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SEED TREATMENT IS AN ECOLOGICALLY SAFETY AND EFFECTIVE WAY OF PROTECTING SUGAR BEET SEEDLINGS

Abstract. Weevils (Bothynoderes punctiventris Germ.) and wireworms (genus Elateridae) cause the greatest damage to the beet growing sector in Ukraine. These pests, with ineffective protection of seedlings, can partially or completely to destroy beet crops. Density and uniformity of plant location decreases with their death and, respectively, sugar beet yield decreases too. Damaged, but living plants lag behind in growth and development which also leads to a decrease in crop productivity.

Studies of the effectiveness of protection of shoots from pests in the subzones of sufficient wetting of the beetroot belt in Vinnytsia region (Archi LLC) and in the subzone of unstable moistening Cherkassy region (Verkhnyatsky ESS of the Institute of Bioenergetic crops and sugar beet of the National Academy of Agrarian Sciences (IBCSB NAAS) and Cherkasy SARSNSC "Institute of Agriculture"NAAS)) were conducted.

The most effective way to protect shoots of sugar beet from pests and diseases is to create tolerant hybrids, as well as tillage, observance of crop rotations, spraying of shoots with insecticides and fungicides during the vegetation period and application of granular protective preparations to the soil. But the most environmentally safe and effective way - plant toxification when insecticides and fungicides are included in dragees and incrustation mixtures in the process of presowing seed preparation.

Research has shown that plant protection chemicals which are less in contact with the soil when seeded with dragee seeds encrusted with protective preparations. The total contact area, depending on the seeding rate, is about 7.03-8.04 m^2 per hectare of sugar beet sowing, when applying granular protection product into the soil is 444 m^2, and when spraying the crops is 10000 m^2. That is, the most ecological way to protect the emergence of sugar beet is sowing seeds treated with protective products.

Keywords: sugar beet, dragee, incrustation, weevils, wireworms.

Introduction. One of the main tasks of agricultural production is to provide the population with food, the use of which in physiologically necessary norms contributes to the normal functioning of the organism and its efficiency. From the large set and assortment included in the list of foodstuffs, one should emphasize only on individual root crops, the processing products of which occupy a prominent place in the diet of people, and many processing industries in Ukraine and the world. Such plant is sugar beet (Doronin et al., 2015).

Ukraine is in fairly favorable soil and climatic conditions and is one of the leading beet-growing countries in the world. However, the economic crisis caused a sharp decline in the production of this crop increased the cost of sugar beet cultivation and low competitiveness in the world market. In connection with this, the state has set a task before the beet growers to increase sugar beet production not only by increasing the yield of root crops, but also an increase in sugar content and a significant reduction in their cost price.

Sugar beet in our country is the only source of sugar, which is necessary to maintain the life of the human body, resistance to diseases, restoration of working capacity in case of physical fatigue and in extreme situations. It should be noted that this culture is high-tech and highly profitable. Traditionally sugar beet was a technical crop, profit from which constitutes a significant share of the profit of all crop production in Ukraine. Soil-climatic conditions of the beet-belt of Ukraine correspond to the biological

properties of beets thus, for centuries our country has occupied a prominent place among the beet-growing countries of the world in terms of the production of sugar raw materials and sugar (Doronin, 2012, Polishuk et al., 2015).

Modern technologies of growing sugar beets are impossible without using high-performance single-seed hybrids created on the basis of cytoplasmic male sterility and their seeds with high seeding qualities. Currently, more than 100 FM-hybrids of sugar beet have been created and registered, which are characterized by a high potential for productivity. Accelerated introduction of them into production will significantly increase the sugar assembly from one hectare. In connection with the new technologies of growing sugar beet the requirements to the quality of the seed material have significantly increased. Seeds should not only be characterized by high purity, germination energy, germination, but uniformity in size, single-flow and germination capacity at low temperatures (Tomaszewska-Sowa, 2012, Tevfyk & Mytrophanova, 2012).

Material and methods. The investigations were carried out in the Verkhnyatsk experimental-selection station IBCSB NAAS, Cherkassy State Agricultural Experimental Station NSC " Institute of Agriculture" NAAS, Archi LLC Kozyatinsky district of Vinnytsia region in 2010-2017. For dragee, the seeds of the triploid hybrid Alexandria and diploid - Uladovo-Verhnyatsky CM 37 and Ukrainian CM 72 was used.

The weight of the dragee shell from the mass of the seeds, %	The name of the dragee mixtures	Country supplier mixtures
Uncontaminated seeds-control		
60–100–200–300	«Vorskla»	Germany
	«Aurora»	Italy
	WM 213	Austria
	WM 214	Austria
	B 100	Austria
	P 1	England
	P 2	England
	G 1	Netherlands

The area of contact between the dragee shell and the ground was calculated from the formula $S = sd \times N \times n \times 106$,

where S - area of contact, m^2,

sd - area of one dragee, mm^2,

N - number of sowing units per hectare, pt,

n - amount of dragee in one seed unit, pt,

106 - conversion factor mm^2 per m^2.

Results and discussion. The productivity of sugar beets depends on many factors: soil and climatic conditions, introduction of highly productive hybrids, quality preseeding seed treatment, the use of modern technology and technology, fertilizer, reliable plant protection, high-technology recycling at sugar factories, etc. Lack of reliable plant protection during the vegetation period or ineffective protection of shoots from pests can partially or completely destroy beet crops.

The most effective way to protect seedlings of sugar beet from pests and diseases is to create tolerant hybrids. The most common methods are the agro-technological methods of growing a crop: soil cultivation, observance of crop rotations, spraying of shoots with insecticides and fungicides during the growing season and the introduction of granular protective preparations into the soil. But the most environmentally safe and effective way is plant toxicity when insecticides and fungicides are included in dragees and incrustation mixtures in the process of presowing seed preparation.

Our investigations have established that chemical plant protection agents with soil are less in contact when sowing dragee seeds inlaid with protective preparations. The total contact area, depending on the rate of seed sowing, is about7,03-8,04 m^2 per hectare of sugar beet, when applying granular protection in

the soil 444 m^2 and when spraying crops 10000 m^2. That is, the most environmentally friendly way to protect the sprouts of sugar beet is seeding with seeds treated with protective preparations.

Species composition of pests in different zones of the beet belt is different. Wireworm (genus Elateridae), beet fleas (Chaetocnema Spp.), gray beet weevil (Tanymecus palliatus Fabr.) occur in all areas of beet-growing and ordinary beet weevil (Bothynoderes punctiventris Germ.), beet crumbs (Atomaria linearis Steph.), scale insects (Cassida Spp.), undermines fly (Pegomyia hyosciami Panz.) and root aphid (Pemphigus fuscicornis Koch.) - only in certain zones (Doronin, 2011). Taking this into consideration, studies on the effectiveness of pest protection against pests were conducted in the subzones where the wireworm and weevils, which annually cause a significant harm to sugar beet are widespread. In the subzone of sufficient moisture of the beetroot belt - the Vinnytsia region (Archi LLC) and in the subzone of unstable moistening - Cherkassy region (Verkhnyatsky ESS, Cherkasy GOSS).

The account of pests prior to sowing confirmed the results of the IBCSB NAAS on their number. So, the greatest number of pests was in the experimental field Archi LLC, where the number of the beet regular weevils was 0,35 ind./m^2, wireworm – 5,5 ind./m^2, at the Verkhnyatsk Experimental Selection Station and the Cherkasy State Experimental Selection Station they were fewer, although their numbers exceeded the permissible damage threshold (table 1).

Table 1 – Pest density before sowing of sugar beet in experiments, average for 2010-2017

Place of experiments	Density of pests, ind./m^2	
	wireworms	weevils
Verkhnyatsky ESS (Cherkassy region)	7,3	0
Cherkasy GOSS (Cherkassy region)	2,2	0,45
Archi LLC (Vinnytsia region)	5,5	0,35
Damage threshold	2	0,2–0,3

It should be noted that before the sowing of sugar beet (the second decade of April), when the average daily air temperature was still low and weevils did not fly, their numbers were not large. It has been established that, with a small number of pests, the composition of preparations Force Magna (15+ 6 g.v./p.e.) and Cruiser 600 FS + Force 20 CS (60 + 8 g.v./p.e.) provided reliable protection of sprouts of sugar beet.

There is only a slight damage to plants with weevils and a wireworm (table 2, figure 1).

Table 2 – Damage to plants by pests, depending on the composition of seed treatment with protective preparations (phase - forks - the first pair of leaves), the average for 2010-2017

Place of experiments	№ of variant	Damage to plants		
		weevils		wireworms
		%	бал	%
Verkhnyatsky ESS, Cherkassy region	1	12,1	1,2	0
	2	6,3	1	0
	3	7,8	1	0
Cherkasy GOSS, Cherkassy region	1	80	3	70
	2	40	0,5	30
	3	20	0,25	10
Archi LLC, Vinnytsia region	1	30	1	32
	2	0	0	5
	3	0	0	0

Figure 1 – Minor damage to plants by weevils and wireworms

Thus, at the Cherkasy Experimental Agricultural Station when sown with dragee seeds treated with Force Magna, weighed 40% of the plants with weevils, and a mixture of preparations of the Cruiser (60 bp/p.e.) + Force (8 bd/p.e.) - 20% of the plants with a damage score of less than 1 (about 5% destroyed leaf surface), while 80% of the plants were damaged in the control and the damage score was 3, that is, up to 25% of the leaf surface was destroyed.

There was no significant damage to plants and by wireworm. Only single lesions of shoots were observed - one - two bites, did not reach the middle of the underground part of the stem and the spine. Similar results were obtained in the experiments of the Verkhnyak Experimental and Selection Station, although the number of pests was higher.

The registration of soil pests on the Verkhnyatsky ESS from sowing and 30 days after it showed that both compositions of the preparations provide reliable protection of seedlings, controlling the number of wireworms. If to the sowing of sugar beet in all variants of the wireworm there were 7 pieces, which is 3.5 times the permissible threshold of damage, then 10 days after sowing, their number decreased significantly, although it exceeded the permissible threshold of damage (figure 2). There was no significant difference in this indicator, depending on the protective composition used.

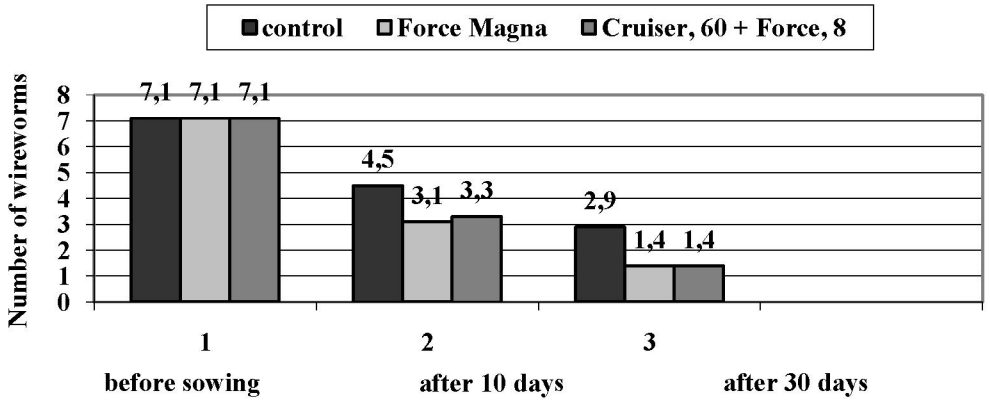

Figure 2 – The number of wireworms for the period of their accounting (Verhnyatsky ESS, average for 2010-2017)

In the experiments conducted in Archi LLC, about 30% of the plants were injured by weevils, 32% by wireworms and 24.1% of plants died. In variants with the treatment of seeds by the composition of Force Magna, the damage by these pests was insignificant. When sowing with seeds treated with the composition Cruiser + Force (60 + 8 g.v./p.e.) Plants were practically not damaged by weevils or wireworms (figure 3).

Figure 3 – General condition of crops
Upper row - Verkhnyatskaya ESS, 2010; lower – Archi LLC, 2011.
From left to right: variant 1 - control; variant 2; variant 3.

Thus, in the variants where the treated seeds were seeded with insecticides, the number of pests significantly decreased and, accordingly, - the number of damaged plants decreased and the degree of their damage both in the phase of the fork and in the phase of the first pair of real leaves. So, if 12.1% of plants were damaged in the phase of the fork in the control in the conditions of the Verkhnyatsky ESS, and in variants where seeded, treated seeds with protective compositions - 6.3% and 7.8%, then in the phase of the first pair of real leaves the number of damaged plants in the control increased to 13.8%, and in cases where the treated seeds were sown increase in the number of damaged plants was not observed, but, on the contrary, the number of damaged plants decreased (table 3).

Table 3 – Damage of plants with weevil, depending on the composition of seed treatment with protective preparations, 2010-2017

Variant - seed treatment		VESS		CGOSS		Archi LLC	
name of the preparations	norm, g.v./p.e.	%	point	%	point	%	point
Fork phase							
Control	–	10,4	1,11	55	4,0	19,3	1,0
Force Magna	15 + 6	5,2	1,0	22	1,0	2,0	1,0
Cruiser 600 FS + Force 20 CS	60 + 8	5,9	1,0	11,8	1,0	0,8	1,0
The phase of the first pair of real leaves							
Control	–	10,8	1,0	35,3	3,5	15	4,8
Force Magna	15 + 6	4,5	1,0	3,5	0,8	0	0
Cruiser 600 FS + Force 20 CS	60 + 8	4,2	1,2	2,5	0,6	0	0

In this case, there is a certain risk of losing a certain number of shoots from phytophages. However, if we take into account that a small number of pests remain alive in the field during this period and the mass of a plant in a phase of 2-3 pairs of leaves is 5-10 times greater than in the initial phases of development, even if they damage plants, the probability of maintaining a sufficient density of plants is increased in comparison with the control.

Similar results were obtained in experiments of Verkhnyatskaya ESS and Archi LLC. It should be noted that there is no significant difference in the number and extent of damaged plants, depending on the composition of the protective preparations for seed treatment that have been used.

In Ukraine weevils and wireworms cause the greatest damage to the beet industry. These pests, with ineffective protection of seedlings, can partially or completely destroy beet crops. With the death of plants, the density and uniformity of their distribution decreases and respectively, and sugar beet yield decreases too, and damaged, but living plants lag behind in growth and development, and this also leads to a decline in crop productivity.

Conclusion. Seed treatment with protective preparations is an ecologically safe and effective way to protect the emergence of sugar beet. When sowing with dragee seeds encrusted with chemical plant protection products they are less in contact with the soil, compared with the introduction of granular plant protection products and spraying crops. The total contact area, depending on the seeding rate, is about 7.03-8.04 m^2 per hectare of sugar beet, when applying granulated protective tools - 444 m^2, and when spraying crops 10000 m^2.

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ТҰҚЫМДАРДЫ ӨҢДЕУ – ҚОРШАҒАН ОРТАНЫ ЖӘНЕ ҚЫЗЫЛША ТҰҚЫМДАРЫН ҚОРҒАУДЫҢ ТИІМДІ ӘДІСІ

Аннотация. Арамшөптер (bothynoderes punctiventris Germ.) және құрттар (Elateridae тұқымдасы) Украинада қызылша өсіретін өнеркәсіпке үлкен зиян келтіреді. Көшеттердің тиімсіз қорғанысы бар бұл зиянкестер қызылша дақылдарын жартылай немесе толықтай жоя алады. Өсімдіктердің орналасу тығыздығы мен біркелкілігі олардың өліміне байланысты азаяды және сәйкесінше қант қызылшасының өнімділігі төмендейді. Зақымдалған, бірақ тірі өсімдіктер өсу мен дамудан артта қалады, бұл дақылдардың шығымдылығына әкеледі.

Винница облысының қызылша белдеуіндегі жеткілікті ылғалдылықтың суб-аймақтарындағы және Черкассы аймағындағы тұрақсыз ылғалдылықтың суб-аймағындағы (Ұлттық ауылшаруашылық академиясының Биоэнергетикалық дақылдар институтының Верхняцкий ЕС және қант қызылшасы) және зиянкестерден өсімдікті зиянкестерден қорғаудың тиімділігі бойынша зерттеулер жүргізілді.).

Қант қызылшасының көшеттерін зиянкестер мен аурулардан қорғаудың тиімді әдісі – бұл тәзімді будандарды құру, сонымен қатар топырақты өңдеу, ауыспалы егісті бақылау, вегетациялық кезеңде көшеттерді инсектицидтер мен фунгицидтермен бүрку және топыраққа түйіршікті қорғаныш препараттарын енгізу. Қоршаған ортаға қауіпсіз және тиімді әдіс – бұл инсектицидтер мен фунгицидтер драже және қабық қоспаларына тұқым даярлау процесінде енгізілген кезде, өсімдіктердің интоксикациясы.

Зерттеулер көрсеткендей, драже тұқымын себу кезінде өсімдіктермен топырақпен аз байланысатын химиялық қорғаныс құралдары қорғаныш препараттарымен жабысады. Тұқым себу жылдамдығына байланысты жанасудың жалпы ауданы топыраққа түйіршіктелген қорғаныс агентін қолданған кезде шамамен 7,03-8,04 $м^2$, ал дақылдарды бүрку кезінде – 10 000 $м^2$ құрайды. Яғни, қант қызылшасының көшеттерін қорғаудың ең экологиялық таза әдісі – қорғаныс агенттерімен өңделген тұқым себу.

Түйін сөздер: қант қызылшасы, драже, қабық, арамшөптер, құрт.

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ОБРАБОТКА СЕМЯН – ЭКОЛОГИЧЕСКИ БЕЗОПАСНЫЙ И ЭФФЕКТИВНЫЙ СПОСОБ ЗАЩИТЫ САЖЕНЦЕВ САХАРНОЙ СВЕКЛЫ

Аннотация. Долгоносики (Bothynoderes punctiventris Germ.) и проволочники (род Elateridae) наносят наибольший ущерб свеклосеющей отрасли Украины. Эти вредители при неэффективной защите рассады могут частично или полностью уничтожить посевы свеклы. Плотность и равномерность расположения расте-

ний уменьшается с их гибелью и, соответственно, снижается урожайность сахарной свеклы. Поврежденные, но живые растения отстают в росте и развитии, что также приводит к снижению урожайности сельскохозяйственных культур.

Проведены исследования эффективности защиты побегов от вредителей в подзонах достаточного увлажнения свекловичного пояса Винницкой области (ООО "Арчи") и в подзоне неустойчивого увлажнения Черкасской области (Верхняцкий ЭСС Института биоэнергетических культур и сахарной свеклы Национальной академии аграрных наук (ИБЦБ НААН) и Черкасский САРСНЦ "Институт сельского хозяйства" НААН).

Наиболее эффективным способом защиты всходов сахарной свеклы от вредителей и болезней является создание толерантных гибридов, а также обработка почвы, соблюдение севооборотов, опрыскивание всходов инсектицидами и фунгицидами в период вегетации и внесение в почву гранулированных защитных препаратов. Но самый экологически безопасный и эффективный способ – интоксикация растений, когда инсектициды и фунгициды включаются в драже и инкрустационные смеси в процессе предпосевной подготовки семян.

Исследования показали, что химические средства защиты растений, которые меньше контактируют с почвой при посеве семян драже, инкрустированы защитными препаратами. Общая площадь контакта, в зависимости от нормы высева, составляет около 7,03-8,04 м^2 на гектар посева сахарной свеклы при внесении гранулированного защитного средства в почву - 444 м^2, а при опрыскивании посевов – 10 000 м^2. То есть, наиболее экологичным способом защиты всходов сахарной свеклы является посев семян, обработанных защитными средствами.

Ключевые слова: сахарная свекла, драже, инкрустация, долгоносики, проволочники.

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