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Use of Beneficial Microorganisms to Improve Soybean Plant Development

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Abstract

Soybean crop has high relevance in the trade balance is considered one of the main agricultural commodities worldwide. There is a growing search for technologies that improve development, increase soybean grain yield, minimise damage by abiotic stresses, and offer higher resistance to phytopathogens, causing the least possible environmental impact and which still have low cost. The inoculation of plant growth promoting microorganisms represents a strategic alternative for sustainable agricultural systems. This group of microorganisms can benefit the plant via multiple mechanisms, which have been divided into direct and indirect stimulation. Direct effects are characterised by mechanisms such as biological nitrogen fixation, hormones production; phosphatases, siderophores and the acceleration of mineralisation processes. Indirect effects are characterised by antagonistic relation established with of target species of pathogens, or by inducing plant resistance mechanisms and by increasing tolerance to abiotic stresses. Co-inoculation consists of adding more than one recognised beneficial microorganism to the plants in order to maximise their contribution to plant development. The objective of this research was to identify the best microorganisms, alone or in mixture for total biomass gain (root + shoot), positive change in gas exchange, nutrient uptake (root, shoot and grain) and yield and yield components in the soybean crop. Trial under greenhouse conditions had the experimental design in a completely randomised scheme with 26 treatments and four replicates. The treatments consisted of the rhizobacteria BRM 32109, BRM 32110 and 1301 (*Bacillus* sp.), BRM 32111 and BRM 32112 (*Pseudomonas sp.*), BRM 32113 (*Burkholderia sp.*), BRM 32114 (*Serratia sp.*), Ab-V5 (*Azospirillum brasilense*) and 1381 (*Azospirillum sp.*), and the fungus *Trichoderma asperellum* (a mix of the isolates UFRA.T06, UFRA.T09, UFRA.T12 and UFRA.T52). Besides, the same isolates were combined in pairs, completing 16 combinations. Control treatments received no microorganism. Microorganisms applied isolated or in combination, provided biomass gain, positive gas exchange, increases in nutrients uptake at the shoot and grain, and improved grain yield and its components than control plants. Stood out the combination Ab-V5 + *T. asperellum* pool, which provided a 25 % improvement in soybean grain yield.

Keywords: Bioagent, gas exchange, *Glycine max*, grain yield, growth promotion, nutrient uptake

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