

Evaluation of Methods for *Azotobacter* Application on the Yield of Rice

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ABSTRACT

Field experiments were conducted at the College of Agriculture, Central Agricultural University, Imphal during rainy season of 1993-1995 to evaluate the methods for *Azotobacter* application on rice (*Oryza sativa* L.) HYV, Leimaphou. Eight methods, namely, seed treatments; seedling root dip; soil application; seed + root; seed + root + soil; seed + root + one top-dressing; seed + root + two top-dressings and root + three top-dressings were evaluated and seed + root + two top-dressings gave the maximum in plant height (93.65cm), effective tillers/hill (6.45 no.), panicle length (20.78 cm), 1000 grain weight (28.51 g.) and yield (7.73 t/ha). It was followed by seed + root + one top-dressing with plant height (90.24 cm.), panicle length (19.74 cm.), 1000 grain weight (28.41 g.) and yield (7.56 t/ha).

Rice needs high dose of nitrogen fertilizer for its optimum growth and yield. However, due to short supply and high cost of chemical fertilizers in India, use of *Azotobacter* could supplement the nitrogen requirement for rice upto 20-40 kg N/ha (Rangaswami, 1975). Methods of *Azotobacter* application namely, seed inoculation (Apte and Shende, 1981 and Singh and Singh, 1996), seedling root dip (Hapase et.al, 1984) and crop inoculation with *Azotobacter* and fertilized with NPK (Mahammad, 1986) were used so far. As little information on the evaluation of methods of *Azotobacter* application on rice is available, the present investigation was undertaken to find out the best method of *Azotobacter* application on rice.

MATERIAL AND METHODS

The experiment was conducted during kharif season of 1993 to 1995 at the experimental field of College of Agriculture, Central Agricultural University, Imphal (774.5m above mean sea-level : 93.54°E, 24.46°N). The soil is clay loam with PH 5.5, available N (320 kg/ha), P₂O₅ (51.6 kg/ha) and K₂O (475.3 kg/ha). The experiment was laid out in RBD with 3 replications.

Eight methods for *Azotobacter* application on rice cultivation were evaluated. (i) In seed treatment, rice husk ash based *Azotobacter* inoculant containing 10⁸ cell/g was used @ 6 kg/ha, sixty kg rice seeds were soaked in 60 litres of water containing 6 kg *Azotobacter* inoculum for 24 h and allowed to sprout for sowing in the wet nursery. (ii) In seedling root dip, 6 kg rice husk ash-based inoculum were suspended in 15 litres of water. The roots of 25-day-old rice seedlings required for 1 ha were sprayed inoculated with 15 litres of *Azotobacter* suspension and kept

Table 1. Effect of different methods of Azotobacter application on grain yield and yield components (mean data of 1993 to 1995)

Method of inoculation	Plant height (cm)	Effective tillers/hill (no.)	Non effective tillers/ (no.)	Panicle length (no.)	Filled grain/panicle (no)	Chaffy grain/panicle (no)	1000 grain wt. (g)	Grain yield (t/ha)
Seed (T ₁)	84.6	6.2	0.5	19.4	84.8	24.6	27.7	6.6
Root (T ₂)	83.9	5.4	0.7	18.2	81.8	24.8	25.6	5.9
Soil (T ₃)	85.6	5.3	0.8	19.3	83.6	24.5	26.2	6.7
Seed+root (T ₄)	84.5	6.0	0.7	18.1	80.8	25.4	28.0	7.0
Seed+root+ Soil (T ₅)	89.0	5.5	0.6	19.5	85.2	21.8	28.0	7.2
Seed+root+ 1topdressing (T ₆)	90.2	6.0	0.5	19.7	86.3	23.9	28.4	7.6
Seed+root+2top dressing (T ₇)	93.7	6.5	0.4	20.8	88.1	20.9	28.5	7.7
Root+3 top dressings (T ₈)	82.3	4.9	0.8	18.9	88.6	31.4	26.5	5.2
Control (T ₉)	79.2	4.3	0.9	18.0	70.4	31.7	26.1	4.9
CD (p=0.05)	2.0	2.0	0.1	0.9	1.1	2.6	0.6	0.5

overnight and transplanted in the experimental plots. (iii) For soil application, 6 kg inoculum was mixed with 10 kg freshly collected rice grain husk ash/ha and broadcasted in the field before transplantation. (iv) In seed and root treatment, 6 kg inoculum was split into 2 equal doses i.e. 3 kg inoculum was mixed with 60 kg rice seeds and 3 kg inoculum was used for spraying roots of rice seedlings required for one ha. (v) For seed, root and soil treatment, 6 kg inoculum was split into 3 equal doses i.e. 2 kg each for seed root and 2 kg for soil for 1 ha. (vi) In seed, root and one top-dressing, 6 kg inoculum/ha was split into 3 equal i.e. 2 kg each for seed, root inoculum and top dressing during maximum to tillering stage of rice. (vii) In seed root and two top-dressings, 6 kg inoculum/ha was split into 4 equal doses i.e. 1.5 kg each for seed, root dip and two top-dressings, one each during maximum tillering and booting stage. (viii) In root and 3 top dressings, 6 kg inoculum/ha was split into 4 equal doses i.e. 1.5 kg each for root inoculation and three top dressings each during maximum tillering, booting and just after flowering and (ix) Control. The required potassic and phosphatic fertilizers were applied @ 40 kg and 60 kg/ha at the time of land preparation. Yield contributing traits and yield were measured after 145 days of sowing.

RESULTS AND DISCUSSION

Of the eight methods for *Azotobacter* application, inoculation of *Azotobacter* on seed+root+two top dressings (one during maximum tillering and other one during booting stage) was found best and most effective method for getting maximum grain yield of 7.73 t/ha followed by seed+root+one top dressing during maximum tillering stage with grain yield of 7.56 t/ha and seed+root+soil application with grain yield of 7.18 t/ha respectively (Table 1). Similar results were reported by kannaiyan et al, (1980) and Nandi and Sen (1985) who found increased in yield of crop plants including rice when sprayed with *Azotobacter chroococcum*. It was further observed that plant height was significantly different among the *Azotobacter* applications and control. Maximum plant height (93.65cm) was recorded from seed + root + 2 top-dressings. Germination of rice seeds treated with *Azotobacter* was quicker with maximum length of shoot than those of control (Apte and Shende, 1981; Singh and Singh, 1996). The yield contributing traits namely number of effective tillers per hill, length of panicle and 1000 grain weight were found maximum in seed+ root+ 2 top-dressings method of its application. For better growth and grain yield of rice, seeds and roots should be treated with *Azotobacter* coupled with 1 or two foliar sprays.

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