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Photodependent acetylene reducing activity (ARA) in ricefields under various fertilizer and biofertilizer management

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ARA and rice yield were measured for 3 seasons in 65 plots (4 x 4 m) receiving 13 partial combinations of: 1) urea (0, 30 + 25 kg N/ha broadcast, 55 kg/ha basal deep-placed); 2) P₂O₅ (0, 30 kg/ha basal or split); 3) Algal inoculation (0, 20 kg/ha); and 4) Azadirachta indica crushed seeds applied to control algal grazers (0, 100 kg/ha). To measure ARA, 8 core samples (2 cm Ø) including floodwater and the 3 first cm of soil were collected per plot. Floodwater was then removed. Incubation was made under 10% C₂H₂ in air for 1 h at 30 klux and 26-28°C. Acetylene/¹⁵N ratio was 4.7 ± 0.7.

o Average ARA per plot ranged from values equivalent to 2 to 38 kg N fixed/ha per crop and averaging 10.5 kg N/ha per crop.

o BGA inoculation and neem application had no statistically significant effect (p = 0.05) on ARA and yield, partly because of the development of indigenous mucilaginous BGA resistant to grazing.

o Split P application increased BNF over basal application by 72%. In 1987, applying 13 kg P/ha increased ARA by a value equivalent to 10 kg N/ha which partly explains a yield increase of 0.5 t/ha.

o BNF by BGA was almost completely inhibited by broadcast urea in 1985-86, but not in 1987, when it was 63% of the control. In 1987, broadcast urea caused a rapid blooming of green algae, leading to a water pH of 10 at noon 4 days after transplanting and high N losses by NH₄ volatilisation, reflected in the absence of yield response to broadcast urea. N losses and reinoculation of the plots by an irrigation water rich in BGA may explain the growth of N₂-fixing BGA after urea broadcasting, but the development of a significant ARA seems to be an index of low fertilizer efficiency as shown by negative correlations between ARA and yield in such plots.

o In 1985-86, ARA was decreased by 75% in plots where urea was deep-placed but, in 1987, it was similar to that in the control, confirming the potential of N deep placement for promoting photodependant BNF in N fertilized fields. Differences observed might result from the method of placement and water management.

o No correlation was found between BNF and yield in control plots and in plots where urea was deep placed. This may indicate that N fixed was little utilized by the crop. Promoting N₂-fixation by BGA in wetland rice does not ensure that fixed N is made available to the crop.

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