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Bio-organic influence on phosphatic fertilizers under wetland rice ecosystem in an alfisol

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ABSTRACT

The efficiency of P fertilizers of varying water solubility was evaluated by comparing the grain yield, P uptake and economic returns. The results revealed that application of SSP @ 50 kg P_2O_5 ha^{-1} + Azophos @ 2 kg ha^{-1} + FYM @ 12.5 t ha^{-1} recorded the highest grain yield (4760 kg ha^{-1}). Among the P sources, highest grain yield was recorded due to the application of SSP as compared to URP. Among the microorganisms inoculated, Azophos enhanced the rice yield followed by VAM and phosphobacteria. The B: C ratio was higher under SSP @ 50 kg P_2O_5 ha^{-1} + Azophos @ 2 kg ha^{-1}. Though the B: C ratio was low in FYM treated plots, incorporation of FYM increased the grain yield and P uptake. For better dissolution of P, Azophos can be used as an efficient P solubilizer under low land ecosystem.

Key words : Rice yield, Phosphorus, P solubilising microorganisms, Phosphorus, Uptake, FYM

Unlike other major nutrients, substantial P inputs from sources other than fertilizer, such as irrigation water and rainfall are not likely to occur and the observed P response reflects the fertilizer efficiency and effective P supply from indigenous soil resources. The use of finely ground phosphate rocks applied directly as P source to tropical soils is an attractive option because they are considerably cheaper than water soluble P fertilizers. Incorporation of FYM under submerged condition enhances the availability of phosphate because of shifting of solubility of P from â tri calcium phosphate towards more soluble octa calcium phosphate mineral. The introduction of efficient P solubilizers in the rhizosphere increases the availability of P from insoluble sources of phosphates and utilization efficiency of water soluble P fertilizer. Hence, in the present investigation, field experiments were conducted to evaluate the relative efficacy of P fertilizers, bio-organics on yield, P uptake and economics in rice-rice cropping sequence under wetland ecosystem.

MATERIALS AND METHODS

Two field experiments were conducted in an Alfisol using rice (var.ADT.43) as test crop. The soil of the experimental area was a sandy clay loam soil classified as Madukkur soil series (Typic Haplustalf). The initial soil had a pH of 7.20, EC of 0.20dSm^{-1}, $KMnO_4$-N of 145 kg ha^{-1}, Olsen-P of 9.0 kg ha^{-1}, 1N NH_4OAc (pH 7.0) K of 249 kg ha^{-1} and organic carbon of 7.5 g kg^{-1}. The experiments were conducted in a Randomized Block design replicated thrice with twelve treatment combinations consisted of two P sources *viz.*, water soluble P fertilizer, Single super phosphate (SSP) and water insoluble P fertilizer, Udaipur rock phosphate (URP) @ 50 kg P_2O_5 ha^{-1}, FYM @12.5 t ha^{-1}, P solubilising bacteria *viz.*, phosphobacteria, Azophos @ 2 kg ha^{-1} and P solubilising fungi VAM @ 100 g m^{-2}. Single super phosphate and Udaipur rock phosphate @ 50 kg P_2O_5 ha^{-1} were applied basally as per the treatment schedule. Nitrogen and potash were applied through urea and Muriate of potash @ 150 kg ha^{-1} and 50 kg K_2O ha^{-1}, respectively in three equal splits *viz.*, basal, active tillering and panicle initiation stages. The biofertilizers were applied as soil application just before transplanting. At harvest stage, grain yield was recorded. The grain samples were analysed for P content (Jackson, 1973) to compute the P uptake. The cost of inputs used in the trial was as follows: Single super phosphate Rs.18 kg^{-1}, Udaipur rock phosphate Rs.10 kg^{-1}, FYM Rs.50 t^{-1} phosphobacteria and Azophos Rs.10 200g^{-1}, and VAM Rs.20 kg^{-1}. The cost of paddy grain and straw were Rs.6 kg^{-1} and Rs.0.25 kg^{-1}, respectively.

RESULTS AND DISCUSSION

Grain yield and P uptake:

Application of SSP @ 50 kg P_2O_5 ha^{-1} + Azophos@ 2 kg ha^{-1} + FYM @ 12.5 t ha^{-1} recorded the highest grain yield (4760 kg ha^{-1}) which was at par with the grain yield of 4474 kg ha^{-1} in the treatment that received SSP @ 50 kg P_2O_5 ha^{-1} + VAM@ 2 kg ha^{-1} + FYM @ 12.5 t ha^{-1}. Lowest grain yield (2800 kg ha^{-1}) was recorded in the treatment that received URP @ 50 kg P_2O_5 ha^{-1} + phosphobacteria @ 2 kg ha^{-1} which was at par with SSP @ 50 kg P_2O_5 ha^{-1} + phosphobacteria @ 2 kg ha^{-1} (Table