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APPLICATION EFFICIENCY OF PLANT PROTECTION PRODUCTS FOR RESTRICTING THE DEVELOPMENT OF SUGAR BEET BACTERIAL DISEASES

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The article presents the results of laboratory studies for determining the bactericidal action of wide spectrum of crop protection chemicals concerning the pathogens of sugar beet bacterial diseases. It is shown the results of field researches of fungicides efficiency in oder to restrict the development of bacterial leaf spot of sugar beet.

Sugar beet, fungicides, bacteria, affection, efficiency, bactericidal effect.

In relation to the intensification of growing crops technologies and application of new pesticides, introduction of monocultures, innovation systems of fertilization and soil treatment on the background of agro-climatic changes, the issues of phytosanitary control in agrocenoses become actual. Primarily, it concerns the phytopathological condition of agrophytocenoses, namely the problems of determination of plant diseases etiology and selection of effective crop protection products. If earlier agrarians had to minimize the harm of fungal infections in the fields, so today diseases of bacterial origin become more common and widespread [4].

Phytopathogenic bacteria cause a number of diseases on the sugar beet leaves and roots that have very important economical value [3, 9].

During growing season the plants of sugar beet are affected by bacterial leaf spot, vein streak virus, bacterial scab, tail rot, cancer and tuberculosis of roots.

In addition, some diseases that are usually caused by fungi, occurring in beets with the participation of bacteria, and as a result appear bacterial forms of root feeder, necrosis fibrovascular bundles and gray rot [5, 9].

In order to limit the development of phytopathogenic fungi on the market we can find a wide arsenal of fungicides, while the influence of the most preparations on pathogenic bacteria for plants has not yet been fully investigated.

The purpose of research – to study the influence of pesticides on pathogenic bacteria that are able to initiate the infectious process on sugar beet plants in the laboratory and field conditions.

Materials and methods.

Effects of pesticides against bacteria strains was studied, that are pathogens of sugar beet bacterial diseases and in a collection of phytopathogenic bacteria in the Zabolotny Institute of Microbiology and Virology of the National Academy of Sciences of Ukraine are stored. The strains have been isolated in the territory of Ukraine in different years and was received from foreign collections. The sensitivity of phytopathogenic bacteria to pesticides found by the intensity of growth on potato agar with pesticides added to it in manufacturer's recommended dosages, that is increased and reduced the tenfold.

For this study the following strains of phytopathogenic bacteria were used: *Rhizobium vitis* (Ophel, Kerr 1990) Young et al. 2001 strains 9054, 9052, 8628; *Pseudomonas syringae* pv. *aptata* (Brown & Jamieson 1913) Yong, Dye & Wilkie 1978 strains 8545 and 8544; *Xanthomonas axonopodis* Starr & Garces 1950 strains 8715, 10, 7325; *Pseudomonas syringae* van Hall 1902 strains 7921 and 7923, which are the causative agents of tuberculosis roots, striation veins of leaves, tail rot and bacterial leaf spot of sugar beet.

Pesticides that are allowed to use in Ukraine and are intended for seed treatment and sowing of sugar beet for limiting development of various pathogens were used in the experiment: that are fungicides disinfectants on the basis of thiram 480 g/l, thiram 200 g/l + carboxin 200 g/l, fludioxonil 25 g/l + 10 g/l metalaxyl-M; insecticidal

disinfectants with active substances of thiamethoxam 350 g/l and 600 g/l, bifenthrin 200 g/l, imidacloprid 700 g/kg, clothianidin 400 g/l + beta-cyfluthrin 53 g/l; fungicides on the basis of spiroxamine 250 g/l + tebukonazole 167 g/l + triadimenol 43g/l, flutriafol 250 g/l, tiofanat-methyl 700 g/kg, propikonazole 250 g/l + cyproconazole 80 g/l, benomile 500 g/kg; insecticides with active substances of fenitrothion 50 g/l and beta-cyfluthrin 12,5 g/l + imidacloprid 100 g/l [7].

Field researches carried out during 2012-2013 years in Uladovo–Lyulinets Experimental Breeding station (ULEBS, Vinnytsia region) in the sufficient moisture zone of the Right-Bank Forest-Steppe of Ukraine. The effectiveness of fungicides against bacterial leaf spot of sugar beet was determined in the experiment.

Scheme of the experiment: *Factor A.* Hybrids: foreign selection – Canyon, Baccara and domestic – Alexandria, Ukrainian ChS-72.

Factor B. Fungicides spraying of sugar beet: Control – water spraying; preparation spraying – Alto Super 330 EC, c.e. (0,5 l/ha), Impact 12,5% c.s. (0,25 l/ha), Falcon 460 EC, c.e. (0,6 l/ha).

Application of fungicides conducted by using knapsack sprayer according to the scheme of experiment. Recordings of plant infestation by diseases carried out according to the methodology developed by the Institute of Bioenergy Crops and Sugar Beet [6].

Results and discussion.

From the list of investigated pesticides in laboratory conditions bactericidal effect showed five preparations and just two of them Vitavaks 200 FF, w.s.c. with active substances tyram 200 g/l + karboksyn 200 g/l and Impact 12,5% c.s. on the basis of flutriafol 250 g/l, had effect of influence in the dose recommended by the manufacturer and increased tenfold, while limiting the bacteria growth *P. syringae* strain 7923 that cause bacterial leaf spot of sugar beets. Insecticidal disinfectant on the basis of bifenthrin 200 g/l initiate a partial inhibition of the growth of bacteria *P. syringae* 7921, *P. syringae* pv. *aptata* 8545, 8544, *X. axonopodis* 6, 10 and R. *vitis* 9052 in a tenfold increase in dose.

It is marked the absence of growth the tail rot pathogen of sugar beet roots of bacteria *X. axonopodis* 7325 by adding to nutrient medium RMx10 of fungicide Falcon

460 EC, c.e. with three active substances spiroxamine 250 g/l + tebukonazole 167 g/l + triadimenol 43g/l. Bactericidal effect was found towards bacterial spot and vein streak virus of sugar beet leaves *P. syringae* 7923 and *P. syringae* pv. *aptata* 8545 of preparation Impact 12,5 % c.s. son the basis of flutriafol 250 g/l. Ten times increased doses of fungicide Alto Super, 33% c.e. with active substances propiconazole 250 g/l + cyproconazole 80 g/l initiated the absence of growth of pathogenic *P. syringae* 7923, *X. axonopodis* 7325, *R. vitis* 8628 (Table. 1).

1. Sensitivity of pathogens of sugar beet bacterioses to different doses of pesticides

Title of the active substance	The main purpose of drug	Sensitive strains of pathogenic bacteria	Dose that limits the growth of bacteria
Tyram 200 g/l + karboksyn 200 g/l	Fungicides disinfectants	*Pseudomonas syringae* 7923	RMx10, RM
Bifenthrin 200 g/l	Insecticidal disinfectants	*Pseudomonas syringae* 7921*	RMx10
		Pseudomonas syringae pv. *aptata* 8545*	RMx10
		Pseudomonas syringae pv. *aptata* 8544*	RMx10
		Xanthomonas axonopodis 6*	RMx10
		Xanthomonas axonopodis 10*	RMx10
		Rhizobium vitis 9052*	RMx10
Spiroxamine 250 g/l + tebukonazole 167 g/l + triadimenol 43g/l	Fungicide	*Xanthomonas axonopodis* 7325	RMx10
Flutriafol 250 g/l	Fungicide	*Pseudomonas syringae* 7923	RMx10, RM
		Pseudomonas syringae pv. *aptata* 8545	RMx10
Propiconazole 250 g/l + cyproconazole 80 g/l	Pungicide	*Pseudomonas syringae* 7923	RMx10
		Xanthomonas axonopodis 7325	RMx10
		Rhizobium vitis 8628	RMx10

Note: RM – doze of the pesticide that is recommended by manufacturer, * - partial inhibition of bacterial growth.

Having completed investigations concerning the influence on pathogenic for sugar beet, bacteria of pesticides, that used on other cultures, we determined bactericidal effect of preparations, which include mankotseb [2]. This accords with the results of other researchers who detected the antibacterial activity of mankotseb-containing preparations Atsydan 72%, Penkotseb 80%, Tattu 55%, Rydomil Gold 68 WG in relation to pathogenic bacteria of different genus and species that are pathogens of cereal crops and tomato [1, 8].

In field conditions we conducted observations and recordings of plant infestation by bacterial leaf spot. The disease manifests itself in the form of oily, necrotic spots of round or irregular shape with a dark border. The spots merge and tissue inside of them dries up and falls out [9].

Due to the recordings of plant infestation by this disease committed in 2012–2013 years in conditions of ULEBS, the first signs of the disease on young plants under favorable conditions for pathogens in the phase of 2–3 pairs of leaves was found. It is determined that indicators of extension and intensity of disease development on plants hybrids of foreign selection are not considerably higher in comparison with corresponding indicators on hybrids of domestic selection. Also we carried out crop spraying with working solution of fungicides in the III decade of June.

Indicators of extension and intensity of bacterial leaf spot of sugar beet were higher on experimental plots, fungicides treatment of which was not carried out. Thus on the plots without spraying with plants protection chemicals per 2012–2013 years in the beginning of July the most common this disease was on the plants of the hybrid Canyon (15,2%) with growth intensity of 9,4%. Maximum intensity of disease development was fixed during the lesions of Baccara hybrid – 10,1% in conditions of disease extension 14,3%.

After determining the intensity of the disease development on plots that have been sprayed with fungicides, we found that higher efficiency in comparison with other variants of the experiment, showed Impact 12,5 % c.s. Its effectiveness was 30% and 32% on the crops of foreign hybrids Canyon and Baccara, and 25 % and 27% in the Ukrainian ChS-72 and Alexandria respectively. It is established that in the field conditions the least influence on the intensity of bacterial leaf spot developmebt has fungicide Falcon 460 EC, c.e.

The effectiveness of its use in conditions of plant processing with hybrid Canyon was 5%, higher it was with Baccara spraying – 13%. Within two years of studies the efficiency of preparation Alto Super 330 EC, c.e. was on average 17% in conditions of plant processing with german hybrids Canyon and Baccara, and 13% and 14% for plant spraying with hybrids of domestic selection Alexandria and Ukrainian ChS-72 (Table 2).

2. Fungicides effectiveness in restricting development of bacterial leaf spot of sugar beet ULEBS, 2012-2013

Hybrid	Fungicide treatment	Extension of disease, %	Intensity of disease development, %	Effectiveness of fungicides, %
Canyon	Control*	15,2	9,4	–
	Alto Super 330 EC, c.e.	13,3	7,8	17,0
	Impact 12,5% c.s.	12,4	6,6	30,0
	Falcon 460 EC, c.e.	14,7	8,9	5,0
Baccara	Control *	14,3	10,1	–
	Alto Super 330 EC, c.e.	13,2	8,4	17,0
	Impact 12,5% c.s.	10,7	6,9	32,0
	Falcon 460 EC, c.e.	13,7	8,8	13,0
Alexandria	Control*	13,0	8,6	–
	Alto Super 330 EC, c.e.	12,9	7,5	13,0
	Impact 12,5% c.s.	11,4	6,3	27,0
	Falcon 460 EC, c.e.	11,9	7,7	10,5
Ukrainian ChS-72	Control*	11,6	8,4	–
	Alto Super 330 EC, c.e.	10,7	7,2	14,0
	Impact 12,5% c.s.	8,9	6,3	25,0
	Falcon 460 EC, c.e.	11,5	7,8	7,0

Note: Control* - spraying crops with water.

Thus the efficiency indicators of the studied fungicides Alto Super 330 EC, Impact 12,5 % and Falcon 460 EC in the field conditions indicate that the ability to influence on the extension and intensity of leaf spot development of sugar beet, caused by phytopathogenic bacteria is low. Higher in comparison with other preparations efficiency indicators of fungicide Impact 12,5 % show the possibility of its use for the main appointment – to restrict the development of plant diseases caused by phytopathogenic micromicetes and in order to influence on pathological process on plant, initiated by bacteria.

Obtained data from laboratory and field researches concerning the effectiveness of chemical plant protection products with different active substances for restricting the development of bacterial diseases of sugar beet point to the necessity of finding alternative protection methods, because from a wide spectrum of preparations, the bactericidal effect show just some of them and fungicides usage in the field conditions is a few effective or even ineffective.

Conclusions

1. In laboratory conditions it was found the absence of bactericidal effect of the majority of preparations that are used for seeds processing and sugar beet sowing in order to restrict the development of various pathogenic organisms, except disinfectants Vitavaks 200 FF, w.s.c, fungicides Impact 12,5 % c.s., Alto Super 330 EC, c.e. and Falcon 460 EC, c.e. that influence on certain strains of pathogens.
2. Fungicides efficiency in the field conditions in restricting the development of bacterial leaf spot of sugar beet in 2012-2013 years amounted to: Alto Super 330 EC, c.e. from 13% on the hybrid plants Alexandria up to 17% on crops of foreign hybrids Baccara and Canyon; Impact 12,5% c.s. from 25% on the Ukrainian Chs-72 up to 32% on plots of Baccara hybrid; the least influence on the intensity of bacterial leaf spot developmebt has fungicide Falcon 460 EC, c.e.: 13% on crops hybrid Baccara, 10,5% on the plants Alexandria, 7 % on the hybrid plants Ukrainian Chs-72 and 5% on the plants of hybrid Canyon.

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Викладено результати лабораторних досліджень з визначення бактерицидної дії широкого спектра хімічних засобів захисту рослин на збудників бактеріальних хвороб цукрових буряків та результати польових досліджень з встановлення ефективності фунгіцидів для обмеження розвитку бактеріальної плямистості листків цукрових буряків.

Цукрові буряки, фунгіциди, бактерії, ураження, ефективність, бактерицидна дія.

Изложены результаты лабораторных исследований по определению бактерицидного действия широкого спектра химических средств защиты растений на возбудителей бактериальных болезней сахарной свеклы и результаты полевых исследований по установлению эффективности фунгицидов для ограничения развития бактериальной пятнистости листьев сахарной свеклы.

Сахарная свекла, фунгициды, бактерии, поражения, эффективность, бактерицидное действие.