DEVELOPMENT OF COMPLEX BIOFERTILIZER FOR A BROAD SPECTRUM OF LEGUME CULTIVARS

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Relevance of protein deficiency problem in Belarus and Venezuela attracts keen interest to grain legume cultivars. Maximal productivity of legume crops may be attained, using presowing seed inoculation with microbial preparations based on nodulating and phosphate-mobilizing microorganisms. Positive impact mechanisms of such artificial associations on legume plants are diverse and most often are aimed at fixation of atmospheric nitrogen. A critical part in interaction between nodulating and phosphate-mobilizing bacteria is attributed to bioactive agents promoting activity, propagation of rhizobia and plant growth.

Application of complex microbial fertilizers ensures rise of productivity and protein content in leguminous plants, provides for enhanced biological diversity of symbiotic and rhizosphere soil microflora. A joint project realized by the Institute of Microbiology, National Academy of Sciences, Belarus and Venezuelan Institute of Scientific Investigations (IVIC) is aimed at elaboration of technology for production and application of a complex microbial preparation showing high biological fertilizing activity based on atmospheric nitrogen fixation, transformation of hardly mobile soil phosphates into form digestible for plants, stimulation of growth and development of legume cultivars to promote yields.

Nodulating bacteria isolated from various plant and soil sources of Grodno, Brest, Minsk regions, the Republic of Belarus, showed specificity to kidney bean *(Phaseolus vulgaris),* soybean *(Glycine max.),* cowpea *(Vigna unquinculata),* birds-foot trefoil *(Lotus corniculatus)* and the following species distribution: *Bradyrhizobium japonicum* – 88, *Rhizobium loti* - 72, *Rhizobium phaseoli* – 44, *Rhizobium vigna* – 80. Screening of obtained isolates resulted in selection of cultures possessing the highest growth –stimulating, nitrogen – fixing activities and nodulating capacity. The strains produced β –indolyl-3-acetic acid at the rate 2.0 -25.0 μg/ml. Stability of their symbiotic properties was tested and nitrogen–fixing activity was registered at the level 1,9 -4.8 N μg/ plant during 30 min. Cultural morphological and physiological–biochemical properties were characterized in most active representatives of nodulating bacteria (Br. japonicum, R. loti, R. faseoli, R. vigna**)** and their affiliation to genus Rhizobium was confirmed. Nodulating bacterial strains deposited at Collection of non–pathogenic microorganisms, Institute of Microbiology, National Academy of Sciences, Belarus did not display pathogenic and toxic action on test animals.

54 bacterial phosphate–mobilizing cultures transforming hardly accessible phosphates of calcium, aluminum or iron were isolated from samples of sod podzol soil in Belarus and 14 cultures were recovered from Venezuelan soil samples. Physiological–biochemical properties of most active phosphate–mobilizing strains were investigated. Bacterial identification by PCR technique allowed to refer them to genera: Bacillus (*Bacillus subtilis* 7), *Pseudomonas* (*Pseudomonas sp.* Ф3, *Pseudomonas fluorescens* П1/л), *Acinetobacter* (*Acinetobacter sp.* 6), *Agrobacterium* (*Agrobacterium radiobacter* ЛМП В-2251), *Serratia* (*Serratia sp.* 53, *Serratia plymuthica* 57) и *Enterobacter* (*Enterobacter sp.* Э 10, *Enterobacter sp.* Ф3, *Enterobacter sp.* 11, *Enterobacter sp.* 64, *Rahnella aquatilis* Е 10). Effects of highly active microbial phosphate mobilizers on seed germination and development of kidney bean, soybean, cowpea and birds –foot trefoil seedlings was established. It was found that about 30 % of studied bacteria exert growth–promoting activity in respect to legume crops and synthesize β–indolyl-3-acetic acid. Phosphate–mobilizing strains *Serratia sp.53, Serratia plymuthica 57, Enterobacter sp. 64* isolated from Venezuelan soil and *Pseudomonas fluorescens* П 1/л isolated from local soil display a complex ac-tion on plants (growth stimulation plus phosphate mobilization), resistance to oil hydrocarbons and in association with legume varieties they may be used for crop cultivation on contaminated plots.

Application of isolated and selected strains of rhizobia and phosphate–mobilizing bacteria as a basis of biofertilizer intended for a broad spectrum of legume cultivars will facilitate solution of fodder protein deficit problem and will ensure excellent harvests of ecosafe legume crops.