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RESPONSE OF IRRIGATED DRY AND WET SEEDED RICE TO NITROGEN LEVELS AND TIME OF BASAL APPLICATION

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ABSTRACT

A field investigation was made to study the level and time of initial fertilizer N application to irrigated dry and wet seeded rice to maximise N use efficiency and yield. Two experiments were conducted during *kuruvai* (June to September) and *samba* seasons (September - January) on dry seeded rice and one experiment in *thaladi* season (October to February) on wet seeded rice. Nitrogen application caused a general increase in the yield of rice, however, the response was at a decreasing rate. The economic dose of N was found to be 95.8, 122.5 and 123.3 kg ha^{-1} to get a grain yield of 51.8, 34.5 and 52.5 q ha^{-1} in *kuruvai*, *thaladi* and *samba* seasons respectively. The initial dose of 50 per cent of total N could be applied 20 days after sowing (DAS) to *kuruvai* and *samba* crops when dry seeding was done and 10 DAS to *thaladi* crop when sprouted seeds were sown on puddled field, to maximise the grain yield and N use efficiency.

KEY WORDS : Direct seeded rice, N dose and timing, production function

Transplanting of rice in puddled field is the uling rice culture in Tamil Nadu. Now-a-days, the eceipt of irrigation water from the nonsoon-dependent river projects is delayed to ake up transplantation of rice in the right season, eading to yield reduction. In order to make best use of the pre-monsoon rains, underground water and anal water on its receipt, direct seeding of rice ither in dry soil in dry season or wet seeding on puddle during monsoon season could be an lternate rice culture system. Management of pplied fertilizer N in direct seeded rice is different rom that of transplanted rice. One way to achieve etter use of aplied N is to apply the nutrient at the ate and time to best meet at the demand of the rice lant (Greenwood, 1982). Varying responses have een reported to graded levels of N application.

For direct seeded rice, Maurya and Vaish 1984) recommended reducing basal application of N to a minimum, as the seedlings take some time to stablish and start absorbing the applied nutrients nd the nutrients in the seeds are sufficient to ustain 15 days of seedling growth. Recent studies n time of N application to direct seeded lowland ice indicated the advantages of delaying first dose f N upto first weeding or maximum tillering stage f 30-40 DAS (Mahapatra *et al.* 1986). In order to ptimise the dose and time of initial dose of N pplication to direct seeded rice to maximise the N use efficiency and yield, the present study was made.

MATERIALS AND METHODS

A field experiment was conducted at Tamil Nadu Rice Research Institute, Aduthurai, Tamil Nadu, on a clay loam soil. The soil had pH 7.3 and 0.42 per cent organic carbon and clay loam in texture, classified as low in available N (199 kg ha^{-1}) and medium in available P (15 kg ha^{-1}) and K (248 kg ha^{-1}). Four N levels at 0,40,80 and 120 kg ha^{-1} in *kuruvai* and 0,50,100 and 150 kg ha^{-1} in *thaladi* (October-February) and *samba* (September January) seasons, and the initial dose (50 % of total) of the N applied at four different times in *kuruvai* (at 10, 20, 30 days after sowing (DAS) and at active tillering) and at five different times in *thaladi* and *samba* (at sowing 10,20,30 DAS and at active tillering). The remaining 50 per cent of N was applied in two equal doses at active tillering and panicle initiation stages except in treatment where the initial dose itself was applied at active tillering. In this treatment N was applied in two splits, half at active tillering and half at panicle initiation. The experiments were laid out in a factorial randomised block design with three replications. Short duration TKM 9, medium duration IR 20, and long duration CR 1009 were sown on *kuruvai*, *thaladi* and *samba* seasons respectively. Dry seeds were broadcasted on dry

Table 1. Yield and apparent recovery of N in irrigated dry and wet seeded rice

Treatments		*Kuruvai*			*Thaladi*			*Samba*		
		Panicles (m^{-2})	Grain yield (q ha^{-1})	Apparent N recovery (%)	Panicles (m^{-2})	Grain yield (q ha^{-1})	Apparent N recovery (%)	Panicles (m^{-2})	Grain yield (q ha^{-2})	Apparen N recover (%)
N levels (kg ha^{-1})										
Kuruvai	*Thaladi* and *samba*									
0	0	289	25.3	-	236	16.3	-	307	32.3	-
40	50	327	42.8	56	308	27.8	44	374	45.2	42.4
80	100	361	50.2	55.6	332	32.8	40.6	434	50.5	43.0
120	150	382	51.5	39.7	351	34.9	33.2	453	52.9	34.7
	CD 5%	10	2.0	-	26	1.5	-	17	1.47	-
Time of N application (Initial 50 % N)										
At sowing		-	-	-	328	30.9	38.8	421	49	40.3
10 DAS		356	47.8	50.4	343	34.6	44.6	434	50.4	40.5
20 DAS		384	54.2	63.1	339	33	41.8	470	54.9	49.3
30 DAS		346	46.5	45.8	325	30.7	37.3	398	47.4	33.3
At tillering		343	44.3	43.2	317	29.7	34.1	378	45.8	37
	CD 5%	11.8	2.4	-	NS	1.9	-	21.8	1.9	-

soil during *kuruvai* and *samba* and sprouted seeds broadcasted on puddled soil in *thaladi*.

RESULTS AND DISCUSSION

Grain yield

N levels profoundly influenced the grain yield in dry and wet seeded rice. In *kuruvai*, the first level of 40 kg N ha^{-1} increased the rough rice yield by about 17.5 q ha^{-1} over control, while, the second increment (40 to 80 kg) boosted it further by 7.4 q ha^{-1}. The response at this stage tended to be quadratic (Table 1). In *thaladi* and *samba* seasons, there were significant responses to applied N upto the highest N level tried (150 kg ha^{-1}). The increase in grain yield at 50, 100 and 150 kg N ha^{-1} over control was 11.5, 16.5 and 18.6 q ha^{-1} respectively in *thaladi* season, and it was 12.9, 18.2 and 20.6 q ha^{-1} respectively for the above levels in *samba* season. Here again, though, the grain yield showed significant increase for each increment in N level, it is evident from above figures that the response exhibited a declining trend. The yield increase obtained by N fertilizers is mostly interpreted as N being a substrate for the synthesis of organic N compounds which are the constituents of protoplasm and chloroplasts as well as its stimulation of meristematic growth and cytokinin biosynthesis (Beringer, 1980).

Regarding time of first dose of N applicatio in *kuruvai* and *samba* seasons, this dose applied 20 DAS enhanced the grain yield (54.2 q ha^{-1} ar 54.9 q ha^{-1} respectively) significantly over othe times of application. Yield reduction to the tune o 9.9 and 9.1 q ha^{-1} was observed when N application was delayed to active tillering stage in the above seasons. In *thaladi* season, the highest grain yeild of 34.6 q ha^{-1} was obtained when the first dose of N was applied on 10 DAS. In this season, early application was required because of the fact that sprouted seeds sown on puddled soil had early seedling establishment and foraging capacity roots.

Production function

N application caused a general increase in rice yields upto the highest level of N tried. The responses to N application fitted quadratic function

Kuruvai : $Y=25.5 + 0.52\ N - 0.003N^2$
Thaladi : $Y=16.4 + 0.26\ N - 0.001\ N^2$
Samba : $Y=30.5+0.29\ N - 0.001\ N^2$

From the production function, the economic levels of N at the existed price levels were found to be 95.8, 122.5 and 123.3 kg N ha^{-1} with an estimated grain yield of 51.8, 34.5 and 52.5 q ha^{-1} for *kuruvai*, *thaladi* and *samba* seasons respectively.

Apparent N recovery

N application increased its uptake, but the apparent recovery decreased at higher levels of N. The recovery was generally low in wet season than in dry season like *kuruvai*, because of greater leaching losses of applied N in wet season. In line with grain yield response, in *kuruvai* and *samba* seasons, N recovery was more when initial N was applied 20 DAS, while in *thaladi*, the same benefit was obtained with initial application at 10 DAS.

The results indicated that a N dose of about 100 kg ha^{-1} in *kuruvai* and 125 kg ha^{-1} in *thaladi* and *samba* seasons would be economical and first dose of N (50% of the total) could be applied 20 DAS in *kuruvai* and *samba* seasons when dry seeding was done and 10 DAS in *thaladi* when sprouted seeds were sown in puddled field, for getting higher yields in direct seeded rice culture.

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APPROPRIATE VARIETIES AND MANAGEMENT TECHNIQUES FOR DIRECT SOWN RICE UNDER PUDDLED CONDITION

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ABSTRACT

Field experiments were conducted during *kuruvai* seasons (June-Sept) of 1994 and 1995 to identify appropriate techniques and suitable rice varieties for direct seeding under puddled condition at Tamil Nadu Rice Research Institute, Aduthurai. Five rice varieties *viz.*, Vikas, IET 9978, IET 9994, IET 9221 and ADT 36 were included during *kuruvai* 1994 and during 1995, the variety, IET 9221 was replaced by IET 10402 and ASD 16. Four management practices *viz.*, transplanting, wet seeding, weed control and split application of fertilizer were included in the experiments. Grain yield obtained under direct seeding is comparable with transplanted rice. Rice varieties, ADT 36, ASD 16 and IET 9978 are found to perform well under direct sown situation with improved management practices *viz.*, herbicide application followed by one hand weeding and application of recommended dose of N,P,K (125:50:50 kg/ha) and $ZnSO_4$ (25 kg/ha).

KEY WORDS : Direct seeding, puddled soil, wet seeding, appropriate varieties, technology

Rice is the most important cereal crop grown in Cauvery delta zone of Tamil Nadu. In recent years, increased irrigated areas, the availability of short duration modern rice varieties and cost-effective herbicides and high labour cost motivated the farmers towards direct seeding in puddled soil (De Datta and Nantasomsaran, 1990). The practice of direct seeding of sprouted seed is possible in areas where land is levelled with good water and weed control. It can help to reduce the labour requirement and duration of crop to some extent and provide comparable grain yields. Rachel Sophia Alexander and James Martin (1995) reported that wet seeded rice cultivation could be a better alternative for transplanted rice. Direct sowing of rice is practiced in Tamil Nadu under conditions of delayed receipt of canal water or due to uncertain monsoon and scarcity for farm labour. Economic use of all inputs is essential, particularly under direct seeded condition. Under direct sown condition, higher dose of 150:75:75 kg N, P_2O_5 and K_2O/ha registered higher grain and straw yields as well as net return/rupee invested in both *navarai* and *samba* seasons with variety ADT 37