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Upland Rice Agronomic Performance as Affected by Multifunctional Microorganisms

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Abstract

The production of upland rice is growing in worldwide importance due to the reduction of irrigation water availability for irrigated lowland rice crops. Constituents of the microflora, the plant growth promoting rhizobacterias (PGPR) and Trichoderma spp. fungus, have important molecules within their cell constitution, such as flagellin (protein constituent of flagella) and lipopolysaccharides (LPS, cell membrane constituents). These components are recognised by the plant as metabolism activators that can improve rice development. Thus, the benefits of the interaction between beneficial microrganisms and plants can be direct, such as growth promotion, since some bacterial groups produce phytohormones such as indole acetic acid (IAA), cytokinins and gibberellins, or solubilising phosphorus and producing siderophores. Among the indirect benefits is the protection against pathogens, such as the induction of resistance and direct antagonism. These benefits could help to reduce or avoid application of products to control insects and diseases in field crops. Therefore, PGPR can significantly improve plant development and provide reduction in production costs. However, there are still little information about the interaction among plant, environmental and microorganisms. The objective of this work was to determine effects of beneficial microorganisms applied alone on in mixture on upland rice development. The experiment was conducted in greenhouse, in a completely randomised design with 26 treatments and three replications. Treatments consisted of the use of *Bacillus* sp., *Serratia sp.*, *Azospirillum sp.*, *Bacillus spp.*, *Azospirillum brasilense* isolate Ab-V5 and *Trichoderma asperellum* pool applied alone or in mixture in three distinct periods, in addition it was include a control treatment (no microorganism application). Microorganisms significantly affected gas exchange, biomass production and nutrient accumulation in the shoots and roots. Microorganisms Ab-V5 + *Bacillus* sp., *Bacillus spp.* + *Azospirillum sp.*, *Trichoderma asperellum* pool and *Serratia sp.*+ *Trichoderma asperellum* pool, provided the largest increases in total biomass production with values of 26.8, 25.4, 23.3 and 21.3 % higher than in the control treatment, respectively. Our results allow inferring that the use of beneficial microorganisms provided improvements in plant development and could be an important strategy to produce more in a sustainable way.

Keywords: Bioagents, growth promoters, inoculation, *Oryza sativa*, sustainable development

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