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**RESEARCH ON THE
INFLUENCE OF BIOLOGICAL
PREPARATIONS AND
ORGANO-MINERAL
FERTILIZERS ON SOYBEAN
GROWTH PROCESSES**

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The article presents the results of experimental studies conducted in 2024-2025 at the experimental field «Agronomichne» of Vinnytsia National Agrarian University. The aim of the work is to determine the effectiveness of the use of biological products and organo-mineral fertilizers for pre-sowing treatment of soybean seeds in agroecosystems of the Right-Bank Forest-Steppe and to assess the synergistic effect on biometric indicators and productivity of soybean varieties Koroleva and Azimut. By the maturity group, the studied varieties belong to mid-ripening. During the experimental studies, it was noted that in BBCH 87-92 in the Koroleva variety the plant height was 105.32 cm, and in the Azimut variety, respectively, 82.92 cm. The height of attachment of the lower bean, the highest in the control variant of the Azimut variety, was 19.92 cm. The effect of the biological product and organo-mineral fertilizer on this technological characteristic was not observed, while the Koroleva variety showed the highest height of attachment of the lower bean in two variants of the experiment with the use of Rizoline-r in combination with the bioprotector Rizosave-r (17.40 cm) and Rizoline-r in combination with the bioprotector Rizosave-r with the use of the organo-mineral fertilizer Helprost soy 17.40 cm. The greatest branching in the Koroleva variety was obtained with the combined use of Rizoline-r in combination with the bioprotector Rizosave-r and the organo-mineral fertilizer Helprost soy (4.20 pcs.), while in plants of the Azimut variety - 4.68 pcs. On the average number of beans in one pod of the Koroleva variety, pre-sowing seed treatment with a biological preparation and organo-mineral fertilizer had a slight effect relative to the control, with treatment with a biological preparation and organo-mineral fertilizer 2.60 beans in one pod, control 2.57 beans in one pod. The Azimut variety was characterized by a significant increase in this indicator under the condition of pre-sowing seed treatment with the organo-mineral fertilizer Helprost soy (2.53 beans in one pod). The highest average grain weight per plant in the studied varieties was obtained when using the biological preparation Rizoline-r in combination with the bioprotector Rizosave-r and organo-mineral fertilizer Helprost soy in pre-sowing seed treatment (Korolev variety 9.00 g on average per plant, Azimut variety 9.60 g on average per plant). Studies show that the maximum yield of the Koroleva and Azimut soybean varieties is achieved under conditions of complex pre-sowing seed treatment. This treatment includes the use of the biopreparation Rizoline-r in combination with the bioprotector Rizosave-r and the organo-mineral fertilizer Helprost soy. Under such conditions, the yield of the Koroleva variety is 3.60 t/ha, and the Azimut variety is 4.02 t/ha.

Keywords: variety, biological products, organo-mineral fertilizer, yield, growing zone.

Table 2., Lit. 10.

Problem statement. The history of soybean begins not only with the first archaeological mentions of its cultivation in East Asia, but also traces a multifaceted transformational path from modest ritual and medical use in ancient cultures to the monumental establishment as a key agricultural crop, which laid an unshakable foundation for future global distribution and testifies to an extraordinary role in the

formation of civilizational processes. The regions of modern China, Japan and Korea are recognized as the undisputed centers of origin of soybean, a wild plant from a regional resource, transformed into a symbol of vitality and a universal source of nutrition that shaped the gastronomic habits and philosophy of the East for millennia. Due to the exceptional combination of high protein content, balanced amino acid composition, unsaturated fatty acids, fiber, vitamins (especially group B) and minerals (iron, magnesium, zinc), soy and its processed products play an important role in the formation of functional, dietary and specialized food products [1].

In recent years, Ukraine has seen a significant increase in soybean acreage, which has now reached 2.4 million hectares, the main areas of concentration are the Forest-Steppe zone, which includes the right-bank Forest-Steppe, in particular such regions as Khmelnytskyi, Vinnytsia, Ternopil, as well as part of Cherkasy and Kyiv regions, the left-bank Forest-Steppe – Poltava and Sumy regions. In Polissia, soybean is mostly distributed in its southern and central part – Zhytomyr, Rivne, Volyn and Chernivtsi regions. The northern and central regions of the steppe are a zone of less moisture, soybeans are grown there, but in smaller quantities, previously Kherson and Zaporizhia regions had significant areas under soybeans, especially on irrigated lands, however, with the beginning of a full-scale war, the situation in these areas is difficult. According to the Ministry of Agrarian Policy and Food of Ukraine and the State Statistics Service of Ukraine, the areas under soybeans were: – 2022 – 1.5 million hectares, 2023 – 1.8 million hectares, 2024 – 2.7 million hectares, 2025 – 2.4 million hectares [2-5].

The growing interest in soybeans in recent years and the increased demand require the introduction of highly effective agrotechnical cultivation techniques in accordance with soil and climatic conditions. The Institute of Feed and Agriculture of Podillia NAAS has proposed effective elements of soybean cultivation, and developed adaptive varieties in accordance with soil and climatic conditions of cultivation, in particular the Forest-Steppe of the Right Bank [6].

Currently, some farms use the soybean growing technologies proposed by the Institute of Feed and Agriculture of the Podillia NAAS, namely bioadaptive technologies, No-till technologies, short-rotation crop rotations, etc. Modern climatic challenges require effective solutions.

The formation of high productivity of agrocenoses is determined by a holistic approach to growing technologies, which involves the selection of adaptive varieties, scientifically substantiated use of mineral nutrition systems, as well as integrated use of plant protection products of both synthetic and biogenic origin. Taking into account the needs of the modern consumer, technologies using biofertilizers, growth stimulants and plant protection products of biological origin are actively spreading [7].

The key challenges of modern agriculture require resource-saving technologies. Direct sowing technology (No-till) is becoming exceptionally relevant in the context of modern challenges of the agricultural sector, determining the key areas of its sustainable development. Its implementation is strategically important for increasing

the efficiency, environmental safety and adaptability of agricultural production [8].

The optimal combination of components of soybean growing technologies is designed to enhance positive effects and neutralize harmful factors, which allows farmers to simultaneously increase production productivity and reduce environmental burden [9].

Analysis of recent research and publications. Currently, when it comes to soybeans, the main issue that worries farmers is how to achieve maximum yield and properly provide plants with nutrients. This topic covers a wide range of factors, from the choice of varieties and soil preparation, to modern methods of processing and plant protection. Optimization of each stage of cultivation is key. In existing technologies, soybean during its cultivation responds well to pre-sowing seed treatment with *Bradyrhizobium japonicum* inoculant and organo-mineral fertilizer. It has been established that when using a complex organo-mineral fertilizer, the growth processes of the plant, its growth and development, are improved, and pre-sowing treatment of seeds with inoculants, due to the revival of symbiotic activity between nodule bacteria and the plant, provides the plant with atmospheric nitrogen and contributes to its accumulation in the soil up to 250 kg/ha, of which up to 100 kg/ha can remain in the soil after harvesting [8-9].

When choosing soybean cultivation technologies, it is necessary to take into account the content of nutrients in the soil, their utilization rate and the plant's output for the planned yield. With a yield of 2.5 t/ha, soybeans output 150-185 kg/ha of nitrogen (N), 30-42 kg/ha of phosphorus (P_2O_5), and 45-62 kg/ha of potassium (K_2O). The amount of nutrients consumed by the plant and the moisture supply of the soil directly depend on the cultivation technology, the characteristics of the variety, and nutrition [10].

The use of biological products (biological preparations) can significantly increase the yield of various leguminous crops. Biological products contain living microorganisms or their waste products, improve the absorption of nutrients, stimulate plant growth, and increase their resistance to stress factors. There is a positive effect of bacterial fertilizers during the formation of the yield of peas, lentils, chickpeas, soybeans, as well as clover and vetch [1].

The use of bacterial preparations is an effective tool for improving the microbial composition of the rhizosphere, which is a critically important area for the exchange of substances between the root system of plants and the soil. This helps to neutralize phytotoxins in the soil and increase the availability of key nutrients. Such as nitrogen and phosphorus, for absorption by plants. The use of solutions containing nitrogen-fixing and phosphate-mobilizing bacteria not only accelerates the onset of the flowering phase, but also provides an increase in yield by 10%-20%. These microorganisms transform difficult-to-access forms of nutrients into easily digestible ones, thereby creating optimal conditions for intensive growth and development of crops [7].

The optimal sowing date and pre-sowing treatment of soybean seeds affect the yield of the plant. Establishing the most effective sowing dates ensures the effective

use of environmental resources, such as soil and air temperature, as is known, the most favorable soil temperature for rapid and friendly seed germination and emergence of shoots is + 12-14 °C, to ensure active vegetation, namely the formation of reproductive organs, flowering, the formation of beans and seeds, the optimal average daily air temperature is +18-25 °C, in more detail - for the formation of reproductive organs, the favorable temperature is +18-19 °C, optimal +21-23 °C, for flowering: minimum +16-18 °C, favorable +19-21 °C, optimal +22-25 °C, for the formation of beans and seeds: minimum +13-14 °C, optimal +17-18 °C, optimal +20-23 °C, for ripening: minimum +8-9 °C, favorable +13-16 °C, optimal +18-20 °C. Frosts down to -2-3 °C can damage seedlings, and low night temperatures below +9-14 °C negatively affect soybean growth. Temperatures of +10-13 °C delay ripening [10].

Studies show that plant density is a key factor affecting stem formation and, accordingly, crop yield. Thus, the authors' studies [10] showed that the optimal seeding rate of 850,000 plants/ha provides an actual yield in the range from 741,000 to 784,000 plants/ha. This indicator varies depending on the selected variety. This emphasizes the importance of adapting cultivation technologies to varietal characteristics. Studies have shown a positive effect of the biopreparation Rhizohumin with an application rate of 2 kg/t on germination, in the two varieties studied by 4.5-4.7%. It is important to emphasize that the percentage of seed germination cannot serve as the only and final criterion for predicting the density of productive soybean plants, which directly affect the formation of the final yield. This indicator only reflects the potential ability of seeds to germinate, while the actual number of plants that have reached the harvesting phase and will form a crop depends on a complex of agrotechnical and biological factors throughout the growing season. In the germination phase, the number of plants varied from 74.1 to 78.4 units per square meter, which indicates a difference of 5.1% between the experiments. However, during the growing season, a decrease in plant density was observed, which ranged from 59.5 to 61.4 thousand units.

Plant height is one of the fundamental indicators characterizing the structure and structure of the stem. This parameter gives an idea of the architecture of the plant and its development. In the same experiment [10], plant height was studied at four key stages of development: in the trifoliate leaf phase, at the beginning and end of flowering, as well as in the ripeness phase. The results obtained indicate that the application of the drug Rhizogmin at a rate of 2 kg/t significantly stimulates stem growth at the initial stages of plant ontogenesis. This stimulating effect provided the advantage of plants treated with the inoculant over control samples by almost 14% for both studied varieties. It is noteworthy that the combined use of Rhizogmin with Biogloblin did not show a significant difference from the effect of pure Rhizogmin, demonstrating only a slight increase of 1.6%. At the same time, at this stage of development, the use of Biogloblin as a monopreparation did not have a noticeable effect, and plant growth in this variant remained at the control level. A study of the effects of different agronomic practices on the height of soybean plants revealed

yield of the plant. Establishing the most effective sowing dates ensures the effective significant differences between the test groups. At the initial flowering stage, plants treated with inoculants showed a height of up to 33.4 cm, while the groups treated with growth stimulants reached up to 33.0 cm. In comparison, the control group, which did not receive any treatment, reached only 28.5 cm. These data clearly indicate a positive effect of the preparations on the initial growth of the crop. At the end of the flowering phase, the following average plant height indicators were recorded for each variant: control 63.8 cm, pre-sowing treatment with Rhizohumin at a rate of 2 kg/t 68.1 cm, with treatment with Biogloblin 1.0 l/t 66.7 cm, variant with combined treatment Rhizohumin + Biogloblin 64.7 cm. Thus, the analysis of height growth between the beginning and end of flowering revealed that the largest absolute growth of 35.3 cm was observed in control plants. Interestingly, the growth in height of soybean plants, the seeds of which were treated with Rhizohumin, both independently and in combination with a growth stimulator, was 34.7 cm, which is 2% less than in the control group. However, in variants with the use of growth biostimulators, the growth was 4.6% lower than the control. Analysis of the study data showed that the general trend of stem height changes at the end of flowering corresponded to the patterns observed at the beginning of this phenological stage. However, the differences were in the rates of plant height growth during the flowering period. At the time of harvest, the stem height indicator varied within 82.6-82.5 cm. The variation in plant height fluctuations at this final stage of development was 4.7%. During the period from flowering to the phase of full maturity, plants demonstrated a height increase exceeding 18 cm, with the smallest increase recorded in the variant with Rhizohumin treatment at a rate of 2 kg/t, amounting to 18.4 cm. At the same time, the largest height increase was observed with the combined use of inoculant and growth stimulator, reaching 19.2 cm. These results indicate that the effect of pre-sowing treatment of soybean seeds with Rhizohumin and Biogloblin preparations on plant growth persists until the final phases of development, although with different growth rates.

Purpose of the study. Determination of the effectiveness of the use of biological products and plow-mineral fertilizers during pre-sowing treatment of soybean seeds in agrocenoses of the Right-Bank Forest-Steppe and assessment of the synergistic effect on morphological indicators and soybean productivity.

Research methodology. The study was conducted in 2024-2025 on the basis of the experimental field «Agronomichne» using the soybean varieties Koroleva and Azimut. By maturity group, the varieties belong to the mid-ripening ripening periods. The soil in the areas of the experiment is gray podzolized medium loam, the content of mobile forms, mg/kg N 60-70; P₂O₅ 149-212; K₂O 80-92; pH 5.3-5.4. Soybean seeds were treated with the inoculant Rizoline-r, bioprotector Rizosave-r, or organo-mineral fertilizer Helprost soy before sowing, all preparations of domestic production BTU. Sowing was carried out in the second decade of May with a row spacing of 45 cm and a seeding rate of 450 thousand plants per hectare in accordance with the recommendations of the Institute of Feed and Agriculture of the NAAS for mid-

season soybean varieties. The Koroleva variety was taken as the control, soybean seeds were treated with water before sowing. The predecessor was winter triticale, immediately after harvesting, soil cultivation was carried out by the method of peeling to a depth of up to 8 cm, in early September, traditional plowing was carried out to a depth of 25-30 cm, in the spring, harrowing with heavy harrows and pre-sowing cultivation after the appearance of the «white thread» (weed germination) to a seed sowing depth of up to 5 cm. Pre-sowing seed treatment with the biopreparation Rizoline-r and the bioprotector Rizosave-r was carried out at the application rate according to the manufacturer's recommendation BTU 3.0 l/t for Rizoline-r and 1.0 l/t for Rizosave-r. The experimental plots were placed using a randomization method with three replications. The study was carried out in accordance with the standard methodology for conducting field experiments [6]. The effectiveness of the use of biological products was assessed by a set of indicators, including biometric parameters of plants, as well as total yield. The obtained data were processed by variance analysis on a personal computer using special application programs.

Presentation of the main research material. Among the factors that affect the productivity of soybean plants, such parameters as plant height, attachment height of the lower bean, number of branches on the plant play an important role. These indicators determine the productivity of the plant and the potential of the future harvest. Making changes to the key parameters of the cultivation technology allows you to effectively navigate the biometric indicators of the crop.

The implementation of biological preparations separately and in combination with organo-mineral fertilizer during pre-sowing seed treatment plays an important role in the morphological development of the plant throughout the growing season and affects soybean productivity. During the experiment, the effect of biological preparations Rizoline-r in combination with the bioprotector Rizosave-r on plant height was established, but only with the addition of organo-mineral fertilizer Helprost soy, so in the variant without treatment the plant height of the Koroleva variety was 102.96 cm, and in combination with the inoculant with organo-mineral fertilizer it was 105.32 cm, which is 2.9% more than the control. A similar experiment with the Azimuth variety shows plant height depending on the control, plant height 81.20 cm, with pre-sowing treatment with inoculant and organo-mineral fertilizer 81.92 cm, which is 0.89% higher than the control. The effect of pre-sowing treatment of soybeans with organo-mineral fertilizer Helprost soy showed the following result depending on the variety, so the plant height of the Koroleva variety without pre-sowing treatment with organo-mineral fertilizer Helprost soy 102.96 cm, with pre-sowing treatment of seeds with organo-mineral fertilizer 101.28 cm, which is 1.6% lower than the control, the Azimuth variety has slightly different indicators, without treatment plant height 81.20 cm, with pre-sowing treatment with organo-mineral fertilizer Helprost soy 80.60 cm, 0.74% lower than the control. The use of the inoculant Rizoline-r in combination with the bioprotector Rizosave-r did not actually affect the height of plants in both varieties. The Koroleva variety showed a height of 102.96 cm in the control variant without treatment and 99.96 cm in the variant with

inoculation and bioprotector, which is 3% lower than the control. The height of plants of the Azimut variety showed in the control variant 81.20 cm, with pre-sowing seed treatment with the inoculant Rizoline-r in combination with the bioprotector Rizosave-r 79.28 cm, 2.4% lower than the control.

The height of the lower bean attachment should correspond to the optimal parameters so that the cutting device of the combine could pick them up and minimize losses. The use of Rizoline-r in combination with the bioprotector Rizosave-r and with the addition of the organo-mineral fertilizer Helprost soy showed itself quite well, as it was established, the height of the lower bean attachment was 42.15% higher than in the control variant, and the use of the organo-mineral fertilizer Helprost soy had a smaller effect, but also a positive one by 8.17% above the control. In the Azimut variety, the use of Rizoline-r in combination with the bioprotector Rizosave-r and the organo-mineral fertilizer Helprost soy had practically no effect on the morphological feature of the lower bean attachment and showed lower results than the control. Biometric indicators of soybean bushes are characterized not only by the external shape of plants and height, but also by the number of branches on the bush, which is an important indicator of potential yield. The results of the study show that pre-sowing treatment of seed material contributes to an increase in plant branching, which is a key factor in the formation of high yields. The average branching rate in the variants without treatment of the Koroleva variety is 2.4 branches, the Azimut variety is 3.4 branches. The variant with pre-sowing treatment of seeds Rizoline-r in combination with the bioprotector Rizosave-r and the organo-mineral fertilizer Helprost soy, the Koroleva variety showed the greatest branching compared to the control by 75%, the Azimut variety has a slightly lower growth, but also a significant, 36% higher indicator than the control variant with Rizoline-r in combination with the bioprotector Rizosave-r.

The average number of seeds in the pod is an important morphological component that directly affects the potential of soybeans, and is a key criterion in growing the crop. The effect of pre-sowing seed treatment with the preparations Rizoline-R and the organo-mineral fertilizer Helprost Soya has a positive effect on the morphological trait of the number of beans in the pod. It was established that the greatest effect on the Koroleva variety was the variant of the experiment with the use of both preparations and amounted to 1.1%, and in the experiment using the Azimuth variety, the highest indicator was shown by the variant with pre-sowing seed treatment with the organo-mineral fertilizer Helprost Soya by 5.8% higher than the control (Table 1).

The indicator of the average mass of beans obtained from one plant serves as a key indicator of the productivity of the varietal genotype and its response to agrotechnical measures. The effect of biological preparations and organo-mineral fertilizers has shown its effectiveness, the following results were established: Koroleva variety in the control variant, the average weight of beans from one plant is 8.3 g, the variant with the use of Rizoline-r in combination with the bioprotector Rizosave-r, the average weight of beans is 8.7 g, 4.8% higher than the control, the

variant with the use of organo-mineral fertilizer Helprost soy 8.2 g, 1.2% lower than the control, the variant with the combined As a result of the experiment, it was found that pre-sowing treatment of seeds with a biological product and organo-mineral fertilizer increased the yield of the soybean varieties Koroleva and Azimut relative to the control.

Table 1

Biometric indicators of soybean plants depending on pre-sowing seed treatment with biological products

Variety	Biopreparation	Plant height, BBCH 87-92, cm	Lower leg attachment height, cm	Number of branches on one plant, pcs.	Average number of beans in one pod, pcs	Average weight of grain from one plant, g
Koroleva	Control, no treatment	102,96	12,24	2,40	2,57	8,30
	Rizoline-r+ Bioprotector Rizosave-r	99,96	17,40	2,32	2,39	8,70
	Helpprost Soy	101,28	13,24	2,68	2,45	8,20
	Rizoline-r+ Bioprotector Rizosave-r + Helprost Soy	105,32	17,40	4,20	2,6	9,0
Azimut	no treatment	81,2	19,92	3,44	2,06	8,5
	Rizoline-r+ Bioprotector Rizosave-r	79,28	15	4,68	2,39	9,5
	Helpprost Soy	80,60	16,4	4,24	2,53	8,5
	Rizoline-r+ Bioprotector Rizosave-r + Helprost Soy	82,92	15,48	4,28	2,46	9,6

Source: Based on own research.

Thus, the highest yield was obtained as a result of the combined use of Rizoline-r in combination with the bioprotector Rizosave-r and the organo-mineral fertilizer Helprost soy in the studied variety Koroleva 3.60 t/ha, while the control showed a yield lower by 0.62 t/ha, the variant of the experiment with the use of Rizoline-r in combination with the bioprotector Rizosave-r had a slightly lower but significant yield indicator of 3.5 t/ha, which is 0.52 t/ha higher than the control, and pre-sowing seed treatment with the organo-mineral fertilizer Helprost soy had an almost significant effect on the yield indicators of 3.10 t/ha, which is 0.12 t/ha higher than the control (Table 2).

The experiment using the Azimut variety also showed the highest yield with pre-sowing seed treatment Rizoline-r in combination with the bioprotector Rizosave-r and the organo-mineral fertilizer Helprost soy 4.02 t/ha, the control was 0.57 t/ha

lower, the use of Rizoline-r in combination with the bioprotector showed an increase in yield relative to the control of 3.98 t/ha, which is higher than the control variant by 0.53 t/ha, the lowest increase in yield relative to the control was shown by the variant with the use of the organo-mineral fertilizer Helprost soy 0.05 t/ha, which reached a yield of 3.5 t/ha.

Table 2

Soybean yield depending on the combination options of biological products and organo-mineral fertilizer

Varieties	Biopreparation	Yield, t/ha	+/- to control	
			t/ha	%
Koroleva	Control, no treatment	2,98	-	-
	Rizoline-r+ Bioprotector Rizosave-r	3,50	0,52	17,45
	Helpprost Soy	3,10	0,12	4,00
	Rizoline-r+ Bioprotector Rizosave-r + Helpprost Soy	3,60	0,62	20,81
Azimut	Control, no treatment	3,45	-	-
	Rizoline-r+ Bioprotector Rizosave-r	3,98	0,53	15,36
	Helpprost Soy	3,50	0,05	1,45
	Rizoline-r+ Bioprotector Rizosave-r + Helpprost Soy	4,02	0,57	16,52
LSD _{0,05} , т/га (Koroleva): A-0,03; B-0,05; C-0,04; AB-0,05; AC-0,03; BC-0,12; ABC-0,07; LSD _{0,05} , т/га (Azimut): A-0,03; B-0,05; C-0,04; AB-0,05; AC-0,03; BC-0,12; ABC-0,07.				

Source: Based on own research.

Conclusions and prospects for further research. After pre-sowing treatment of seeds with the biological preparation Rizoline-r in combination with the bioprotector Rizosave-r and the organo-mineral fertilizer Helprost soy, both studied varieties showed the greatest increase in plant height, Koroleva 105.32 cm, Azimuth 82.92 cm. The height of the lower bean attachment was the highest in the control variant of the Azimuth variety 19.92 cm, the effect of the biological preparation and organo-mineral fertilizer on this morphological trait was not observed, while the Koroleva variety showed the greatest height of the lower bean attachment in two variants of the experiment, with the use of Rizoline-r in combination with the bioprotector Rizosave-r 17.40 cm and Rizoline-r in combination with the bioprotector Rizosave-r with the addition of the organo-mineral fertilizer Helprost soy 17.40 cm. The greatest branching in the Koroleva variety can be obtained with the combined use Rizoline-r in combination with the bioprotector Rizosave-r and the organo-mineral fertilizer Helprost soy 4.20 branches, while in the Azimut variety, the largest number of branches was obtained when using Rizoline-r in combination with the bioprotector Rizosave-r, without adding the organo-mineral fertilizer Helprost soy 4.68 branches. On the average number of beans in one pod, the Koroleva variety, pre-sowing treatment of seeds with a biological preparation and organo-mineral fertilizer has a small effect compared to the control, with treatment with a biological

preparation and organo-mineral fertilizer 2.60 beans in one pod, control 2.57 beans in one pod, the Azimut variety showed a significant increase under the condition of pre-sowing treatment of seeds with the organo-mineral fertilizer Helprost soy 2.53 beans in one pod. The highest average grain weight per plant in both varieties can be obtained by applying a combined pre-sowing seed treatment with the biopreparation Rizoline-r in combination with the bioprotector Rizosave-r and the organo-mineral fertilizer Helprost soy, the Koroleva variety 9.00 g on average per plant, the Azimut variety 9.60 g on average per plant. Studies show that the maximum yield of the Koroleva and Azimut soybean varieties is achieved under conditions of complex pre-sowing seed treatment. This treatment includes the use of the biopreparation Rizoline-r in combination with the bioprotector Rizosave-r and the organo-mineral fertilizer Helprost soy. Under such conditions, the yield of the Koroleva variety is 3.60 t/ha, and that of the Azimut variety is 4.02 t/ha.

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АНОТАЦІЯ

ДОСЛІДЖЕННЯ ВПЛИВУ БІОЛОГІЧНИХ ПРЕПАРАТІВ ТА ОРГАНО-МІНЕРАЛЬНИХ ДОБРИВ НА РОСТОВІ ПРОЦЕСИ СОЇ

У статті представлено результати експериментальних досліджень, що проводилися на дослідному полі «Агрономічне» Вінницького національного аграрного університету. Метою роботи є визначення ефективності застосування біопрепаратів та органо-мінеральних добрив за передпосівної обробки насіння сої в агроценозах Лісостепу правобережного та оцінка синергетичного ефекту на біометричні показники та продуктивність сої сорту Королева та Азимут. За групою стиглості досліджувані сорти належать до середньостиглих. У ході експериментальних досліджень відзначено, що у ВВСН 87-92 у сорту Королева висота рослини становила 105,32 см, а у сорту Азимут відповідно 82,92 см. Висота прикріплення нижнього бобів, найвища у контрольному варіанті сорту Азимут 19,92 см. Вплив біопрепарату та органо-мінерального добрива на дану технологічну ознаку не спостерігалась, тоді як сорт Королева показав найбільшу висоту прикріплення нижнього бобів у двох варіантах досліді з застосуванням Різолاین-р у поєднанні з біопротектором Різосейв-р (17,40 см) та Різолاین-р у поєднанні із біопротектором Різосейв-р з використанням органо-мінерального добрива Хелпрост соя 17,40 см. Найбільше гілкування у сорту Королева отримано за комбінованого застосування Різолاین-р у поєднанні з біопротектором Різосейв-р та органо-мінеральним добривом Хелпрост соя (4,20 шт.), тоді як у рослин сорту Азимут – 4,68 шт. На середню кількість бобів у одному стручку сорту Королева передпосівна обробка насіння біопрепаратом та органо-мінеральним добривом мала незначний вплив відносно контролю, з обробкою біопрепаратом та органо-мінеральним добривом 2,60 бобів у одному стручку, контроль 2,57 баба у одному стручку. Сорт Азимут характеризувався суттєвим збільшенням даного показника за умови передпосівної обробки насіння органо-мінеральним добривом Хелпрост соя (2,53 бобів у одному стручку). Найбільшу середню масу зерна з однієї рослини у досліджуваних сортів отримано при застосуванні у передпосівну обробку насіння біопрепарат Різолاین-р у поєднанні із біопротектором Різосейв-р та органо-мінеральним

добривом Хелпрост соя (сорт Королева 9,00 г в середньому з однієї рослини, сорт Азимут 9,60 г в середньому з однієї рослини). Дослідження демонструють, що максимальна врожайність сортів сої Королева та Азимут, досягається за умов комплексної передпосівної обробки насіння. Ця обробка включає застосування біопрепарату Різолан-р у поєднанні з біопротектором Різосейв-р та органо-мінеральним добривом Хелпрост соя. За таких умов, урожайність сорту Королева становить 3,60 т/га, а сорту Азимут 4,02 т/га.

Ключові слова сорт, біопрепарати, органо-мінеральне добриво, врожайність, зона вирощування.

Табл. 2., Літ. 10.

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