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MICROBIOLOGICAL ACTIVITY OF WINTER WHEAT RHIZOSPHERE DEPENDING ON DIFFERENT PREDECESSORS AND APPLICATION OF BIOLOGICALLY ACTIVE PREPARATIONS

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In the article the research results of the effect of different rates of herbicide Lantselot 450 WG (13;23;33 g / ha) applied separately and in cooperation with plant growth regulators Biolan and Radostim on the grouping of rhizospheric microbiota of winter wheat grown after different predecessors are given.

It is well known that microorganisms are necessary link in the cycle of all biogenic elements and direct participants in the processes of soil formation [1]. These soil microorganisms provide ecological balance of any soil ecosystem [2].

The interaction of different groups of microorganisms with cultivated plants occurs most actively in the root zone - rhizosphere [3, 4], but the relationship of cultivated plants with soil microorganisms, in particular with rhizosphere isn't now studied enough. Thus, the experimental data of national and foreign scholars testify that when using for agricultural crops biologically active preparations of herbicidal effect the number, composition and proportion of major groups of soil microbiota may significantly change [5, 6]. In particular, according to Z. Hrytsaienko and others [7], herbicides have to be used at the science-based rates in order not to produce at places of their application toxic to most microorganisms concentrations.

Scholars also assert [5] that biologically active preparations with growth stimulating features increase the activity of natural microbial associations and contribute to the synthesis of antibiotic preparations against a wide range of pathogens. However, the influence of growth stimulating preparations on the formation of crop productivity, including winter wheat isn't studied enough. With this context our goal was to investigate how different rates of herbicide Lantselot 450 WG applied separately and with plant growth regulators (PGR) Biolan and Radostim applied in different ways influence the total amount of bacteria and micromycetes in winter wheat rhizosphere.

Research methods The research was conducted in 2011-2012 on the experimental field of training, research and production department of Uman National University of Horticulture. Soil of the research field is podzolized chornozem, low humus heavy clay loamy on loess of humus content in the plow

layer (0-30cm) –3.3%. In the experiment winter wheat "Smuglyanka" was sown after maize for silage and perennial grasses predecessors.

Field experiments were laid out in accordance with the schemes given in the tables, in particular in the variants 4, 5, and 6 in the phase of full tillering of winter wheat herbicide Lantselot 450 WG (AI aminopiralid 300 g / kg and florasulam 150 g / kg) was applied in spring after seedling stage at the rates of 13,23 and 33 g / ha; in the third variant Biolan was applied separately (AI – Emistim C – 1.0 g / l, trace elements) by spraying seeds; in the variants 7-9 PGR Biolan was applied in spring in the phase of tillering in combinations with appropriate rates of Lantselot 450 WG; in the variants 10-17 seeds were treated with Radostym (AI – Emistym C – 0,3 g / l, potassium salt of alpha-acid naphthyl acetic acid (1.0 ml / l and microelements) before sowing at the rate of 250 ml / t (ground); in the variants 12-14 in spring in the phase of tillering Lantselot 450 WG at the rates of 13, 23, and 33 g / ha was applied on the background; in the variant 11 in spring in the phase of tillering only Biolan was applied on the background; and in the variants 15-17 in spring in the stage of tillering Lantselot 450 WG was applied at the rates of 12, 23, and 33 g / ha in combination with Biolan at the rates of 20 ml / ha on the background.

The amount of microorganisms in winter wheat rhizosphere was determined according to Zviagintsev and others [8], in particular the total amount of microorganisms was determined by sowing of soil suspension of appropriate dilution on meat-and-peptone agar, micromycetes – on Czapek's medium. The amount of bacteria was stated in colony-forming units per gram of soil.

Research results. As the result of the investigation it has been determined that biologically active preparations affected the formation of rhizosphere population of microorganisms irrespectively of wheat predecessor. But the total number of rhizosphere microbiota depended on different norms of application of herbicide combined with PGR Biolan and pre-sowing spraying of seeds with PGR Radostim. So, at the rates of 13 and 23 g / ha of application of Lantselot 450 WG the total number of bacteria in winter wheat rhizosphere grown after maize for silage predecessor on the 25^{th} day after application of preparations increased by 8 and 20% in comparison with control without application of preparations and hand weeding (table 1). With increasing the rate of application of Lantselot 450 WG to 33 g / ha the amount of microorganisms in comparison with previous norms of herbicide decreased but in comparison with control I was by 4% more.

Application of plant growth regulator Biolan at the rate of 20 ml / ha stimulated development of bacteria of winter wheat rhizosphere by 23% in comparison with control I.

1. **The total amount of rhizospheric microbiota of winter wheat under the application of different norms of herbicide Lantselot 450 WG and different application methods of PGR Biolan and Radostim (maize for**

silage predecessor, 25th day after application of preparations, average for 2011-2013)

Variant of experiment	Total amount			
	bacteria		micromycetes	
	CFU, thous. u/g of soil	% before control	CFU, thous. u/g of soil	% before control
Without application of preparations (control I)	1453	100	462	100
Without application of preparations + hand weeding during the growing season (control II)	1700	117	818	177
Biolan 20 ml / ha	1787	123	582	126
Lantcelot 450 WG 13 g / ha	1569	108	594	129
Lantcelot 450 WG 23 g / ha	1744	120	610	132
Lantcelot 450 WG 33 g / ha	1511	104	573	124
Lantcelot 450 WG 13 g / ha + Biolan 20 ml / ha	1889	130	739	160
Lantcelot 450 WG 23 g / ha + Biolan 20 ml / ha	1962	135	767	166
Lantcelot 450 WG 33 g / ha + Biolan 20 ml / ha	1714	118	624	135
Radostym 250 ml / t – seed treatment (Radostym)	1758	121	614	133
Radostym + Biolan 20 ml / ha	1860	128	790	171
Radostym + Lantcelot 450 WG 13 g / ha	1976	136	758	164
Radostym + Lantcelot 450 WG 23 g / ha	2049	141	864	187
Radostym + Lantcelot 450 WG 33 g / ha	1845	127	748	162
Radostym + Lantcelot 450 WG 13 ml / ha + Biolan 20 ml / ha	2296	158	882	191
Radostym + Lantcelot 450 WG 23 g / ha + Biolan 20 ml / ha	2194	151	868	188
Radostym + Lantcelot 450 WG 33 g / ha + Biolan 20 ml / ha	2092	144	799	173
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Combined application of herbicide Lantcelot 450 WG with PGR Biolan also conduced to the increase of amount of soil microbiota. So after the application of herbicide Lantcelot 450 WG at the rates of 13 g / ha general amount of bacteria of winter wheat rhizosphere in comparison with control I increased by 30%, and after

the application of herbicide Lantcelot 450 WG at the rates of 23 and 33 g / ha – by 35 and 18% compared with control 1.

The increase of amount of bacteria of winter wheat rhizosphere by 21 and 28% in comparison with control I was also investigated if seeds were treated with plant growth regulator Radostim before sowing (250ml / t) and after seedling stage with PGR Biolan at the rate of 20 ml/ ha after treatment of seeds with PGR Radostim.

Spraying of crops with herbicide Lantcelot 450 WG at the rates of 13; 23 and 33 g / ha after the pre-sowing treatment of seeds with PGR Radostim conduced to the increase of amount of bacteria of winter wheat rhizosphere by 36; 41 and 27% in comparison with control I and at the same time by 16; 21 and 9% –with the variant without applying of preparations with hand weeding during vegetation period (control II).

The pre-sowing treatment of winter wheat with PGR Radostim and applying of herbicide Lantcelot 450 WG with PGR Biolan after seedling stage conduced to growth and development of bacteria of investigated crop rhizosphere, but bacterial micribiota was developed the most actively in the variant with applying of mixture of herbicide Lantcelot 450 WG at the rate of 13 g / ha with Biolan, which exceeded control I and control II by 58% and 35% accordingly.

As a result of investigation of total number of rhizospheric microbiota of winter wheat grown after perennial grasses predecessor on the 25^{th} day after application of preparations we have noticed analogical regularity in the development of rhizospheric bacteria as with maize for silage predecessor, at the same time as to the results of amount of rhizospheric microorganisms after the perennial grasses predecessor, the results of rhizospheric microbiota of winter wheat grown after maize for silage predecessor predominated. So, the researches made in 2011-2013 had shown that on the 25^{th} day after application of herbicide Lantcelot 450 WG at the rates of 13; 23 and 33 g / ha the amount of bacteria of winter wheat rhizosphere in comparison with control I increased by 13; 24 and 9% accordingly (table 2).

At the combined application of herbicide Lantcelot 450 WG at the rates of 13; 23 and 33 g / ha with PGR Biolan the amount of bacteria in winter wheat rhizosphere after perennial grasses predecessor also increased in comparison with control I by 36; 42 and 23% accordingly, at the same time in comparison with appropriate variants when herbicide was applied without PGR Biolan – by 376; 294 and 229 thous. CFU / g soil.

After the pre-sowing treatment of winter wheat with PGR Radostim the most intensive development of rhizospheric bacteria was registered after application of herbicide Lantcelot 450 WG at the rates of 13; 23 and 33 g / ha with PGR Biolan, that exceeded control I by 76; 68 and 60% accordingly.

2. The total amount of rhizospheric microbiota of winter wheat under the application of different norms of herbicide Lantselot 450 WG and different application methods of PGR Biolan and Radostim (perennial grasses predecessor, 25th day after application of preparations, average for 2011-2013)

Variant of experiment	Total amount			
	bacteria		micromycetes	
	CFU, thous. u/g of soil	% before control	CFU, thous. u/g of soil	% before control
Without application of preparations (control I)	1634	100	603	100
Without application of preparations + hand weeding during the growing season (control II)	1977	121	1085	180
Biolan 20 ml / ha	2059	126	778	129
Lantcelot 450 WG 13 g / ha	1846	113	808	134
Lantcelot 450 WG 23 g / ha	2026	124	856	142
Lantcelot 450 WG 33 g / ha	1781	109	772	128
Lantcelot 450 WG 13 g / ha + Biolan 20 ml / ha	2222	136	1013	168
Lantcelot 450 WG 23 g / ha + Biolan 20 ml / ha	2320	142	1067	177
Lantcelot 450 WG 33 g / ha + Biolan 20 ml / ha	2010	123	862	143
Radostym 250 ml / t – seed treatment (Radostym)	2042	125	947	157
Radostym + Biolan 20 ml / ha	2190	134	1061	176
Radostym + Lantcelot 450 WG 13 g / ha	2271	139	1031	171
Radostym + Lantcelot 450 WG 23 g / ha	2484	152	1158	192
Radostym + Lantcelot 450 WG 33 g / ha	2173	133	1019	169
Radostym + Lantcelot 450 WG 13 ml / ha + Biolan 20 ml / ha	2876	176	1194	198
Radostym + Lantcelot 450 WG 23 g / ha + Biolan 20 ml / ha	2745	168	1146	190
Radostym + Lantcelot 450 WG 33	2614	160	1067	177

g / ha + Biolan 20 ml / ha				
HIP_{05}				

Analyzing in general bacteria figures of winter wheat rhizosphere grown after maize for silage and perennial grasses predecessors it should be noticed that the most of their amount was registered in the variant with spraying crops with herbicide Lantcelot 450 WG at the rates of 13; 23 and 33 g / ha with PGR Biolan in comparison with pre-sowing treatment of seeds with PGR Radostim at the rate of 250 ml / t, but bacterial micribiota developed the most actively after perennial grasses predecessor. In particular among the research variants most of rhizospheric bacteria after perennial grasses predecessor was registered after the application of preparation of Lantcelot 450 WG at the rate of 13 g / ha with PGR Biolan after the pre-sowing treatment of seeds with PGR Radostim that exceeded control I by 76%. These data coincide with those obtained indices of most chlorophyll content in leaves of winter wheat and highest photosynthetic activity of crops in this version of the experiment, causing activation of energy and constructive processes of metabolism in plants, which resulted in increased amount of fluid, which serve as a factor of growth and development of soil rhizospheric microorganisms [9].

Investigated preparations also influenced the development of fungus microbiota of winter wheat rhizosphere (tables 1, 2). So, after the application of herbicide Lantcelot 450 WG at the rates of 13; 23 and 33 g / ha the number of micromicetes of winter wheat rhizosphere grown after maize for silage predecessor increased control I by 29; 32 and 24% accordingly. Obtained results show positive impact of different rates of Lantcelot 450 WG on micromicetes, however, their greatest amount was observed after optimal norms of herbicide (23 g / ha) with PGR Biolan 20 ml / ha, that exceeded control 1 by 305 thous. CFU / g of soil.

After the pre-sowing treatment of winter wheat seeds with PGR Radostim and spraying of crops with PGR Biolan at the rate of 20 ml / ha the amount of micromicetes exceeded control 1 by 71%.

Application of herbicide Lantcelot 450 WG at the rates of 13; 23 and 33 g / ha after treatment of seeds with PGR Radostim resulted in increase of micromicetes of winter wheat rhizosphere by 758; 864 and 748 thous.CFU / g of soil or by 64; 87 and 62% in comparison with control I. In the variants with joint application of herbicide Lantcelot 450 WG at the rates of 13; 23 and 33 g / ha with PGR Biolan after treatment of seeds with PGR Radostim the amount of micromicetes was the largest and it came to 882; 868 and 799 thous. CFU in 1 g of soil.

The largest amount of micromicetes was registered in the variant of experiment when crops were sprayed with herbicide Lantcelot 450 WG at the rate of 13 g /ha together with PGR Biolan at the rate of 20 ml / ha combined with pre-sowing treatment of seeds with PGR Radostim at the rate of 250 ml / t – 882 CFU / g of soil.

Similar results of the amount of micromicetes of winter wheat rhizosphere were also obtained when cultivated after perennial grasses predecessor. It is evident that perennial grasses enriching the soil with nitrogen and organic mass of high-quality of decayed materials contribute to improve its structure and help to activate its passing microbiological processes that are stated in increase of number of microbiota, including micromicetes.

Also in the variants of experiment the increase of amount of rhizospheric bacteria and micromicetes can be explained by the fact that herbicide eliminates competition of winter wheat crops with weeds, as a result, crops grew and developed better, actively formed aboveground and root mass, physiological processes occurred actively in them. Overall, this contributed to a more intense release of root systems of organic compounds that serve as a breeding ground for the development of microbiota.

Conclusions.

1. The amount of bacteria and micromycetes of winter wheat rhizosphere grown after different predecessors depends upon the pre-sowing treatment of seeds with PGR Radostim and post emergence apply of herbicide Lantcelot 450 WG and PGR Biolan.

2. The most of bacterial and fungus microbiota is observable under the pre-sowing treatment of winter wheat seeds with plant growth regulator Radostim and spraying of crops with herbicide Lantcelot 450 WG at the rates of 13 g / ha with PGR Biolan (20 ml / ha), that exceeds the control I by 58 and 91% after maize for silage predecessor and by 76 i 98% after perennial grasses predecessor.

3. Higher amount of microbiota of winter wheat rhizosphere is grown after the perennial grasses predecessor that is consistent with higher intensity of plant physiological processes.

REFERENCES

1. Волкогон В. В. Мікробні препарати у землеробстві / В.В. Волкогон, О.В. Надкернична, Т.В. Ковалевська та ін. – К.: Аграрна наука, 2006. – 312с.

2. Патика Н. В. Подходы к анализу комплексности бактериальных сообществ в разных типах почв / Н.В. Патыка // Агроекологічний журнал. – 2005. – № 1. – С.44-46.

3. Пауко О. В. Перспективність використання азотфіксуючих мікроорганізмів та водоростей для підтримання екологічно стійких агроекосистем /О. В. Пауко, Ю. О. Гончар, Т. В. Паршикова// Агроекологічний журнал. – 2009. – № 2. – С. 82-85.

4. Минеев В. Г. Агрохимические, микробиологические и фитотоксические свойства дерново-подзолистой почвы в период

последейсвия удобрений / В. Г. Минеев, Н. Ф. Гомонова., И. И. Скворцова [и др.] // Агрохимия. – 1999. – №7. – С. 19-23.

5. Тернична О. В. Модифікація методу дифузії в агарі для визначення чутливості мікроорганізмів до пестицидів/ О. В. Тернична // Агроекологічний журнал. – 2004. № 4. – С. 68-70.

6. Андреюк К. І. Функціонування мікробних ценозів в умовах антропогенного навантаження / К. І. Андреюк, Г. О. Іутинська, А. Ф. Антипчук та ін. – К.: Оберег, 2001. – 240 с.

7. Грицаєнко З. М. Біологічна активність ґрунту в посівах озимої пшениці в залежності від дії гербіцидів, внесених окремо і сумісно з біостимуляторами росту / З. М. Грицаєнко, І. Б. Леонтюк // Зб.наук пр.. Уманської ДАА, 2001. – С. 101-105.

8. Методы почвенной микробиологии и биохимии / [Алиева И. В., Бабъева И. П., Бызов Б. А. и др.]; под ред. Д. Г. Звягинцева. – М: Изд-во Московского Университета, 1991. – 304 с.

9. Биорегуляция микробно-растительных систем / Иутинская Г. А., Пономаренко С. П., Андреюк Е. И. [и др.]; под ред. Г. А. Иутинской и С. П. Пономаренко. – К.: Ничлава, 2010. – 464 с.

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Annotation

The results for the research of the effects of various norms of herbicide Lancelot 450 WG (13, 23, 33 g / ha) applied separately and combined with plant growth regulators Biolan and Radostym on the grouping of microbiota rhizosphere of winter wheat grown after different predecessors are given. It was established that the number of bacteria and micromicetes of winter wheat rhizosphere grown after different predecessor depends on the presowing treatment of seeds with PGR Radostym and postemergence apply of herbicide Lancelot 450 WG and PGR Biolan. The greatest number of bacterial and fungal microbiota is observed against the presowing treatment of winter wheat seeds with PGR Radostym and spraying with herbicide Lancelot 450 WG in the norms of 13 g / ha and PGR Biolan (20 ml

/ ha), which exceeds the control I over 58 and 91 % after the maize for silage predecessor and 76 and 98 % – after the perennial grasses predecessor. Larger quantities of microbiota of winter wheat rhizosphere are developed after the perennial grasses predecessor that is accorded with a higher intensity of plant physiological processes.

Keywords: herbicide, growth regulators, rhizosphere, bacteria, micromycete, predecessor, winter wheat.

МИКРОБИОЛОГИЧЕСКАЯ АКТИВНОСТЬ РИЗОСФЕРЫ ОЗИМОЙ ПШЕНИЦЫ ПРИ РАЗЛИЧНЫХ ФОНАХ ВЫРАЩИВАНИЯ И ПРИМЕНЕНИЯ БИОЛОГИЧЕСКИ АКТИВНЫХ ВЕЩЕСТВ

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Аннотация

Представлены результаты исследований по изучению действия различных норм гербицида Ланцелот 450 WG (13 , 23; 33 г / га), внесенных отдельно и совместно с регуляторами роста Биолан и Радостим, на группировки ризосферной микробиоты озимой пшеницы выращиваемой после различных предшественников. Установлено, что численность бактерий и микромицетов ризосферы озимой пшеницы, выращиваемой после различных предшественников, зависит от предпосевной обработки семян РРР Радостим и послевсходовым внесением гербицида Ланцелот 450 WG и РРР Биолан. Наибольшая численность бактериальной и грибной микробиоты отмечается на фоне предпосевной обработки семян пшеницы озимой РРР Радостим и опрыскивания посевов гербицидом Ланцелот 450 WG в норме 13 г / га с РРР Биолан (20 мл / га), что превышает контроль I на 58 и 91 % на фоне предшественника кукуруза на силос и 76 и 98 % – на фоне предшественника многолетние травы. Высшая численность микробиоты ризосферы озимой пшеницы развивается по предшественнику многолетние травы, согласующихся с высокой интенсивностью прохождения в растениях физиологических процессов.

Ключевые слова: гербицид, регуляторы роста, ризосфера, бактерии, микромицеты, предшественник, пшеница озимая.