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AGROECOLOGICAL RATIONALE OF TECHNOLOGICAL METHODS OF GROWING LEGUMES

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Abstract

Competitive bioorganic varietal technology of legumes cultivation is given, which provides for the development of regulations for the application of a set of alternative types of fertilizers for their cultivation in terms of short-term and long-term action and basic superstructure of factor assessment of soil fertility, hydrothermal conditions of the region, resource conditions. The scientific value of the article is to present the results of research conducted on the basis of the Research Farm «Agronomiche» Vinnytsia National Agrarian University, Agronomichne village, Vinnytsia district of Vinnytsia region. The scientific substantiation of technological methods of growing legumes allows to modernize the system of training of future specialists in the field of agrotechnologies and to increase the production and practical orientation of such professional training.

Keywords: technology of legumes, bioorganic varietal technology, growing, agrotechnologies.

Formulation of the problem. Strategic development of agrotechnologies with a focus on global trends in approaches to growing and fertilizing crops necessitates the development of adapted varietal cultivation technologies, which will ultimately ensure the formation of a modern technological strategy for the development of Ukraine's agro-industrial complex and guarantee its food security in the long run. Today, many types of legumes have not lost their importance as important food crops and occupy a prominent place in the formation of food and protein resources in many countries. At the same time, the pronounced tendencies to climate change, the formation of alternative fertilizer systems in the technology of growing crops, the global strategy for biologization of technological support for vegetable protein – requires the search for effective bioorganic systems in realizing the potential of basic legumes in the symbiotic interaction biological products of various nature (stimulants, nitrogen fixation enhancers, etc.) and the search for optimal models, a combination of this approach with a set of modern chelated microfertilizers.

Conditions and methods of research. In modern agriculture, the cultivation of leguminous crops has become widespread, which are characterized by high productivity and liquidity in the market. However, their cultivation is associated with the use of high norms of mineral fertilizers with an acid reaction, which negatively affect the soil, the intensive use of soil herbicides and soil cultivation methods that contribute to the development of erosion processes, the creation of a subsoil microbiological state of the "sole", the deterioration of the physicochemical parameters of the soil from - due to the limited supply of organic residues to the soil. Crops such as maize, sunflower, canola and sugar beet create tension in agrocenoses. At the same time, leguminous crops require low rates of phosphorus-potassium fertilizers, and nitrogen comes to them as a result of symbiotic fixation and associative activity of microorganisms, a significant amount of which is accumulated and used by subsequent crops in crop rotation. The root system of leguminous crops is well developed, able to withstand drought and well drains the soil and restores its structure, positively affecting the soil microbiota.

The research provided for the study of the peculiarities of growth, development and formation of the crop and grain quality of intensive varieties of peas and white lupine depending on the impact of pre-sowing seed treatment and foliar fertilization in the Right-Bank Forest-Steppe. The research was conducted during 2011-2017 according to the methods of field research. The scientific value of the article is to present the results of research conducted on the basis of the Research Farm «Agronomiche» Vinnytsia National Agrarian University, Agronomichne village, Vinnytsia district of Vinnytsia region.

Research results. Morphological and functional properties of plants in agrophytocenoses are determined by the genetic characteristics of the organism and a number of environmental factors that act in a complex way. Therefore, the study of biological features of peas, the basic laws of its growth and development, namely the passage of the phases of vegetation, the dynamics of photosynthetic and symbiotic apparatus, accumulation of dry matter, quantitative and qualitative assessment of yield will allow to develop techniques for growing technology based on plant biology.

On average, the results of research indicate a significant impact of the studied technological methods of cultivation on yield (Table 1). In this case, the varietal difference between the yields on different variants of the experiment was mainly determined by the difference in yield on the control.

Table 1.

Yield of white lupine grain depending on technological methods of cultivation, t / ha (average for 2013-2017)

Factors			Years					Average
variety	pre-sowing seed treatment	foliar feeding *	2013	2014	2015	2016	2017	
Veresnevyi	Without pre-sowing seed treatment	without fertilization **	3,08	3,24	2,55	2,86	3,06	2,96
		one feeding	3,13	3,35	2,59	2,92	3,12	3,02
		two feedings	3,18	3,42	2,62	3,12	3,22	3,17
	Ryzogumin	without fertilization	3,15	3,71	2,90	3,15	3,35	3,25
		one feeding	3,31	3,88	2,94	3,25	3,51	3,38
		two feedings	3,40	3,90	3,05	3,33	3,57	3,45
	Emastym C	without fertilization	3,10	3,68	2,82	3,12	3,28	3,20
		one feeding	3,20	3,74	2,86	3,22	3,32	3,27
		two feedings	3,31	3,81	2,93	3,30	3,40	3,35
	Ryzogumin + Emastym C	without fertilization	3,08	3,62	2,88	3,13	3,25	3,19
		one feeding	3,12	3,85	3,01	3,24	3,40	3,32
		two feedings	3,58	4,10	3,15	3,39	3,83	3,61
Makarivskyi	Without pre-sowing seed treatment	without fertilization	2,69	2,74	2,46	2,60	2,66	2,63
		one feeding	2,78	2,81	2,54	2,62	2,80	2,71
		two feedings	2,90	2,93	2,62	2,72	2,89	2,81
	Ryzogumin	without fertilization	3,00	3,13	2,51	2,76	3,00	2,88
		one feeding	3,14	3,31	2,72	2,95	3,15	3,05
		two feedings	3,20	3,45	2,80	3,00	3,30	3,15
	Emastym C	without fertilization	2,68	2,78	2,28	2,48	2,68	2,58
		one feeding	2,71	2,85	2,32	2,52	2,72	2,62
		two feedings	2,80	2,90	2,50	2,58	2,88	2,73
	Ryzogumin + Emastym C	without fertilization	3,11	3,24	2,38	2,82	3,00	2,91
		one feeding	3,22	3,40	2,41	2,90	3,12	3,01
		two feedings	3,34	3,65	2,70	3,10	3,36	3,23

LSD $_{0,5}$ t / ha: A-0,07; B-0,10; C-0,08; AB-0,14; AC-0,12; BC-0,17; ABC-0,24
2013 LSD $_{0,5}$ t / ha: A-0,04; B-0,05; C-0,04; AB-0,07; AC-0,06; BC-0,08; ABC-0,12
2014 LSD $_{0,5}$ t / ha: A-0,05; B-0,06; C-0,06; AB-0,09; AC-0,08; BC-0,11; ABC-0,16
2015 LSD $_{0,5}$ t / ha: A-0,04; B-0,06; C-0,05; AB-0,08; AC-0,07; BC-0,10; ABC-0,14
2016 LSD $_{0,5}$ t / ha: A-0,02; B-0,04; C-0,04; AB-0,07; AC-0,06; BC-0,09; ABC-0,13
2017 LSD $_{0,5}$ t / ha: A-0,03; B-0,04; C-0,04; AB-0,06; AC-0,05; BC-0,08; ABC-0,12

Note: * – Emistim C; ** – control.

The maximum grain yield of white lupine September was obtained on the variants of the experiment with pre-sowing seed treatment with inoculum Rhizohumin and growth stimulant Emistim C in combination with two foliar fertilization Emistim C. The grain yield was 3.61 t / ha, and the variant 0.65 t / ha, and as a percentage, respectively – 18%.

It is noted that in addition to the studied technological methods of cultivation, the level of grain yield of white lupine was significantly influenced by meteorological conditions over the years of research. The observed dependences of the formation of the yield value of white lupine grain on the influence of climatic factors are described in the regression equations:

$G = -4,49638 + 0,376266x_1 + 0,007298x_2 + 0,002101x_3$ for the Veresnevyi variety;

$G = 4,65928 - 0,13252x_1 + 0,31046x_2 + 0,001015x_3$ for the Makarivskyi variety:

where G is the grain yield, t / ha; x_1 – average daily air temperature during the growing season, ° C; x_2 – precipitation, mm; x_3 – hydrothermal coefficient.

The obtained experimental studies are substantiated by the fact that models of white lupine cultivation technology, which include in pre-sowing treatment the bacterial preparation Rhizohumin and growth stimulator Emistim C in combination with two foliar fertilization with growth stimulator Emistim C create optimal conditions for maximum realization of biological potential in the region.

Analyzing the grain yield of peas in the studied varieties, it should be noted that along with hydrothermal resources to a greater extent on the formation of its value were significantly influenced by factors, pre-sowing seed treatment and foliar feeding. Thus, in the control variants according to the years of research (2011-2017), the grain yield of peas of the Tsarevich sowing variety varied from 2.92 t / ha to 3.04 t / ha, in the Ulus variety from 2.80 to 3.47 t / ha. Ha. The average yield for three years in the varieties was 2.97 and 3.15 t / ha, respectively. That is, the variety Ulus prevailed the variety Tsarevich in grain productivity by 0.18 t / ha (Table 2).

Table 2.

Yield of pea grain depending on the impact of pre-sowing seed treatment and foliar fertilization, t / ha, 2011-2017

Pre-sowing seed treatment	Foliar feeding	Years							Average
		2011	2012	2013	2014	2015	2016	2017	
variety Tsarevich									
$N_{45}P_{60}K_{60}$ (background)	without fertilization	3,04	2,92	2,95	2,94	2,95	2,97	3,02	2,97
	Polymyxobacterin	3,16	3,04	3,04	3,00	3,14	3,08	3,10	3,08
	Ryzogumin	3,23	3,09	3,13	3,10	3,19	3,15	3,16	3,15
	Ryzogumin + Polymyxobacterin	3,38	3,21	3,21	3,20	3,18	3,27	3,43	3,27
background +I*	without fertilization	3,37	3,23	3,18	3,15	3,20	3,26	3,43	3,26
	Polymyxobacterin	3,46	3,35	3,30	3,25	3,30	3,37	3,56	3,37
	Ryzogumin	3,54	3,41	3,43	3,40	3,38	3,46	3,60	3,46
	Ryzogumin + Polymyxobacterin	3,74	3,54	3,51	3,49	3,44	3,60	3,87	3,60
background +I+II*	without fertilization	3,53	3,45	3,35	3,33	3,45	3,44	3,54	3,44
	Polymyxobacterin	3,69	3,53	3,51	3,48	3,55	3,58	3,71	3,58
	Ryzogumin	3,78	3,62	3,57	3,54	3,65	3,66	3,79	3,66
	Ryzogumin + Polymyxobacterin	4,00	3,79	3,72	3,70	3,85	3,84	3,97	3,84
background +I+II+III*	without fertilization	3,65	3,53	3,46	3,44	3,55	3,55	3,66	3,55
	Polymyxobacterin	3,82	3,67	3,58	3,56	3,69	3,69	3,82	3,69
	Ryzogumin	3,95	3,74	3,70	3,66	3,79	3,80	3,95	3,80
	Ryzogumin + Polymyxobacterin	4,19	3,95	3,88	3,84	3,99	4,01	4,20	4,01
variety Ulus									
$N_{45}P_{60}K_{60}$ (background)	without fertilization	3,47	2,80	3,19	3,17	2,82	3,15	3,46	3,15
	Polymyxobacterin	3,58	2,96	3,28	3,26	2,98	3,27	3,57	3,27
	Ryzogumin	3,69	3,02	3,36	3,34	3,04	3,36	3,31	3,36
	Ryzogumin + Polymyxobacterin	3,86	3,17	3,47	3,45	3,19	3,50	3,44	3,50
background +I*	without fertilization	3,78	3,11	3,42	3,40	3,14	3,44	3,39	3,44
	Polymyxobacterin	3,95	3,24	3,54	3,50	3,26	3,58	3,52	3,58
	Ryzogumin	4,07	3,32	3,63	3,60	3,34	3,67	3,57	3,67
	Ryzogumin + Polymyxobacterin	4,24	3,53	3,76	3,73	3,55	3,84	3,78	3,84
background +I+II*	without fertilization	3,99	3,32	3,58	3,56	3,35	3,63	3,58	3,63
	Polymyxobacterin	4,18	3,46	3,71	3,68	3,56	3,78	3,73	3,78
	Ryzogumin	4,33	3,57	3,82	3,75	3,59	3,91	3,84	3,91
	Ryzogumin + Polymyxobacterin	4,54	3,80	4,00	3,90	3,82	4,11	3,61	4,11
background +I+II+III*	without fertilization	4,13	3,42	3,67	3,65	3,47	3,74	4,10	3,74
	Polymyxobacterin	4,31	3,58	3,81	3,75	3,61	3,90	4,34	3,90
	Ryzogumin	4,50	3,72	3,94	3,84	3,74	4,05	4,57	4,05
	Ryzogumin + Polymyxobacterin	4,74	3,99	4,20	4,10	4,00	4,31	4,83	4,31

Note: * I – out of turn. podzh. in the budding phase - KODA Fol 7–21–7; II – pozakor. podzh. in the phase of green beans - KODA Fol 7–21–7; III – pozakor. podzh. in the seed filling phase - KODA Complex.
LSD $_{0,05}$ t / ha; A – variety; B – foliar feeding; C – pre-sowing seed treatment.
2011 A - 0,021; B - 0,029; C - 0,007; AB - 0,042; AC-0,042; BC – 0,059; ABC - 0,083
2012 A - 0,024; B - 0,034; C - 0,009; AB - 0,048; AC-0,048; BC – 0,068; ABC - 0,096
2013 A - 0,023; B - 0,032; C - 0,008; AB - 0,045; AC-0,045; BC – 0,064; ABC - 0,091
2014 A - 0,011; B - 0,019; C - 0,005; AB - 0,032; AC-0,032; BC – 0,049; ABC - 0,073
2015 A - 0,014; B - 0,014; C - 0,006; AB - 0,038; AC-0,038; BC – 0,058; ABC - 0,086
2016 A - 0,013; B - 0,012; C - 0,006; AB - 0,035; AC-0,035; BC – 0,054; ABC - 0,081
2017 A - 0,013; B - 0,012; C - 0,005; AB - 0,042; AC-0,035; BC – 0,054; ABC - 0,081

Inoculation of pea seeds with Rhizohumin contributed to the formation of grain yield in the variety Tsarevich at the level of 3.15-3.80 t / ha, which is more by 0.18-0.25 t / ha or 6.1-7.0% compared to variants without processing. In the Ulus variety, due to seed inoculation, the yield increased by 6.7-8.3%.

Improvement of nitrogen and phosphorus nutrition of pea plants occurred with simultaneous pre-sowing treatment of seeds with Polymyxobacter and Rhizohumin, increased grain yield of Tsarevich variety on the background of fertilizer N45P60K60 to 3.27 t / ha or 0.30 t / ha, or 10% compared to control. The use of this method in combination with foliar fertilization with complex fertilizers KODA increased grain yield by 0.34-0.46 t / ha or 10.4-13.0%.

Conclusion. The research results make it possible to recommend for production the most economically profitable and competitive technology for growing white lupine Veresnevy in the right-bank Forest-Steppe of Ukraine, which ensures the formation of grain yield at 3.61 t / ha and crude protein yield 1.44 t / ha; and peas of the Ulus sowing variety with the yield of 4.3 t / ha and the yield of crude protein – 1.02 t / ha.

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ОЦЕНКА ЭФФЕКТИВНОСТИ ФУНГИЦИДОВ ПРОТИВ КОРНЕВОЙ ГНИЛИ И ФУЗАРИОЗНОЙ ИНФЕКЦИИ СЕМЯН ПШЕНИЦЫ, ВЫЗЫВАЕМЫХ ГРИБОМ FUSARIUM SUBGLUTINANS

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EVALUATION OF THE EFFECTIVENESS OF FUNGICIDES AGAINST ROOT ROT AND FUSARIUM INFECTION OF WHEAT SEEDS CAUSED BY THE FUNGUS FUSARIUM SUBGLUTINANS

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Аннотация

Изучено влияние фунгицидов Вайбранс Интеграл, Винцит, Премис Двести и Триактив на развитие корневой гнили и фузариозной инфекции семян озимой пшеницы, вызываемых грибом Fusarium subglutinans. Исследования проводились на искусственном инфекционном фоне. Наибольшей (100 %) биологической эффективностью против патогена обладал фунгицид Премис Двести. Препарат Триактив снижал развитие корневой гнили и фузариозной инфекции на 97,2 – 97,8 %, Вайбранс Интеграл – на 81,3 – 88,9 %, Винцит – на 67,0 – 72,2 %. Результаты исследований могут быть использованы в производстве.

Abstract

The influence of the fungicides Vaibrans Integral, Vincit, Premis Dvesti and Triactive on the development of root rot and fusarium infection of winter wheat seeds caused by the fungus Fusarium subglutinans was studied. Studies were conducted on an artificial infectious background. The greatest (100 %) biological effectiveness against the pathogen was possessed by the fungicide Premis Dvesti. The preparate Triactive reduced the development of root rot and fusarium infection by 97,2 – 97,8 %, Vaibrans Integral – by 81,3 – 88,9 %, Vincit – by 67,0 – 72,2 %. The results of the research can be used in production.

Ключевые слова: фунгициды, гриб Fusarium subglutinans, корневая гниль, фузариозная инфекция, озимая пшеница, искусственный инфекционный фон, биологическая эффективность.

Key words: fungicides, fungus Fusarium subglutinans, root rot, fusarium infection, winter wheat, artificial infectious background, biological effectiveness.

Грибы рода Fusarium встречаются во всех регионах возделывания сельскохозяйственных культур и в частности, пшеницы. Они способны вызывать различные заболевания у многих культурных и дикорастущих растений. Зерновые злаки, как правило, поражаются корневыми гнилями, фузариозом колоса и зерна. Корневые гнили относятся к наиболее серьезным заболеваниям пшеницы, которые приводят к значительным потерям урожая. Данный показатель варьирует от 15 до 40 % [4]. Заражение происходит осенью – на озимых или ранней весной – на яровых зерновых культурах. Поражается подземное междоузлие, корни, основание стебля. Болезнь может распространиться неравномерно и приводить к выпадению всходов, уменьшению продуктивной кустистости, массы зерен и их числа в колосе. Фузариозная инфекция передается с семенами, через почву и растительные остатки. В связи с этим, вопрос о защите растений от этих патогенов является весьма актуальным. Особенно это важно в начальный период развития, чтобы избежать гибели или угнетения растений пшеницы. Для решения данной проблемы проводится протравливание