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THE EFFECT OF GROWING TECHNOLOGY ELEMENTS ON SOYBEAN YIELD

Soybeans [Glycine max (L.) Merrill] are a key protein and oil crop in global agriculture, widely used in the food industry, animal feed production, and biodiesel production [1]. The phenomenon of consumption of their seeds is due to the unique combination of organic compounds, which are highly digestible and soluble and play a key role in the physiological and biochemical processes that ensure the vital functions of the human and animal organism. The cultivation of high-yielding soybean crop communities is impossible without providing the necessary nutrients throughout the growing season. N is a component of proteins, amino acids, nucleic acids, vitamins, alkaloids, and chlorophyll, which in turned play a key role in the functioning of the plant organism [2]. P is a component of key biomolecules involved in energy metabolism (ATP, NADPH), the synthesis of nucleic acids (DNA, RNA), and phospholipids in cell membranes. This element plays a crucial role in the photosynthesis process; therefore, its deficiency leads to a decrease in the rate of carbon dioxide assimilation and a reduction in the above-ground biomass production by plants [3]. K ensures plant movement and turgor in plant tissues, supports stem strength and plant resistance to lodging, as well as to the adverse effects of drought and salinity. An adequate supply of this element improves conditions for photosynthetic activity by increasing stomatal conductance and mesophyll resistance [4]. An effective method for increasing plant resistance to adverse environmental factors and enhancing their productivity could be the use of growth stimulants, which are natural or synthetic substances that alter the direction or intensity of vital processes in plant organisms [5].

The field study was conducted in 2024–2025 at the Poltava State Agricultural Research Station named after M.I.Vavilov of Institute of Pig Breeding and Agro-Industrial Production of NAAS. The study design included the application of the biological inoculant Rhizoaktiv Soy and the plant growth stimulator NORDAGRI

Growth Stage under varying mineral fertilizer treatments ($N_0P_0K_0$, $N_0P_{40}K_{40}$, $N_{20}P_{60}K_{60}$).

The results of the experiment show that the studied factors had a positive effect on the linear growth of plants in height. This effect was most pronounced in treatments involving the combined application of a biological inoculant, plant growth stimulant and $N_{20}P_{60}K_{60}$, where plant height increased by 14.4 cm compared to the control variation. A positive effect of the studied factors on the formation of the leaf area of soybean crops was observed. Seed inoculation contributed to an increase in leaf area of 1,300 m²/ha compared to the control. The effect of the combined application of a biological inoculant and a growth stimulator on the formation of the leaf area of plants was more pronounced. Overall, the highest value in the experiment was observed in the variant $N_{20}P_{60}K_{60}$ + Rhizoactive Soy + NORDAGRI Growth Stage. The increase in leaf area contributed to greater accumulation of above-ground organic matter by the plants and, consequently, to an increase in their individual productivity and overall crop yield. In particular, an increase was observed in the number of pods formed per plant, the number of seeds per pod, and the weight of 1,000 seeds by 27.2–41.6%, 29.4%, and 10.82–15.81%, respectively. In the variants with biological inoculant application, the values of these indicators increased by 18.93%, 11.76%, and 7.08%, respectively. The combination of seed inoculation and crop treatment with a growth stimulant proved to be more effective, as indicated by an increase in the values of the studied yield components relative to the control by 42.4%, 23.5%, and 8.56%, respectively. The highest number of beans formed per plant, the number of seeds per bean, and the weight of 1,000 seeds were observed when a biological inoculant and a growth stimulant were used in combination with an application of $N_{20}P_{60}K_{60}$. The number of plants per unit area, the number of reproductive elements formed on them, and the weight of 1,000 seeds determined the amount of soybean seed yield. It increased as the plants' nutrient regime improved and, on average over the two years of research, was highest in the variant Rhizoaktiv Soy + NORDAGRI Growth Stage + $N_{20}P_{60}K_{60}$.

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