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Enhancement of growth and yield of upland rice (*Oryza sativa* L.) by Actinomycetes

Jayvee Adriano Cruz
Philippine Rice Research Institute, Philippines

Growth room and greenhouse experiments examined the potential of actinomycetes as microbial inoculant to improve the yield of upland rice. Fifty-nine isolates from rice and corn rhizosphere and existing collection of the National Institute of Molecular Biology and Biotechnology (BIOTECH) were screened for growth promoting activities. Thirty-two isolates produced indoleacetic acid (IAA), fourteen of which showed ACC deaminase activity while twenty-four solubilized bound phosphate *in vitro*. Five isolates were selected from among 59 isolates evaluated for further study.

The selected isolates were subjected to morphological and 16S rDNA analysis to establish isolates identity. Based on morphology and 16S rDNA analysis, the probable identities of the selected isolates with their corresponding percent identity are as follows: YB6y, Actinomycetales bacterium-95%; AVermi3, uncultured *Actinomyces*-96%; AVermi7, *Streptomyces* sp-95%; NB1, *Rhodococcus* sp-95%; NB3, *Streptomyces mutabilis*-98%.

In the growth room, the selected actinomycetes increased root dry weight of upland rice by 24 to 71% at 14 days after sowing (DAS). All five isolates were rhizosphere competent as indicated by the root colonization study. Actinomycetes colonized the roots of upland rice with population densities ranging from 5.9 x 105 to 1.2 x 107 CFU g-1 rhizosphere soil with R:S ratios of 0.8 to 1.1. At 30 DAS, actinomycete isolate NB3 population in the rhizosphere increased 100-fold with R:S ratio of 1.08.

In the greenhouse, NB3 combined with full rate of fertilization, had the highest shoot biomass. At full rate of fertilization, inoculation with NB1, AVermi7, YB6y and NB3 significantly increased P uptake by 80 to 136% over the uninoculated control. Inoculation with NB3 and AVermi7 significantly increased grain yield by 62% and 48% respectively, relative to uninoculated treatment.

The significant increase in grain yield by NB3 and AVermi7 and their ability to colonize the rhizosphere demonstrate the potential of these actinomycetes as plant growth-promoting inoculants for upland rice. However, field assessment is recommended to determine the effect of biotic and abiotic stresses in the performance of promising actinomycetes.

jayveeacruz@gmail.com