

## **EFFICIENCY OF NANO PREPARATIONS IN SOYBEAN GROWING TECHNOLOGY**

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Nanotechnology is seen as one of the key technologies in the twenty-first century, which promises to improve traditional agricultural practices and offer sustainable development by improving management and conservation tactics by reducing agricultural resources costs. The creation and implementation of new environmentally friendly and technological nano preparation designed to increase the efficiency of plant nutrient use from mineral fertilizers and soil – is one of the ways to increase crop yields and the quality of agricultural products. The use of engineered nanomaterials in sustainable agriculture has shown a completely new way of food production that has the potential to overcome uncertainty in an agricultural sector with limited resources. Currently, there are a significant number of promising areas for the use of nanotechnology in crop production: a source of nutrients, activation and growth of productivity of photosynthesis, immune correctors, antistressors, nanopesticides, specific root effectors for rooting shoots and tissue cultures, multivalent drugs to increase plant resistance to stress. To reduce macro- and micronutrient deficiencies by increasing the efficiency of nutrient use and overcoming the chronic problem of environmental pollution, nano fertilizers may be the best alternatives.

The aim of the research was to determine the effect of pre-sowing seed treatment and fertilizing of sowings by nano preparation Avatar (micro fertilizer of carboxylates of natural acids), Iodis-concentrate (immunomodulator – a stimulator of growth processes), and Super Micro Plus (nanochelate fertilizer), and leaf

apparatus formation of soybean Khorol variety. Field research was conducted in 2016–2020 in a stationary experiment at the NULES of Ukraine “Agronomic Research Station” in 10-field crop rotation and also in laboratory “Demonstration collection field of crops” of the Plant Science Department. HyStik (400 g/100 kg seeds) was used as an inoculant. The form of the preparation is sterilized peat. The active ingredient is *Bradyrhizobium japonicum* (strain 532 C). Soybeans were grown on the background of applying mineral fertilizers at the rate of  $N_{45}P_{60}K_{60}$ .

As a result of the conducted researches, was established that the use of nano preparation Avatar, Iodis-concentrate, and Super Micro Plus for seed treatment and fertilizing intensified leaf surface formation and symbiotic apparatus activity of soybean plants. Presowing inoculation of seeds in combinations with nanopreparations, which were used for seed treatment and feeding during the growing season, ensured the differentiation of plants by growth and development, first of all, it was possible to identify by the intensity of formation of the leaf surface area. The largest (35,3-37,2 thousand  $m^2/ha$ ), on average over the years of research, the leaf surface area was formed by the crops of soybeans of the Khorol variety in the variants of the experiment, where feeding was carried out with the nano-chelate fertilizer Super Micro Plus against the background of seed treatment with a combination of the HyStik and micro fertilizer Avatar.

The main criterion for assessing the efficiency of photosynthesis processes, biological nitrogen fixation and the formation of plant productivity are indicators of individual plant productivity and the value of soybean productivity. The obtained results confirm that the application of the complex of nano fertilizers Jodis-concentrate, Avatar, and nano-chelate fertilizer Super Micro Plus in the soybean fertilization helped to increase the yield, which indicates their unconditional effectiveness. The highest efficiency of nano fertilizers was shown by inoculation and seed treatment by Avatar with co-fertilizing Avatar +nano-chelate fertilizer Super Micro Plus, providing formation of 52,4 thousand  $m^2/ha$  of leaf surface area of soybean variety Khorol, 69,7 pcs/plant tubers on the root system, 785 mg/plant of their weight and yield at the level of 2,79 t/ha.