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Effect of AM fungi PGPR and different soil nitrogen sources to improve growth and yield of paddy (cv. JAYA)

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SUMMARY

Arbuscular mycorrhizal fungi and plant growth promoting *rhizobacteria* have a wide range of application in sustainable low input agricultural systems. The use of these two organisms may contribute to reducing chemical fertilizers and aids in high yield productivity. Studies were conducted in the net house in the botanical garden. There were 16 unsterilized mixed soil inoculum treatments with control. *Glomus macrocarpum*, *Azotobacter chroococcum* and *Glomus macro carpum* + *Azotobacter chroococcum* at four different levels of nitrogenous fertilizer. Paddy plants inoculated with *Glomus macrocarpum* attained maximum height when nitrogen was added @ 44 kg/ha. The *Azotobacter chroococcum* inoculated plants, however, require less nitrogen that is 24 kg/ha to attain height at par with *Glomus macrocarpum* inoculated plants. Dual inoculated plants irrespective of rate of nitrogen application produced maximum shoot biomass plants height, tiller number, 1000 grains weight N, P, in shoot than single inoculation. Effeminacy of AM fungi was significantly improved, when they were used along with *Azotobacter chroococcum*. The results of the present work strongly suggest that application of bioinoculants such as AMF and PGPR would enable farmers for optimizing paddy production with minimum input of inorganic fertilizers.

Key words : Arbuscular mycorrhizal fungi (AMF), Plant growth promoting bacteria (PGPR), *Glomus macrocarpum*, *Azotobacter chroococcum*

AMF (arbuscular mycorrhizal fungi) is widely distributed in agro-ecosystems (Smith and Read, 1997), forming symbiotic associations with the roots of plants. They play an important role in plant mineral nutrition and plant health (Barea *et al.*, 2002). These fungi have a wide range of application in sustainable low input agricultural systems (Schreiner and Bethlenfalvay, 1995). The use of AMF may contribute to reducing chemical fertilizer inputs and sustaining plant productivity in agriculture (McGonigle, 1988).

The contribution of PGPR (plant growth promoting rhizobacteria) in phytostimulation, phytoremediation, and biofertilization is well documented (Barea, 2000). *Azotobacter is* regarded as a broad-spectrum inoculant as it could be used for inoculating wide variety of crops such as wheat, rice, sorghum, barley, potato, sugarbeet, cotton, maize, etc. (Rai and Gaur, 1982).

The present study, therefore, was conducted under net house conditions using unsterilized soils, to test the effectiveness of the introduced AMF and plant growth promoting rhizobacteria in the presence of their indigenous counterparts on paddy grown at different soil nitrogen sources.

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MATERIALS AND METHODS

Soil:

Test soil was collected from rice fields located near Karwara South Canara district of Karnataka. It contained 0.037% phosphorus (total), 0.109% nitrogen (total), and 1.3 ppm potassium with pH 5.70, and moisture content of 38%. Earthen pots of 20 cm diameter with a drainage hole were filled with approximately 4 kg of soil.

Experimental design and treatments:

The pot experiment was conducted in the net house in the botanical garden, Department of Botany, Karnatak University, Dharwad. The (Completely Randomized Block) design was used for the experiment. There were 16 soil treatments with control, *Glomus* only, *Azotobacter chroococcum* only, and *Glomus macrocarpum* + *Azotobacter chroococcum* only, at four different levels of nitrogenous fertilizer; that is, zero kg/ha, 24 kg/ha, 48 kg/ha-and 144 kg/ha. These 16 soil treatments were replicated three times. Nitrogen was applied in three splitted doses. The first dose, consisting of 1/3 the normal dose, was applied before transplantation; the second 1/3 at the time of tillering; arid the last 1/3 at the panicle initiation phase.