

Nanochemistry and biotechnology

Use of metal nanoparticles as polymicrofertilizer for increasing soybean productivity

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Microfertilizers are one of the most effective means of influencing the crop productivity and product quality. Lack of trace elements in soil causes disruption of growth and development of plants that leads to a significant decrease of yield. The use of nanoparticles of biogenic metals compensates loss of microelements, increases plant stress tolerance that improves the quality of the final product. The aim of the research was to study the effect of colloidal solution of nanoparticles of metals (Fe, Mn, Mo, Co, Cu, Zn, Ag) on soybean to determine the prospects for their use in agrotechnology. Objectives of study included the optimization of way of treatment and determining of effective concentrations of metal nanoparticles for soybean. The objects of study were varieties of soybean recommended for the forest-steppe ecoregion of Ukraine: ultra-early and early maturing Annushka and Ustyia respectively.

Obtained results showed that complex colloidal solutions of metals nanoparticles could be recommended for cultivation technology of early maturing soybean varieties in typical black humus-poor soil as presowing seed treatment and plant fertilizing in reproductive phases R1 and R2. Concentration of colloidal solution of metal nanoparticles 120 and 240 mg/L with the consumption rate 0.1 L/t of seeds are preferable for presowing seed treatment, and for foliar spraying of soybean working solution should be prepared considering consumption rate of 1L of stock solution in 100-300L of water per 1 ha. Use of metal nanoparticles solution in concentration 240 mg/L for pre-treatment of soybean seeds and further spraying by 240 mg/L solution in R1 phase on background of mineral fertilizers in doses N₆₀P₆₀K₆₀ promote increasing productivity of soybean by 1,5-2,5%.

Thus, the obtained results indicate the feasibility of using of colloidal solution of nanoparticles of biogenic metals as polymicrofertilizer in agricultural technologies of soybean, which improves productivity of this crop.