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Effect of nursery management techniques on nitrogen nutrition of rainfed, lowland transplanted rice (*Oryza sativa*)

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ABSTRACT

An experiment was conducted to study nitrogen nutrition of rainfed lowland rice nursery (*Oryza sativa* L.) using farmyard manure (FYM), decomposed *Gliricidia* leaves (DGL), urea and diammonium phosphate (DAP) each @ 60 and 120 kg N/ha proved superior in terms of dry matter, plant height and seedling quality (80% superior to the control). Addition of FYM @ 60 kg N/ha, inorganic (through urea or DAP @ 60 kg N/ha) and DGL could also improved seedling quality by 75, 66 and 54% respectively.

Key words : Rainfed lowland rice, Nursery management, Yield

The rice crop raised with healthy and vigorous N-fertilized seedlings is more tolerant and shows a better stand with more profuse tillering and less mortality under conditions of intermediate deep water (15-50 cm) and flash floods (Panda *et al.*, 1991). Moorthy and Manna (1982) reported that under shallow water depth (0–10 cm), crop shows no difference with respect to crop performance whether planted with seedlings from fertilized or unfertilizer nursery. Planting with aged (45–60 days) and fertilized nursery seedlings is essential for better flood tolerance of rice under excess water condition (Sharma, 1992). In such cases nitrogen requirement is likely to be enhanced. Energy crisis and higher cost of N fertilizer have created considerable interest worldwide in the use of organic sources in crop production. The present investigation was therefore undertaken to find out the effect of different sources and levels of nitrogen on growth and quality of rice seedlings to attain increased grain yield under rainfed, lowland, transplanted condition.

MATERIALS AND METHODS

The experiment was conducted on sandy clay-loam soil classified as Haplustalf at the Central Rainfed Lowland Rice Research Station, Kharagpur, during wet season of

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1995 and 1996. The soil having pH 6.4, organic carbon 0.30% contained 0.030% total nitrogen, 30.0 kg/ha available P and 100 kg/ha available K. The test variety was 'Manasarovar'. Farmyard manure (FYM) and decomposed gliricidia leaves (DGL) were used as organic source and urea and diammonium phosphate (DAP) as inorganic source. Including 1 control, altogether 9 treatments were tried with each source @ 60 and 120 kg N/ha. The quantity of organic source was calculated on the basis of their N. Organic source of N was applied basal dose while inorganic source was applied in 3 equal splits at biweekly intervals. Observations were recorded on 45-day-old seedlings. For taking up observations, the nursery was replicated thrice with the aforesaid 9 nursery treatments in randomized block design. The seedlings were indexed with 1 to 5 scale on the basis of their colour intensity. Seedling growth was calculated as dry matter/unit height. Quality of rice seedlings was computed as seedling quality-seedling growth × colour intensity.

The experimental plots in the main field received a uniform basal application of 40 kg N, 20 kg P_2O_5 and 20 kg K_2O/ha. Seedlings from each treatment imposed in nursery were transplanted in separate plots following randomized block design with 3 replications and their effects were measured in grain yield. Transplanting was done with 45-days-old seedlings/hill at 20 cm × 15 cm spacing during last week of July in both years.

Table 1. Seedling characters as influenced by different nursery treatments (pooled data of 1995 and 1996)

Nursery treatment	Dry matter (mg/plant)	Height (cm)	Seedling growth (mg/cm)	Seedling quality	Nitrogen content (%)
Urea					
60 kg N/ha	245.5	50.1	4.91	14.73	1.00
120 kg N/ha	270.3	55.4	4.87	24.35	1.45
Diammonium phosphate (DAP)					
60 kg N/ha	250.4	51.7	4.84	14.52	1.16
120 kg N/ha	257.6	52.4	4.91	24.55	1.23
Decomposed gliricidia leaves					
60 kg N/ha	248.8	48.2	5.16	10.32	1.26
120 kg N/ha	246.5	46.3	5.32	10.64	1.20
Farmyard manure					
60 kg N/ha	260.3	53.1	4.90	19.60	1.09
120 kg N/ha	254.1	52.7	4.82	19.28	1.06
Control (0 kg N/ha)	100.9	20.7	4.87	4.87	0.89
CD (P = 0.05)	30.43	16.32			

RESULTS AND DISCUSSION

Seeding growth and Nitrogen

Application of urea @ 120 kg N/ha significantly increased dry matter and height of seedling over the control and was at par with all other sources and levels of N (Table 1).

Plant height increased from 20.7 cm to 55.4 cm with an increase in N from 0 to 120 kg N/ha, which may tolerate water depth in early growth stages for better establishment under such a situation. Seedling growth calculated as dry matter (mg) per unit height (cm) ranged from 4.87 to 5.32, being highest under DGL @ 120 kg N/ha which might be owing to marked enhancement of native microbial population (Rao *et al.*, 1989). Seedling quality was improved by 80, 75, 66 and 54% with application of inorganic source (urea or DAP) @ 120 kg N/ha. FYM, inorganic source (urea or DAP) @ 60 kg N/ha and DGL respectively over the organic sources at different levels, i.e. 60 or 120 kg N/ha. This can be partly due to application of large amounts of organic source which spurts biochemical activities including immobilization and fixation of available N (Yoshida, 1978). The N content of seedlings was higher under inorganic source than the organic source due to former being readily available to the plant throughout (Stangel, 1977).

Yield and yield attributes of rice

The productive tillers/m^2, panicle weight

Table 2. Yield and yield attributes as influenced by different nursery treatments (pooled data of 1995 and 1996)

Nursery treatment	Productive tillers/ m^2	Panicle weight (g)	Grain yield (q/ha)	Cost of cultivation (Rs)	Net return (Rs)	Cost : benefit ratio
Urea						
60 kg N/ha	182	2.30	36.15	12,450	3,414	1:1.27
120 kg N/ha	232	2.92	46.15	12,930	7,393	1:1.27
Diammonium phosphate (DAP)						
60 kg N/ha	189	2.38	37.75	12,770	3,800	1:1.29
120 kg N/ha	210	2.64	41.90	13,090	5,482	1:1.41
Decomposed gliricidia leaves						
60 kg N/ha	189	2.38	37.60	12,130	4,443	1:1.36
120 kg N/ha	183	2.30	36.45	13,110	3,000	1:1.22
Farmyard manure (FYM)						
60 kg N/ha	219	2.76	43.70	11,910	7,403	1:1.62
120 kg N/ha	210	2.64	41.80	12,710	5,765	1:1.45
Control (0 kg N/ha)	136	1.71	27.10	12,000	280	1:1.02
CD (P = 0.05)	23.64	0.29	4.70			

and grain yield were significantly increased by different nursery treatments (Table 2). Maximum grain yield was obtained under urea @ 120 kg N/ha, followed by FYM @ 60 kg N/ha, DAP @ 120 kg N/ha and FYM @ 120 kg N/ha. Next in order were DAP @ 60 kg N/ha, DGL @ 60 kg N/ha, DGL @ 120 N/ha and urea @ 60 kg N/ha and were at par among themselves. Yield attributes, viz. productive tillers/m^2 and panicle weight, also showed trend similar as that of grain yield. The results are in harmony with those of Maskina *et al.* (1985).

It was concluded that in nursery beds instead of applying urea @ 120 kg N/ha, it was sufficient to apply FYM only @ 60 kg N/ha for obtaining healthy and vigorous seedlings, which can successfully be used for transplanting under 15–30 cm of water depth. This would give not only the better yield but also cost less.

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