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Influence of seedling age, source and schedule of nitrogen application on rice (*Oryza sativa*)

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ABSTRACT

A field experiment was conducted during dry seasons (*rabi*) of 1992 and 1993 to study the effect of 3 ages of seedlings (30, 45 and 60 days old), 2 nitrogen sources (prilled urea and large granular urea) and their schedules of application, namely control; basal; 2 splits (50% basal + 50% panicle initiation); 2 splits (75% basal + 25% panicle initiation) and 3 splits (50% basal + 25% tillering + 25% panicle initiation stage) on growth, grain yield and economic returns of rice (*Oryza sativa* L.) variety 'Rasi'. Thirty and forty-five days old seedlings recorded significantly higher grain yield (13 to 15%) than that of the 60 days old seedlings. Large granular urea recorded significantly higher grain yield over that of prilled urea. Among different schedules of N application, 3 splits of N application gave significantly higher grain yield (5.50 t/ha) over rest of the schedules of N applications.

Key word : Rice, Seedling age, Sources and schedules of nitrogen, Economic returns

In most of the southern parts of India, rice is grown during both wet and dry seasons. Generally low temperature during dry (*rabi*) season causes slow growth of seedlings in the nursery which makes it difficult to decide the optimum age of seedlings for transplanting because in these regions transplanting varies from December to February. Nitrogen being the most important plant nutrient for growth and development, its utilization efficiency is known to vary with seedling age (Rao and Raju, 1987). Thus, higher yields of rice can be obtained by transplanting the seedlings of optimum age at right time with the application of recommended dose of nitrogen through right source (Kurmi *et al.*, 1993).

MATERIALS AND METHODS

A field experiment was conducted during dry (*rabi*) seasons of 1992 and 1993 at Directorate of Rice Research farm, Ramachandrapuram, Hyderabad in a clay loam soil having 8.2 pH, 195 kg/ha available N, 30 kg/ha available P_2O_5 and 282 kg/ha available K_2O. Rice seedlings of 3 ages, viz. 30, 45 and 60 days old were transplanted with 2 sources of nitrogen (prilled urea and large granular urea) under five schedules of nitrogen application, i.e. control (no nitrogen);

Table 1. Crop growth, yield attributes and grain yield as influenced by seedling age and sources and time of N application

Treatment	Plant height (cm)		Panicle length (cm)		Panicle number/m²		Panicle weight (g)		Grain yield (t/ha)		
	1992	1993	1992	1993	1992	1993	1992	1993	1992	1993	Pooled
Age of seedlings (days)											
30	80.0	79.6	19.38	19.10	292	293	2.58	2.63	4.13	3.93	4.03
45	80.6	80.6	19.59	19.13	296	298	2.62	2.65	4.17	4.03	4.10
60	72.8	73.0	18.01	17.80	269	275	2.46	2.53	3.62	3.49	3.56
CD (P = 0.05)	3.3	2.7	0.72	0.56	10	9	0.09	0.4	0.29	0.14	0.18
Sources of Nitrogen											
S_1 (Prilled urea)	77.0	76.6	18.67	18.34	285	280	2.52	2.55	3.83	3.65	3.74
S_2 (Large granular urea)	78.4	80.2	19.29	19.00	287	289	2.59	2.64	4.12	3.99	4.06
CD (P = 0.05)	1.3	NS	0.42	0.24	NS	3	0.06	0.02	0.11	0.13	0.12
Time of N application											
T_1 (control)	63.7	64.0	15.84	15.43	205	207	2.08	2.09	2.86	2.64	2.75
T_2 (Basal)	72.7	73.0	17.82	17.64	300	304	2.58	2.60	3.93	3.61	3.77
T_3 (50% Basal + 50% P.I.)	80.3	79.5	19.68	19.26	305	310	2.61	2.62	3.70	3.70	3.70
T_4 (75% Basal + 25% P.I.)	84.4	83.7	20.42	20.12	300	307	2.67	2.70	3.81	3.71	3.76
T_5 (50% Basal + 25% Til + P.I.)	87.5	88.7	21.22	21.03	316	317	2.84	2.99	5.57	5.42	5.50
CD (P = 0.05)	2.0	2.4	0.40	0.69	5	6	0.09	0.07	0.23	0.15	0.19

basal (total dose); 2 splits (50% N as basal + 50% N at P.I. stage); 2 splits (75% N as basal + 25% N at P.I. stage) and 3 splits (50% N at basal + 25% N at tillering + 25% N at P.I. stage) in a split-split plot design with 3 replications. A total quantity of 120 kg N/ha was applied as per treatment with uniform dose of 60 kg P_2O_5 and 40 kg K_2O/ha as basal dressing. Rice variety 'Rasi' (115 days duration) was transplanted on 10 and 8 January during 1992 and 1993 respectively at a spacing of 20 × 10 cm using 2-3 seedlings/hill. The data on growth and yield attributes were recorded at harvesting. Harvesting dates varied with differences in seedling age. Grain yield was calculated at 14% moisture. Economic returns (Rs) were calculated by considering the sale price of rice (Rs 2,400, and Rs 2,700/t) during 1992 and 1993, respectively while cost of cultivation was worked out to be Rs 6,500 during both the years.

RESULTS AND DISCUSSION

Crop growth, yield and yield attributes

The age of seedlings influenced significantly growth, yield attributes and grain yield of rice during both the years (Table 1). The mean maximum plant height and yield attributes such as panicle length, panicle number/m^2 and panicle weight of 45 and 30 days old seedlings was significantly higher than the 60 days old seedlings. The reason of lower plant height and reduction in yield attributes in these seedlings may be due to the fact that 60 days old seedlings remained for longer period in nursery which attained a maximum tillering stage within 60 days sowing. Transplanting of this stage seedlings did not provide sufficient nutrients to vegetative growth and also for reproductive phase which ultimately leads to reduction in plant height, yield attributes and grain yield. Similar results were reported by Singh *et al.* (1996) and Banik *et al.* (1997). The maximum mean grain yield of 4.10 t/ha was recorded with 45 days old seedlings followed by 30 days old seedlings (4.03 t/ha) while 60 days old seedlings recorded significantly lowest grain yield (3.56 t/ha). The per cent increase in grain yield was of 15 and 13 under 45 and 30 days old seedlings respectively than 60 days old seedlings. Singh *et al.* (1996) and Kurmi *et al.* (1993) also observed similar results. Large granular urea (LGU) recorded significantly higher grain yield (4.06 t/ha) than prilled urea (3.74 t/ha). It is due to

Table 2. Interaction effect between age of seedlings and schedules of N application on grain yield during 1992

Treatment	Schedule of N application				
	T1	T2	T3	T4	T5
Age of seedlings (day)					
30	3.20	3.99	3.73	4.11	5.62
45	3.01	4.23	3.67	3.88	6.04
60	2.36	3.57	3.69	3.44	5.05
CD (P = 0.05)	0.56	Same N schedules at different age of seedlings			
	0.32	Same age of seedlings at different schedules of N application			

Table 3. Mean economic returns (Rs/ha) as affected by different age of seedlings and source of N application 1992 and 1993

Age of seedlings (days)	Gross returns (Rs/ha)			Benefit : cost ratio		
	1992	1993	Mean	1992	1993	Mean
30	9,912	1,0611	10,262	0.53	0.63	0.58
45	10,008	1,0881	10,445	0.54	0.67	0.61
60	8,688	9,423	9,056	0.34	0.45	0.39

higher number, length and weight of panicles under large granular urea. These results are in confirmity with those of Pandey and Tripathi (1994). Grain yield difference among different schedules of nitrogen application were observed to be significant. 3 splits of N application (50% N at basal + 25% N at tillering + 25% N at panicle initiation stage) recorded significantly higher grain yield of 5.50 t/ha as compared to other schedules of nitrogen application. The per cent increase in grain yield under 3 N splits was of 100, 45.89, 48.65 and 46.28 than the mean grain yield of control (no nitrogen), basal (single application), 2 splits (50% basal + 50% PI) and 2 splits (75% basal + 25% PI) respectively.

The interaction effects between age of seedlings and schedules of nitrogen application showed that the mean maximum grain yield of 6.04 t/ha was recorded by 45 days old seedlings with 3 splits of N application. However, difference between 45 and 30 day old seedlings at same schedule of N application were not significant (Table 2).

Economic returns

The mean maximum gross returns and benefit : cost (B : C) ratio was recorded with 45 days old seedling (Rs 10,445/ha and 0.65 B : C) followed by 30 days old seedlings (Rs 10,262/ha and 0.58 B:C) and lowest gross returns of Rs 9,056/ha and 0.39 B:C ratio was recorded by 60 days old seedlings (Table 3).

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