phytophagan at the beginning of grain filling, the milky stage coincides with 10-11 stages of organogenesis of wheat, when the grain is forming, and accumulation in the grains of nutrients, which determine the ear grain content, the size and mass of grains, resistance to dry wind. A damage of wheat at 10-12 stages of the organogenesis by cereal chafers lead to a blind-seed disease or deformation of grain, but in some cases it leads to complete destruction of grain, to decrease in the absolute mass of grain, to deterioration of baking and sowing qualities of seeds [2].

Cereal chafers belong to a large family of scarab beetles (Scarabaeidae). Three kinds of cereal chafers are most common, such as cereal chafer (Anisoplia austriaca), beetle crusader (A.agricola), beetle-colored beetle (A.segetum). Ansilopia austrica beetles are the most common in the studied region among all cereal chafers. When determining reduction in yield from cerealchafers, some authors indicate them in relative terms, namely in percentage of damaged grains or in percentage of losses of grain yield [3].

Such expression of reduction in yield from cereal chafers makes it very easy to imagine their significance as a dangerous pest, but it can not be used to justify the economicthresholds of damage states that during its period of life, one beetle eats 7-8 gr of grain, considering the grain that it knocks out, so, one beetle destroys 8-10 heads [4].

In the experiments of T.A. Turganbaev and V.S. Kucherov (2012), in the West Kazakhstan region on crops of grain crops the first beetles appeared on June 7, and massively - on June 20. Increase in the number of cereal chafers was observed gradually. Thus, at the end of flowering of spring wheat, the number of beetles was 0.3-3.2 specimens/m2. During milk-wax stage of ripeness the number of beetles increased till the 5,1 specimens/m2, which exceeded the economic threshold of damage. This means that a chemical treatment is necessary, taking into account the high danger of the phytophagan [5].

Eskov (2004) notices that nocuity of the anisoplia austriaca depends from phenological stage of cropper in the period of its population and from the length of stay of the pest on seeding. When the wheat is populated, during formation period of seeds, the nocuity from the bread beetle cause leakage of grain contents and only shell remains in the ears. During feeding, on the milk and milk-wax stage of ripeness, beetles eat part of seed. The daily loss per beetle at this moment is 1.5-2.0 times less than in the period of grain formation and make to 0.30g on winter wheat, 0,22 g on spring wheat and 0,16 g on barley. In the process of further maturing of grain, the daily loss per beetle increases, but they are consisted not only from those eaten grains, but also from grains, which were knocked out from the ear, and the number of beat down grains according to many researches can reach up to 50-90 pieces [6,7].So, 1 imago of anisoplia austriaca eats about 1 gram of grain for the period of its development on wheat. A.V. Badulin (1978) has the same opinion; he shows the lowest indicator of yield loss from the bread beetle in the volume up to 1 gram of grain [8]. According to the results of field research of V.I. Tanskii and others (2002), the average yield loss from one beetle was defined as 4.2 g. The economic threshold of nocuity (ETH) during the flowering period was 3-5 beetles on wheat, and it was 6-8 beetles per 1 m2 during the period of milk ripeness of grain [9].

Other authors have calculated that one beetle during its life destroys the yield of 5-6 ears. Depending on the weather conditions, the damage from the anisoplia austriaca is equal to 5-8 size of its mass [10]. M.V. Pavlichuk and E.V. Chenikalova (1976) show the highest figures of losses from bread beetles, they believe that cereal chafers destroy more than 10 grams of grain [11].

Consequently, such expression of crop losses from bread beetles helps us to imagine their significance as a dangerous pest, but it can not be used as a template for all regions of the country to justify the economic thresholds of damage. I.D. Eskov (1996) thinks, that the most vivid way of expressing the nocuity of the bread beetle is in kilograms per hectare, with showing the number of beetles per square meter. Since such approach of determining the nocuity of beetles provides the calculation of the duration ofthe beetles on the field, that is why it was necessary to study the damage from them not for the entire season, but for a day [12,13].

The procedure of research. We have made field experiments on dark chestnut soils in the Zelenovsky district of the West Kazakhstan region in order to achieve the set goals and objectives. The researches were carried out in the system of grain-steamed crop rotation by the method of the state variety testing of agricultural crops and by the method of field experiment (Dospehov, 1985) [14,15]. The definitions of the species composition, the counts of the main phytophagan population, were carried out according to generally accepted methods [16].

Tests of insecticides and determination of biological efficacy were carried out according to the "Methodological guidelines for carrying out registration tests of insecticides, acaricides, biologics and pheromones in plant growing", Almaty-Akmola, 1997 and "Rules for conducting registration, production tests and state registration of pesticides (harsh chemicals) in the Republic of Kazakhstan", Astana, 2012, List of pesticides permitted for use in the territory of the Republic of Kazakhstan for 2013-2022 [17].

The counts of the number and nocuity of the anisoplia austriaca were determined during the periods of the formation and ripening of the grain in the vegetation-field experiment. With the beginning of milk ripeness, 30 nylon cages of 0.5x0.5x0.5 m size were set on the sowing of spring wheat. Cages from below were sprinkled with earth, and on top they were tied to exclude accidental feeding of the ear with other bugs. The settlement of cages by beetles was carried out in the phase of development of ears, which were variants of the experiment; replications were cages with 5 cages in each variant.

Once in 4-5 days, 5 anisoplia austriacas (3 females 2 males) were planted in 5 cages. After two days they were taken from the cages and the cage was closed. The next time, beetles were planted in the other 5 cages and so on, and 5 cages without beetle infestation served as control. Before the beginning of harvesting in this field all the cages were removed, the ears were cut off and the scattered grains were collected. The ears were threshed, the grain and the beaten grain was separately weighed from the ears. The loss of grain in different stages of maturation was determined by the difference in the weight of the grain in control cages and in cages with beetles. We have received the average daily loss of grainfrom one beetle by dividing the obtained value by 2 (the time of feeding of beetles in cages) and the number of planted beetles. After increasing this figure by the number of days between the counts, the size of grain losses from one bread beetle at different phases of wheat ripening was obtained [18].

Results and Discussion. The researches have shown that the nocuity of the anisoplia austriacas depends on the phonological phase of the feed crop, in our experiment of spring wheat, during its colonization and the length of the pest stay on the crop. When the wheat was populated during the period of grain formation, damage to beetles causes leakage of grains and only seed peels remain in the ears. The average losses from one beetle reach 0.64 g per day during this period (table 1).

Table 1 – Nocuity of the anisoplia austriacas on spring wheat crops (West Kazakhstan region, average for 2017-2019)

Options (phases of the formation of grains)	The mass of grain in the ear (g)	The decrease in the mass of grain in the ear compared to the control (g)	The mass of beaten grains (g)	Total loss grains (g)
Grain formation	0,13	0,64	–	0,64
Milk ripeness	0,52	0,25	–	0,25
Milky-wax ripeness	0,47	0,30	–	0,30
Middle dough stage	0,51	0,26	0,8	0,34
Complete ripeness	0,49	0,28	1,1	0,39
Control	0.77			

Cereal chafers, during feeding with grain in the phase of milk and milk-wax ripeness, eat part of the grain, but leave stubs. In the process of feeding on these stages of development, the beetles do not actually beat the grains with paws. The loss of grain is due to partial eating of grains by the beetles and reaches 0.25-0.30 g per beetle. The daily loss per beetle is, on average, 1.5-2 times less than during the formation of grains. As the grain further matures, the daily losses per beetle do not increase significantly, but they are added up not only from those that were eaten, but also from seeds ejected from the ear. When beetles eat grains in the wax ripeness phase, except the eating of their contents, then the beetles beat whole kernels with their paws. On this stage, grain losses make on average 0.34 g.

The data, which we have received about the тnocuity of the bread beetles in spring wheat crops, are important for production, because they allow to determine the economic thresholds of nocuity of the phytophagan. The use of economic thresholds for the nocuity of bread beetles should contribute to the solution of the main task - to preserve the quantity and quality of spring wheat yield. The most dangerous is the feeding for adult specimen-imagos of the anisoplia austriacas on wheat during the period of formation-ripening of grain, when plants can no longer compensate the damage caused by beetles. During this period, the number of beetles reached from 5.5 to 7.0 specimen/ m2, which exceeded the economic threshold of damage (table 2).

Table 2 – Dynamics of the number of bread beetles on spring wheat crops, pcs/m^2 (average data for 2017- 2019)

Experiment Options	Consumption rate, l/hectare	Dynamics of the number of bread beetles		
		4.07	15.07	19.07 before processing
Control	–	0,4	5,5	6,0
Agrocyp, 10% k.e. (alpha-cypermethrin, 100g/L)	0,2	0,2	3,0	5,8
Danadim Expert, k.e. (dimethoate, 400 g /L)	1,0	1,1	5,0	6,5
Decis Expert, k.e.(deltamethrin, 400 g/L)	0,1	1,6	4,6	6,2
Karate 050, k.e.(lambda-cyhalothrin, 50 g/L)	0,2	2,0	5,2	7,0
Fastak,10%, k.e.(alpha-cypermethrin, 100 g/L)	0,15	3,0	4,0	7,0
Engio 247, (thiemethoxam, 141 g/L +lambda cyhalothrin, 106 g/L)	0,15	2,0	4,4	5,5

During the years of research, the first appearance of adult specimen of beetles on the fields of spring wheat was noted at the end of the second decade of June. The increase in the number of beetles in early July was small – 0.2-0.4 specimen/m^2, and then there was a gradual increase in the number and reached up to 7 individuals per 1 square meter.

This indicated that it is necessary to carry out protective measures, considering the high danger of the imago of the anisoplia austriacas. Insecticides show high effectiveness in combating the bread beetle during vegetation. In this case, they are recommended for use in the number of this phytophagan, exceeding the economic threshold ofnocuity (ETH). Over the past few years, established with long-term researches ETH of bread beetles in spring wheat crops at the level of 5 specimens/m^2 during the formation and milk-wax ripeness of grain.

In our studies counts of the number of bread beetles were recorded and an assessment of the biological effectiveness of the use of insecticides in its crops was made during the three vegetation periods of spring wheat (2015-2017). There was a task – to study the possibility of using synthetic pyrethroids (fastak, karate, decis expert, agrocyp), an organophosphorus preparation (Danadim Expert) and a two-compound preparation (Engio 247) combating against the anisoplia austriacas in the sowings of spring wheat Saratov 42 in the conditions of the steppe zone of the West Kazakhstan region (table 3).

Table 3 – Effectiveness of insecticides in combating the anisoplia austriacas on spring wheat crops. (average for three years)

Experiment Options	Number beetles before processing, pcs/m^2	Biological efficiency after days after treatment				Productivity, t/ ha	Yield increase, c/ ha
		3 days		7 days			
		Number of beetles for 1 m^2	%	Number of beetles for 1 m^2	%		
Control	6,0	6,2	-	7,0	-	7,1	
Agrocyp, 10% k.e. (0.2 l/ha)	5,8	1,2	80,5	1,8	74,6	8,2	1,1
Danadim (1,0 l/ha)	6,5	0,6	89,0	1,3	81,4	8,5	1,4
Decis Expert, k.e. (0.1 l/ha)	6,2	1,1	82,4	1,7	75,2	8,3	1,2
Karate 050, k.e.(0.2 l/ha)	7,0	0,7	88,0	1,7	76,0	8,4	1,3
Fastak,10%, k.e.(0.15 l/ha)	7,0	1,3	78,7	2,0	73,0	8,2	1,1
Engio 247, (0.15 l/ha)	5,5	0,5	92,3	0,8	88,7	8,6	1,5
$HCP_{0,05\ centner\ /\ ha}$ = 0.71							

We should take into account that all the records and observations in the experiment with the testing of the preparations were carried out relatively on the control plots with planar cutting, which were not previously influenced with chemical treatment neither soil nor vegetative insecticides.

Such insecticides as Engio 247, Danadim Expert, and Karate 050 showed high biological effectiveness in the processing of crops during the milky wax ripeness against beetles, which resulted in the death of the bread beetles three days after processing and make 92.3%, 89.0% and 88.0%. The effectiveness of such insecticide as Fastak was lower, within 78.7%. Accounting of number of beetles 7 days after processing indicates that the effectiveness of insecticides has decreased, but remained sufficient to contain the density of the pest at a level below the ETH, the most effective insecticide was Enghio 247 - 88,7%.

Thus, practically all the preparations provided a very high biological efficiency even after 72 hours after processing. In general, for three years of research, such insecticides as Engio 247 showed the highest biological efficiency in the processing. of insecticides in spring soft wheat crops during the milky wax ripeness (thiemethoxam, 141 g/l + lambda-cyhalothrin, 106 g/L) at a rate of 0.15 l/ha and Danadim Expert, (dimethoate, 400 g/L) at a rate of 1.0 l/ha, which showed the deaths of the bread beetles in 92.3% and89.0%, respectively, 72 hours after processing. Karate 050 k.e. showed a high result among the synthetic pyrethroids with a rate of 0.2 liters/ha – it is almost 88.0%. It should be noted that synthetic pyrethroids (agrocyp, fastak, karate, decis expert) refer to the third generation of insecticides. They show mainly high biological activity against insects in the early stages of their development with low rates of consumption. They are able to suppress a wide range of harmful insects, including cereal chafers.

Reliable increases in the yield of grain of spring wheat were received from the use of such insecticides as Engio 247 at a rate of 0.15 l/ha -1.5 c/ha and Danadim Expert, with a rate of 1.0 l/ha – 1.4 c/ ha compared to the control without processing. Agrocyp preparations, 10% and Fastak 10% showed significantly weaker effect - the yield increments of grain of spring soft wheat, during their use made 1.1 and 1.2 c/ha, respectively.

Taking into account all the above, it is possible to recommend such insecticides as Engio 247, Karate 050, and Danadim Expert for the control the anisoplia austriaca on the fields of spring wheat in the conditions of the West Kazakhstan region.

Conslusion. Due to the results of experimental research, we have established that the level of grain losses from the anisoplia austriaca is determined by the phase of development of spring wheat during its colonization. The obtained data on the nocuity of bread beetles in spring wheat crops are important for production, because they allow determining the economic thresholds of nocuity of the phytophagan. Reliable increases in the yield of grain of spring wheat were received from the use of preparations as Engio 247, with a rate of 0.15 l/ha - 1.5 c/ha and Danadim Expert, with a rate of 1 l/ha - 1.4 c/ha compared to the control without processing. Agrocyp 10% of the and Fastak10 % showed lesser results - the yield increments of grain of spring soft wheat during their use made approximately 1.1 and 1.2 centner/ha, respectively.

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БАТЫС ҚАЗАҚСТАН ЖАҒДАЙЫНДА ЖАЗДЫҚ БИДАЙ ЕҒІСТІКТЕРІН АСТЫҚ ҚОҢЫЗЫ- КУЗЬКАДАН ҚОРҒАУ ШАРАЛАРЫ МЕН ЗИЯНДЫЛЫҒЫ

Аннотация. Батыс Қазақстанда астықтың жалпы түсімінде жаздық бидайдың маңызы зор. Астықтың пайда болу және пісу кезіндегі жаздық бидайдың даму ерекшелігі жер үстіндегі және жер астындағы веғетативті орғандардың өсуін тоқтатып, оларды сумен, қоректік заттармен өзара қамтамасыз етудің толық жүйесі болып табылады. Өсімдіктер ұрпақты жалғастыру үшін өнімді проңесті жүргізуге дайын, сондықтан олар дәннің ғенеративті мүшелерін құрайды. Бұл кезең орғаникалық заттарға - белоктарға, майларға және көмірсуларға айналған ассимиляторлар түрінде резервтік заттардың жиналуынан басталады және жалғасады – адам мен барлық тірі орғанизмдердің негізгі қоректену элементі элементтері. Алайда, бидай дәндерінің

қалыптасуынан бастап масақтарда пісіп жетілуіне дейін фитофагтар түрлі зақымдалады алады. Сондықтан, астық шығымдылығын арттыру және астық өндірісін ұлғайту, сонымен қатар оның сапасын жақсарту жөніндегі шаралар қатарына өсімдіктерді қоргау жатады. Ауылшаруашылық жүйелерінде өсімдіктерді зиянкестерден қоргау астық дақылдарының өнімділігін шектейтін факторлардың әсерін шектеу үшін маңызды буын болып табылады. Қазақстан Республикасында ауыл шаруашылық дақылдар мен табиги жайылымдарда көпкоректілердің 50-ге жуық түрі және мамандандырылган зиянкестердің 100-ден астам түрі, аурудың 70-тен астам түрі және арамшөптердің 120-га жуық түрі зиян келтіреді

Мақалада 2015-2016 жылдары жаздық бидай алқаптарында астық қоңызы кузьканың зияндылыгын зерттеу нәтижелері көрсетілген. Астық қоңызы салдарынан дәннің шығыны деңгейі масақта дәндердің қалыптасу кезеңіне байланысты екені анықталды. Қоңыздың қоректенуі сүттеніп пісу және сүттеніп–қамырланып пісу, қалыптасу кезеңдерінде кемірген бидайлардан тұрады. Қамырланып пісу және толық пісіп жетілген фазасында кемірілген бидай салмағына қоңызбен қоректену кезінде қағылган дәндер салмагы қосылады.

Бидай дақылдарында кездесетін астық қоңыздарының үш түрінің Anisoplia austriaca – астық кузька қоңызы басым екендігі анықталды, ал қалгандары аз мөлшерде байқалды.

Жаздық бидай дақылдарына астық қоңыздарының зияндылыгы туралы біздің деректер өндіріс үшін құнды, өйткені фитофагтың зияндылығының экономикалық шегін анықтауга мүмкіндік береді.

Жаздық бидай дақылдары өнімділігінің саны мен сапасын сақтау үшін астық қоңыздарының зияндылыгына экономикалық шегін пайдалану негізгі мәселені шешуге көмектеседі. Кузька қоңызының ересегі бидай дәнінің қалыптасуына кезенінде көбірек зиян келтіреді, өйткені өсімдіктер қоңыздар келтірген зиянды өтей алмайды Көрсетілген кезеңде қоңыздардың саны 5,5-тен 7,0 экз./м^2-ге жетті, бұл зияндылықтың экономикалық шегінен асты, сондықтан дақылдарды химиялық өңдеу жүргізілді.

Ең жогары жаздық бидай дәніпің қосымша шынайы өнімі Энжио 247 с.к., препаратын шығын мөлшері (0,15 л/га) қолданганда 1,5-2,0 ц/га және Данадим эксперт э.к., шығын мөлшері (1,0 л/га), ал қосымша өнім 1,4-1,8 ц/га мөлшерінде бақылау нұсқасымен салыстырганда алынды. Батыс Қазақстан облысы жағдайында жаздық бидай егістіктерінде астық қоңызының имагосына инсектицидтердің тиімділігі багаланды.

Түйін сөздер: астық қоңызы-кузька, зияндылық шегі, дәннің шығыны, күрес шаралары, инсектицидтер, биологиялық, шаруашылық тиімділік.

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ВРЕДОНОСНОСТЬ ХЛЕБНОГО ЖУКА-КУЗЬКИ В ПОСЕВАХ ЯРОВОЙ ПШЕНИЦЫ И МЕРЫ БОРЬБЫ С НИМИ В УСЛОВИЯХ ЗАПАДНОГО КАЗАХСТАНА

Аннотация. Яровая пшеница имеет первостепенное значение в валовом сборе зерна в Западном Казахстане. Особенности развития яровой пшеницы в период формирования, созревания зерна заключаются в окончательном прекращении роста вегетативных надземных и подземных органов и полностью завершенной системой их взаимного обеспечения водой, питательными веществами. Растения готовы к продуктивному процессу для продолжения себя потомства, следовательно, они формируют генеративные органы зерна. Начинается и продолжается указанный период с накопления запасных веществ в виде ассимилянтов, превращаемых в органические вещества – белки, жиры и углеводы – главные элементы питания человека и всех живых организмов. Однако начиная с формирования и до созревания зерна пшеницы в колосьях,оно подвергается различным повреждениям фитофагами. Поэтому среди мер, обеспечивающих повышение урожайности зерновых культур и увеличение производства зерна, а также улучшение его качества принадлежит защите растений. Защита растений от вредных организмов в системах земледелия является важнейшим звеном в ограничении действия факторов, лимитирующих продуктивность полевых культур. В Республике Казахстан сельскохозяйственным культурам и естественным пастбищам причиняют вред около 50 видов многоядных и свыше 100 видов специализированных вредителей, более 70 видов болезней и около 120 видов сорных растений

В статье представлены результаты исследований за 2015-2017 г. по вредоносности хлебного жука кузьки и защитные мероприятия проводимые на посевах яровой пшеницы. Установлено, что уровень потерь зерна от хлебного жука зависит от фазы формирования зерновок в колосе. При питании в фазах формирования –молочной и молочно-восковой спелости потери зерна состоят из выеденного жуком зерна, а

в фазе восковой и полной спелости к весу съеденного зерна добавляется масса выбитых жуком в процессе питания зерновок.

Установлено, что из трех видов хлебных жуков, встречающихся на посевах пшеницы, преобладает хлебный жук кузька – *Anisoplia austriaca*, остальные наблюдались в единичном количестве.

Полученные нами данные по вредоносности хлебных жуков в посевах яровой пшеницы являются ценными для производства, т.к. позволяют определить экономические пороги вредоносности фитофага.

Использование экономических порогов вредоносности хлебных жуков должно способствовать решению главной задачи – сохранению количества и качества урожая яровой пшеницы. Наиболее опасно питание взрослых особей – имаго жука-кузьки на пшенице в период формирования-созревания зерна, когда растения уже не могут компенсировать причиненный жуками вред.

В указанный период численность жуков достигла от 5,5 до 7,0 экз./м^2, что превышало экономичес-кий порог вредоносностии поэтому была проведена химическая обработка посевов.

Достоверные прибавки урожайности зерна яровой пшеницы получены отпримененнии препаратов, как Энжио 247 с.к. при норме расхода 0,15 л/га–1,5 ц/га и Данадим Эксперт, к.э. с нормой расхода 1,0 л/га–1,4 ц/га по сравнению с контролем без обработки. Дана оценка эффективности инсектицидов против имаго хлебного жука н посевах яровой пшеницы в условиях Западно-Казахстанской области

Ключевые слова: хлебный жук-кузька, порог вредоносности, потери зерна, меры борьбы, инсекти-циды, биологическая, хозяйственная эффективность.

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