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Influence of Levels of Nitrogen and Foliar Nutrition on Growth and Yield of Machine Transplanted rice

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ABSTRACT

A field experiment was conducted during *Kharif* 2013 under canal irrigation at Andhra Pradesh Rice Research Institute & Regional Agricultural Research Station – Maruteru, to study the influence of levels of Nitrogen and Foliar Nutrition on growth and yield of Machine transplanted rice. The experiment was laid out in a split plot design and replicated thrice. The results revealed that application of 150% recommended dose of nitrogen (135 kg ha^{-1}) recorded highest dry matter production, yield attributes and grain and straw yield. Foliar nutrition with different fertilizers at PI stage did not influence the dry matter production, yield attributes and grain and straw yield significantly. The interaction between nitrogen levels and foliar feeding treatments was found to be non-significant. The highest benefit cost ratio (2.9) was obtained with 150% Recommended Dose of Nitrogen (135 kg ha^{-1}). Relatively higher gross and net returns, higher benefit cost ratio (2.59) was with foliar application of 1% 19-19-19 over 2% KNO_3 and 2% DAP due to marginal increase in grain yield.

Key words : DAP, Foliar nutrition, Machine transplanted rice, Yield.

Rice is the most important crop among major cereals and staple food for 40 per cent of the world population. About 90 per cent of rice grown in the world is produced and consumed in Asian countries, China and India account for more than half of the total acreage. In India, rice is cultivated in an area of 43.77 million hectares with a production of 95.32 million tons. Rice productivity in India is 2240 kg ha^{-1} and contributes 26% of global rice production. Andhra Pradesh is one of the important states contributing to national food pool with productivity of 3028 kg/ha.

MATERIAL AND METHODS

A field experiment was laid out at Andhra Pradesh Rice Research Institute and Regional Agricultural Research Station, Maruteru, West Godavari district in Godavari zone of Andhra Pradesh during *Kharif* 2013. Maruteru is located at 81.44^0 E longitude, 26.38^0 N latitude, and at altitude of 5 MSL. The soil of experimental field was sandy clay loam in texture, with pH 8.13, low in available nitrogen (188.2 kg ha^{-1}), low in phosphorus (14.36 kg ha^{-1}) and high in available potassium (1254.4kg ha^{-1}). The mean maximum and minimum temperatures during crop growth period ranged from 29.7 °C and 22.9°C respectively. The experiment were laid out in a split plot design with four main treatments and three sub treatments replicated thrice. The treatments were,75 % RDN,100% RDN,150% RDN and 200%RDN in main plots and 2% KNO_3, 2% DAP and 1% 19-19-19 in sub plots.

Recommended dose of 90:60:60 kg ha^{-1} of nitrogen, phosphorus and potassium were applied in the form of urea (46 percent N), (18 percent N, 46 percent P_2O_5) and Muriate Of Potash (60 percent K_20). Fifty percent of nitrogen and potassium and full dose of phosphorus were applied basally before transplanting. The balance fifty percent of nitrogen and potassium was applied at active tillering and panicle initiation stages of rice crop.

The spray Solution of 1% 19-19-19 was prepared by dissolving 10 g of 19-19-19 in 1 litre of water to get 1 percent concentration. Similarly, KNO_3 and DAP solution was prepared by dissolving 20g each in1litre to get 2 percent concentration. As per the treatment schedule , foliar application of 1% 19-19-19, 2% KNO_3 and 2% DAP was done manually with knapsack sprayer at panicle initiation stage of crop.

RESULTS AND DISCUSSION

Growth parameters

The different treatments significantly influenced the rice growth parameters. Among the treatments tried, application of 150% RDN (135 kg ha^{-1}) produced highest dry matter (Table 1). Supply of nutrients through foliar feeding at different levels of nitrogen did not show much significant effect in increasing the drymatter production.

The increased dry matter production with increased nitrogen application might be due to the fact that nitrogen fertilization made the plants more efficient in photosynthetic activity, enhancing the carbohydrate metabolism and ultimately increasing the dry matter accumulation. More drymatter accumulation at 150% recommended dose of nitrogen might be due to increased nitrogen availability which is responsible for profused tillering and higher growth rate. Similar results were also reported by Stalin *et al*. (1999), Rao *et al*. (2004), Dwivedi *et al*. (2006), and Prasad Rao *et al*. (2011).

The total number of tillers m^{-2} (Table 1) was higher under 150% recommended dose of nitrogen than at 75% RDN & 100% RDN. Relatively higher tiller number was registered with 1% 19-19-19 foliar spraying over 2% KNO_3 and 2% DAP but the differenceswere not significance. Nitrogen levels improve tiller number in rice (Rajput and Warsi 1992), and Madhav *et al*. (1996). Interaction between nitrogen levels and foliar feeding treatments was found to be non-significant.

Yield attributes

The number of productive tillers m^{-2}, total number of grains $panicle^{-1}$, number of filled grains $panicle^{-1}$, test weight were significantly influenced by N levels only where in application of 150% recommended dose of nitrogen exerted favourable influence and improved all the yield attributes. Foliar nutrition with different fertilizers at PI stage did not influence the yield attributes significantly.However, the interaction between nitrogen levels & foliar feeding treatments was found to be non-significant. Increase in yield attributes might be due to to higher availability of N at panicle initiation and grain development stages .The contribution of carbohydrates from photosynthetic activity for longer period might have resulted in efficient translocation of food material into grain. These results are in line with those of Kumar *et al*. (2008).

Grain and straw yield

Increase in level of nitrogen significantly increased the grain yield of paddy up to 150% RDN. Further increase to 200% RDN resulted in significant reduction (Table 2). Application of 150% RDN recorded highest grain yield (6363 kg ha^{-1}) which was significantly superior over 75% RDN (4765 $kgha^{-1}$) and 100% RDN (5737 kg ha^{-1}) Additional nutrition through foliar application of 1% 19-19-19 (5731kg ha^{-1}) though not statistically significant, tended to increase grain yield marginally over 2% DAP (5697 kg ha^{-1}) & 2% KNO_3(5640 kg ha^{-1}). Incremental increase of nitrogen recorded significant increase in grain yield and in corroboration with the findings reported by Sharma *et al*. (2007), Singh and Jain (2000).

The treatment which received 150% RDN recorded highest straw yield (9399 kg ha^{-1}) and found significantly superior over 75% RDN (7456 kg ha^{-1}) and 100% RDN (8505 kg ha^{-1}) but remained on par with 200% RDN (9150 kg ha^{-1}) . Foliar feeding through different fertilizers did not show beneficial effect on straw yield. Increase in the dose of N increased the straw yield and these findings are in agreement with that of Gangaiah and Rajendra prasad (1999).

Economics

The economic analysis in rice (Table 2) revealed that the highest gross returns (Rs.76204 ha^{-1}) was obtained with 150% RDN. The lowest gross returns (Rs.57646 ha^{-1}) were obtained with 75% RDN. Foliar application of 1% 19-19-19 registered relatively higher gross returns (Rs.68973 ha^{-1}) mainly due to higher grain and straw yields. Maximum net returns and benefit cost ratio was obtained with 150% RDN (Rs. 56868 ha^{-1} & 2.93) because of higher yield and less expenditure towards the cost of N fertilizer . The lowest net return and benefit cost ratio of (Rs. 38688 ha^{-1} & 2.03) was recorded with 75% RDN. Among foliar feeding, foliar application of 1% 19-19-19 resulted in relatively higher net returns and benefit cost ratio (Rs.49835 ha^{-1} & 2.59) than 2% DAP and 2% KNO_3.

Table 1. Effect of nitrogen levels and foliar nutrition on growth and yield parameters of rice at harvest.

Treatments	Drymatter production (kgha $^{-1}$)	Number of tillers m^{-2}	Productive tillers m^{-2}	Total number of grains panicle^{-1}	Number of filled grains panicle^{-1}	Test weight (g)
Nitrogen levels						
75% RDN	10292.7	241.0	220.2	200.6	117.8	19.5
100% RDN	12079.2	293.3	258.6	224.4	126.4	19.6
150% RDN	13711.6	307.5	274.3	250.1	134.4	20.2
200% RDN	13035.5	305.2	274.1	248.3	129.8	19.8
SEm±	270.5	5.3	2.3	4.5	1.2	0.2
CD (p=0.05)	936	18.3	8.2	15.5	4.2	NS
C.V %	5.9	5.5	5.6	5.8	5.9	3.3
Foliar nutrition						
2% KNO_3	11730.4	282.5	251.6	224.5	126.4	19.6
2% DAP	12060.0	283.8	258.5	232.6	126.9	19.8
1% 19-19-19	13049.0	294	260.3	235.5	128.1	20.0
SEm±	293.5	4.4	5.0	7.1	1.9	0.2
CD (p=0.05)	NS	NS	NS	NS	NS	NS
C.V %	8.2	5.3	6.7	10.6	5.3	4.2
Interactions	NS	NS	NS	NS	NS	NS

Table 2. Effect of nitrogen levels and foliar nutrition on yield and economics of rice.

Treatments	Grain yield (kg ha $^{-1}$)	Straw yield (kg ha $^{-1}$)	Gross return (Rs.ha^{-1})	Net return (Rs.ha^{-1})	B:C ratio
Nitrogen levels					
75% RDN	4765	7456	57646	38688	2.0
100% RDN	5737	8505	68856	49772	2.6
150% RDN	6363	9399	76204	56868	2.9
200% RDN	5893	9150	70900	51312	2.6
SEm±	124	126	-	-	-
CD (p=0.05)	428	436	-	-	-
C.V %	6.5	6.7	-	-	-
Foliar nutrition					
2% KNO_3	5640	8530	67810	48262	2.4
2% DAP	5697	8538	68422	49382	2.5
1% 19-19-19	5731	8815	68973	49835	2.5
SEm±	93.3	239	-	-	-
CD (p=0.05)	NS	NS	-	-	-
C.V %	5.6	9.5	-	-	-
Interactions	NS	NS	-	-	-

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