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FORMATION OF STABILITY SUGAR BEET PLANTS HARMFUL ORGANISMS IN SEED TREATMENT PROTECTIVE-STIMULATING SUBSTANCES

Efficiency of new protective-stimulating formulations against pests of sugar beet sprouts has been investigated. It was established that the application of plant growth regulators in combination with protectants for seed pre-treatment can increase the efficiency of such formulations against pests and pathogens, in particular, improves field seed germination, initial plant growth and development, reduces the level of damage by beet flea beetles, beet weevils and black root.

***Keywords**: sugar beet; preplant seed treatment; plant growth regulators; plant growth and development; pests; black root; damage of plants.*

Introduction. Damage of sugar beet plant caused by pests in the early stages of ontogeny is a major factor reducing their productivity. That is why measures aimed at preventing mass development of pests and reduce their negative impact on plant growth and development must attach importance in farming practice.

The most promising in this respect, both in terms of economic efficiency and environmental safety of growing crops is growing resistant varieties. However, the creation of these varieties through breeding is very difficult, time consuming and do not always get the desired results [1-3].

The study on the phenomenon of plant resistance against pests reveals that certain types or varieties contain certain protective substances that cause death or prevent insect feeding on leaves or other bodies of plants [4-5]. For example, according to D.F. Rudniev and V.P. Smilianets [6], the stability of different types of pine trees against pests is due to insects content of toxic substances acetates terpenes.

However, sugar beet plants are characterized with almost complete absence of active protective reaction that could prevent or inhibit the development of pest populations (i.e., mechanisms of antixenosis and antibiosis). In this case, we can only talk about a certain level of tolerance of plants to damage by phytophages, manifested through restoration of lost of organs or replacement by spare nutrients.

The solution to this problem is possible by artificial immunization of plants by introduction relevant toxic substances (insecticides) to a plant organism. When toxic substances enter plant organism, direct poisoning occurs when pests are feeding on such plants. This method allows although not genetically fixed immunity properties, but can reliably protect the body from injury [7-8].

When growing sugar beet, protection from pests is practically needed right after seed germination; most effective way to intoxication plants is pre-plant seed

treatment. This method of increasing plant resistance to insect damage has long been successfully used in the protection of crops from many pests [9-10]. At present, the further improvement of seed treatment technology using protective substances is a constant search and testing of new formulations pesticide active ingredients and their application rates etc.

An important element of the improving insecticides regulation, which requires a thorough and in-depth study is specifics of their interaction with other physiologically active substances used in the formulation for pre-plant treatment, namely fungicides, plant growth regulators, fertilizers, etc. that are inductors of defence reactions.

Therefore, the goal of our research was to establish the efficacy of pre-treatment for sugar beet seeds using protective-stimulating formulations comprising plant growth regulators against pests and forming the total sugar beet resistance to damage done pests.

Materials and methods. The research was carried out at Veselopodilska Experimental Breeding Station of the Institute of Bioenergy Crops and Sugar Beet NAAS of Ukraine in 2007-2009.

Check variant (background) was sugar beet seeds treated with insecticide Kruiser 350 FS, (42 ml/sowing unit) and fungicide Maxim XL 035 FS (12 ml/sowing unit.). The studied variants with growth regulators were background + Emistim C (standard) and background + Grainactive C.

Soil was typical low-humus mid-loamy chernozem. Sown area was 25 m^2, repetition quadruple. Sugar beet hybrid under study was Ivanovo-Veselopodilskyi CMS 84. Records of intensity of the initial growth and development of sugar beet and its damage level by ground pests and black root were performed according to the Methodology of Research on Sugar Beet [11].

Results and discussion. When using protective-stimulating substances for seed pre-treatment, an important indicator is not only their impact on the field germination, but also effect on further sprouts growth and development. It is the intensity of these processes, including growth of vegetative mass of plants, which fully reflects the vitality of seedlings, their ability to withstand adverse environmental factors and meanwhile lays the ground for the full potential realization of sugar beet plant productivity.

It was established that the use of growth-stimulating substances in the field for 2-3 days accelerated emergence, provided good and even sprouts, which largely contributed to increasing field seeds germination of. On the average over three years of research field germination with Emistim C and Grainactive C kept the same level of 79.7 and 81.8%, which was by 5.7 and 7.8% higher than the check, where grows regulators were not applied - 74.0% (*Table 1*). Type of growth stimulator had no significant difference in respect to field germination.

Checks show that the use of growth stimulators intensively promotes the growth of the sugar beet plant weight in the early stages of development (*Table 2*). Thus, when using growth regulator Grainactive C, weight 100 plants in the cotydelon stage was significantly higher than in check option and made up 11.4 g against 9.5 g, and was by 0.7 g higher than the same index in the option with Emistim C.

Table 1

Field germination and weight of 100 sugar plants when seeds have been treated with growth regulators (mean of 2007-2009)

Variant	Field germination, %	Weight of 100 plants (g) at the stage	
		cotydelon stage	2-4 leaf stage
Check (background)	74.0	9.5	56.5
Background + Emistim C (standard)	79.7	10.7	62.3
Background + Grainactive C	81.8	11.4	66.7
LSD_{05}	4.9	1.2	3.9

A similar pattern was observed in the subsequent phases of sugar beet development. In particular, when applying growth promoters, plant weight at the 2-4-leaf stage exceeded control by 12.6-20.0%. A significant increase in plant weight is associated with a stimulating effect of applied growth regulators on growth processes in sugar beet plant, and thus increasing their resistance against stressors of biotic and abiotic nature, including herbivores' harmful effect of.

Table 2

Effect of growth regulators in the formulation of protective-stimulating agents on the level of sugar beet crops damage by phytophages (mean of 2007-2009)

Variant	Damage indices		
	Damaged plants, %	Mean score	Index
Beet weevil			
Check (background)	44.7	1.3	0.58
Background + Emistim C (standard)	38.6	1.2	0.46
Background + Grainactive C	35.9	1.2	0.43
LSD_{05}	–	–	0.08
Beet flea beetles			
Check (background)	30.1	1.1	0.33
Background + Emistim C (standard)	23.4	1.1	0.26
Background + Grainactive C	24.4	1.0	0.24
LSD_{05}	–	–	0.03

Note: Damage of sugar beet by pests monitored during fork – two-leaf stage

For sugar beet being a crop sensitive to damage by leaf-eating insects. Their sprouts develop slowly, leaf surface for a long time remains small, and this determines the sensitivity of plants to damage by beet flea beetles and beet weevils that appear in spring on crops almost simultaneously with the crop sprouting.

Therefore, stimulating rapid emergence and sprouts initial development should be considered as priority actions to improve the resistance (endurance) to young plants damage by pests and diseases.

The results of field studies show that the inclusion of the growth stimulating substances to insecticide-fungicide composition improves its effectiveness against sugar beet pests. In the variants of seeds processed with growth promoters, plant damage by phytophages significantly decreased. Thus, when adding disinfectants Emistim C and Grainactive C to the composition, damaged by beet weevils plants percentage was lower by 6.1-8.8%, and beet flea beetles, by 5.7-6.7%, respectively, as compared with the check, where seed were treated with protectants only (Table 3).

Meanwhile, the positive impact of combination of protective and stimulant formulations manifested itself in marked decrease in the intensity of damage of crops by phytophages. As seen from Table 2, these variants marked decrease in the average index of damage compared to check, and, accordingly, the final index, which reflects the level of harmful influence of insects on damage index. It was established that biologically active preparations Emistim C and Grainactive C reduce plant beet weevils damage coefficient by 20.7-25.9%, respectively, and by beet flea beetles by 21.2-27.3% compared with those of check option.

Having explored the effectiveness of the protective-stimulating agents against pests of sugar beet, we cannot slide the effect of black root, which is an extremely dangerous disease. Having damaged plants starting at seed germination stage and finishing at 4-6-leaf stage, black root causes profound disorder of physiological processes in plants, inhibits their growth and development, leading to thinning out crops and significant (up to 40%) yield shortfall [14].

It was established that the combination of growth regulators Emistim C and Grainactive C with fungicide Maxim XL in the composition of protective-stimulating substances contributes to its fungicidal activity (Table. 3).

Table 3

Influence of growth regulators in the composition of protective-stimulating substances on sugar beet crops infestation by black root (mean of 2007-2009)

Variant	Black root development	
	Occurence, %	Degree of development, %
Check (background)	17.3	6.0
Background + Emistim C (standard)	13.2	4.1
Background + Grainactive C	12.5	3.7
LSD_{05}	3.0	1.7

Note: Damage of sugar beet by pests monitored during cotyledon – two-leaf stage

In particular, when treating seed with the formulation mixtures, the occurrence and average degree of black root development were as following: in the variant with Emistim C 13.2% and 4.1%, in the variant with Grainactive C 12.5% and 3.7%. In check variant, where seeds were processed only with insecticide and fungicide, these

figures were, respectively, 17.3% and 6.0%. Thus, the occurrence of the disease in these options was lower by 31.7-38.3%, and the intensity of the seedlings destruction decreased on the average 1.5 times compared to check.

Conclusions. Grounded on the research results, positive role of growth regulators Grainactive C and Emistim C in forming sugar beet plant resistance to harmful organisms should be noted. Application of these formulations in protective-stimulating substances compositions during pre-treatment increases seeds field germination, activates the initial growth and development of plants, reduces harmfulness of herbivores and black root on sugar beet crops, which overall can significantly minimize their negative impact on the growth processes in crops.

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Анотація

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Формування стійкості рослин цукрових буряків до шкідливих організмів за обробки насіння захисно-стимулюючими речовинами

Досліджено ефективність нових композицій захисно-стимулюючих речовин проти шкідливих організмів на сходах цукрових буряків. Встановлено, що застосування регуляторів росту рослин у поєднанні з протруйниками за передпосівної обробки насіння культури дозволяє підвищити ефективність дії таких композицій проти шкідників та збудників хвороб, зокрема покращує польову схожість насіння та початковий ріст і розвиток рослин культури, знижує рівень їх пошкодження буряковими довгоносиками й блішками та ураження коренеїдом.

Ключові слова: *цукрові буряки, передпосівна обробка насіння, регулятори росту рослин, ріст і розвиток рослин, шкідники, коренеїд, пошкодженість рослин.*

Аннотация

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Формирование устойчивости растений сахарной свеклы к вредным организмам при обработке семян защитно-стимулирующими веществами

Исследовано эффективность новых композиций защитно-стимулирующих веществ против вредных организмов на всходах сахарной свеклы. Установлено, что применение регуляторов роста растений в сочетании с протравителями при предпосевной обработке семян культуры позволяет повысить эффективность таких композиций против вредителей и возбудителей болезней, в частности улучшает полевую всхожесть семян, начальные рост и развитие растений, снижает уровень их повреждения свекловичными долгоносиками и блошками и поражения корнеедом.

Ключевые слова: *сахарная свекла, предпосевная обработка семян, регуляторы роста растений, рост и развитие растений, вредители, корнеед, поврежденность растений.*