THE IMPACT OF BIOLOGICAL PREPARATIONS ON THE EFFECTIVE SOIL FERTILITY AND MINERAL NUTRITION OF APRICOT AND CHERRY PLUM SEEDLINGS

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Annual fruit crops seedling production requires the use of large doses of mineral fertilizers, but in recent years, their administration significantly decreased due to high material costs. In this regard, it reduced the quality of planting material and the efficiency of its cultivation. On the other hand, long-term application of high doses of mineral fertilizers has led to the accumulation of hardly soluble phosphates in soils [9], as well as contamination of subsoil and groundwater with nitrates [8]. An alternative to chemical intensification of agricultural production is biological, including the use of microbial preparations (MP) for the improvement of mineral nutrition of vegetative plants, the stimulation of growth, control of plant pathogens and phytophages development. They are created on the basis of efficient strains of nitrogen-fixing, phosphate-mobilizing, bio-protective, and entomopathogenic bacteria. Currently, microbial preparations, created by using these microorganisms, are successfully used in the production of cereals, legumes, vegetables, fodder and other crops [5; 6]. The use of biological preparations in growing of fruit crops was mainly concerned with apple, cherry and peach [4; 12].

When using the MP, it is important to know not only how they impact the plant and its productivity, but also what processes occur in the soil, how its fertility changes. For fruit crop nursery such studies are few. [3]

The objective of the study was to investigate the effect of MP based on efficient strains of nitrogen-fixing, phosphate-mobilizing, growth-stimulating and bio-protective bacteria on the effective soil fertility, mineral nutrition and the efficiency of apricot and plum seedlings growing in fruit crop nursery.

Objects and methods of the study. The study was carried out in the nursery of Nikitskyi Botanical Garden (NBG) - NSC in the steppe part of the Crimea. In field small-plot experiments in 2010-2013 we studied the effect of MP on mineral nutrition and yield of apricot Krymskyi Amur and cherry plum Obilnaia on

rootstocks of apricot and plum respectively, as well as the content of mobile forms of nutrients and organic matter in the soil. The study included the following MP designed and produced in the Department of Microbiology of the Institute of Agriculture of the Crimea: Diazofit (*Agrobacterium radiobacter* 204) and Azotobacterin (*Azotobacter chroococcum* 10702), biological agents of which are active strains of nitrogen-fixing bacteria; Fosfoenterin based on the strain of *Enterobacter nimipressuralis* 32-3, transforming hard-to-reach phosphates; as well as Complex of microbial preparations (CMP), consisting of a mixture of Diazofit, Fosfoenterin and Biopolitsid (based on a strain of *Paenibacillus polymyxa* P - antagonist of pathogenic micromycetes) in equal parts.

MP were applied to seeds prior to planting of fruit crops in the fall. The inoculation load was 105 bacterial cells per seed.

The soil on the plot - the southern black carbonate red-brown light-clay soil. The content of organic matter - 2.5-2.7%, nitrate nitrogen from 5 to 34 mg/kg, mobile phosphate P - 15-19 mg/kg, exchangeable potassium - 250-320 mg/kg. The soil supply with mobile phosphorus is low, with nitrate nitrogen - from low to medium, with potassium - high.

The scheme of planting in the nursery - 0.7 x 0.1 m. The farming technique – common for fruit crop nurseries on the southern black soil [2]. The nursery is irrigated. The soil moisture was maintained at 75-80% of MWC (minimum water capacity). When sowing seeds no fertilizers were administered to the soil. On the second field of the nursery mineral nitrogen in the form of dressing in the amount of 50 kg of dose per hectare was administered during the active growing phase of seedlings.

The records of grade and condition of apricot and cherry plum seedlings were carried out according to the procedure [7]. The repetition of experiment is four-time, the location of variants is randomized within a nursery row. The accounting plot area is 2-3 m². The number of accounting plants is 30-40.

The content of mobile forms of phosphorus and potassium in the soil layer of 0-40 cm was determined by Machihin (DSTU 4114-2002), nitrate nitrogen - potentiometrically by GOST 26951-86, organic matter - according to Tiurin (DSTU 4289: 2004). The leaves were collected by Chapman technique [11], the content of NPK in the leaves was determined after wet ashing with the mixture of sulfuric and perchloric acids by Ginzburg and Shchekhlova [1].

The statistical analysis of the study results was carried out by ANOVA programs. A 5% significance level was adopted as authentic.

Thus, the bacterization of cherry plum and apricot seeds with MP biological agents before sowing without the use of large doses of mineral fertilizers contributed to an increase in the content of mobile forms of nutrients in the soil under the plantlets (N-NO₃ - by 4-11; P₂O₅ - by 1,7-4,6; K₂O - up to 52 mg/kg of soil) and seedlings (N-NO₃ - by 1-5; P₂O₅ - by 4-6; K₂O - by 6-14 mg/kg) of cherry plum and apricot. The application of Azotobacterin and CMP led to the decrease in the content of organic matter in the soil, which indicates the need for organic fertilizers application, introduction of green manure or perennial grasses in nursery crop rotation. The use of Fosfoenterin stabilized the organic matter content in the soil under the cherry plum plants, and the use of CMP and Fosfoenterin contributed to its increase under apricot seedlings by 0.12-0.14%.

The application of MP had positive effect on apricot plantlets nutrition with nitrogen (an increase of 0.09-0.14% of the leave dry weight),

particularly effective was Azotobacterin. When growing cherry plum plantlets the nitrogen content in the leaves was reduced by using MP, due to more intensive growth of seedlings under the influence of growth-stimulators produced by bacteria, as well as an increase in the number of plants per hectare. When growing cherry plum and apricot seedlings (the second field of the nursery) the use of MP resulted in improved supply of seedlings with basic elements. Particularly effective was the use of Azotobacterin and CMP (increase in N – by 0.05-0.13%, P₂O₅ - by 0.03-0.05%, K₂O – by 0.11-0.14%).

The increase of nutrition elements content in the soil and the improvement of mineral nutrition of apricot and cherry plum seedlings at MP use caused an increase in the output of standard planting material per area unit. For both studied cultures Azotobacterin and CMP contributed to this to a greater extent. At this the first one increased the output of standard apricot seedlings by 21%, the second one – by 37%. When growing cherry plum the application of Azotobacterin and CMP allowed to get additional 7-8 thousand annual standard seedlings per hectare. Consequently, Azotobacterin and CMP can be recommended for the treatment of seeds before sowing in fruit crop nurseries to improve the efficiency of apricot and cherry plum grafted seedlings growing. The greatest effect will manifest itself at the replenishment of organic matter in the soil.