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STUDIES ON DIFFERENTIAL RESPONSE OF RICE VARIETIES TO NITROGEN*

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The concept of "plant type" in relation to the yielding potential of the rice plant is of significance. Now it is well established that plants with "built-in" morphological mechanisms remain physiologically active till a late stage in maturity and are adapted to improved agronomic practices which make them efficient grain producers. That the strains belonging to the different plant types respond differentially to nitrogen nutrition has also been reported by various workers like Chandraratna (1954), Ishizuka and Tanaka (1955), Tanaka *et al.* (1958). Baba (1961), Anonymous (1966-1967) and Patnaik (1967). The present paper reports results of studies on the relative performance of two exotic varieties viz. Tainan 3 (Ponlai) and I R 8 under varying levels of nitrogen in comparison with a local improved strain, Ptb 9 when grown in a sandy clay loam of Kerala.

Materials and methods

The experiment was laid out at the Model Agronomic Research Station, Karamana, Trivandrum, during the first crop (*Virippu-Kharif*) season of 1967-1968. The soil was sandy clay loam in texture, with pH 6.1, The treatments consisted of the three varieties of rice and three levels of nitrogen, ie. 60, 80 and 100 kg per hectare. Nitrogen was applied as ammonium sulphate in three split doses of 50 per cent as basal dressing, 25 per cent at maximum tillering stage and the rest at panicle initiation stage. All the plots received a uniform basal application of P_2O_5 (as single superphosphate) at the rate of 60 kg per ha and K_2O (as muriate of potash) at the rate of 60 kg per ha. Seedlings, 28 days old, were planted at the rate of two seedlings per hill. Irrigation, weeding and plant protection measures were done at optimum levels. The experiment was conducted in three replications. Growth characters of the plants were recorded thrice, at intervals of 20 days from planting, and yield attributes were assessed at harvest.

Results and discussion

Table 1 shows that the effects on the height of plants due to varieties and variety X nitrogen interaction were significant at all stages. In the case of I R 8 and Tainan 3 the plants continued to increase in height even after the 61st day while Ptb 9 did not.

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Table I. Height of different strains of paddy receiving different doses of Nitrogen

Paddy strain	Doses of N Kg/ha	Mean height in cm at different intervals (days) after planting			
		20	40	60	At harvest
IR 8	60	40.6	60.8	75.2	80.9
	80	40.9	61.6	76.3	80.6
	100	41.5	64.1	77.0	81.8
Tainan 3	60	46.7	68.1	104.3	108.0
	80	43 I	71.4	101.8	110.3
	100	44.4	69.1	103.4	110.6
Ptb 9	60	53.4	97.4	139.5	139.9
	80	54.7	103.4	149.3	150.3
	100	55.9	102.8	148.0	147.4
C. D. at 5% level					
Varieties and levels of nitrogen		1.7	3.9	5.4	3.9
Combinations of N and V		2.9	6.9	9.3	6.8

Table 2. Mean number of tillers and number of panicles per square metre of different strains of paddy receiving different doses of nitrogen

Paddy strain	Doses of N (Kg/ha)	Days after transplanting			At harvest	
		20	40	60	Percentage of productive tillers	Number of panicles per square metre.
IR 8	60	244	277	328	77.0	253
	80	271	339	355	89.8	319
	100	297	341	385	97.9	378
Tainan 3	60	240	295	312	80.5	260
	80	260	305	335	84.5	283
	100	281	291	354	95.4	337
Ptb 9	60	223	208	246	81.6	199
	80	245	216	244	80.9	198
	100	226	216	248	73.1	182
C. D. at 5% level						
Varieties and levels of nitrogen				25	3.5	18
Combinations of N and V		27		44	5.9	31

gave the highest yield of grain and G/S ratio whereas ptb 9 gave the lowest G/S ratio under same levels of nitrogen.

Varietal differences in productivity (kilograms of grain per hectare per day) and efficiency of nitrogen utilization (kilograms of grain per kilogram of nitrogen applied) are shown in Table 5. Maximum productivity as well as efficiency of nitrogen utilization were shown by IR 8 followed by Tainan 3 and Ptb 9. The response of IR 8 to applied nitrogen with respect of grain yield was linear and those of Tainan 3 and Ptb 9 were quadratic in nature. Tainan 3 did not show any significant response above 80 kg/per ha of nitrogen.

The regression equations fitted for the yield data of different varieties were $Y = 39.2625 x + 3082.5$ for IR 8, $Y = -0.6286 x^2 + 87.35 x - 823.0$ for Tainan 3 and $Y = -0.4747 x^2 + 87.35 + 1320.80$ for Ptb 9, The economic and optimum doses of nitrogen for the varieties were 102.0 and 92.0 kg per ha respectively for Tainan 3 and 98.7 and 87.6 kg per ha respectively for Ptb 9. These values in respect of IR 8 could not be calculated because response curve was linear (with positive slope).

Summary

An experiment was conducted during 1st crop (*Virippu-Kharif.*) season of 1967-68 to study the differential response to varying levels of nitrogen of two exotic plant types of rice viz. IR 8 (dwarf *indica*) and Tainan 3 (Ponlai) in comparison with a local improved tall *indica* variety, Ptb 9. The varietal effect was highly significant in respect of all the characters studied. The effect due to nitrogen was significat for percentage of productive tillers, number of penicles, percentage of filled grains, yield of grain and straw and grain/straw ratio. At all levels of nitrogen, IR 8 gave significantly higher yield of grain and the rate of response was linear throughout the entire range of 60 to 100 Kg N per ha. For Tainan 3 the rate of response was more in the range of 60-80 kg N per ha. Increasing levels of nitrogen had no effect on Ptb 9. Application of high doses of nitrogen, beyond 100 kg per hectare, appeared to be essential to exploit the full production potential of IR 8. Tainan 3 yielded best in the range of 60-80 kg N per ha. The performance of Ptb 9 at 60 kg N per ha was almost equal to that of IR 8.

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Table 4. Mean yields of grain and straw and grain/straw ratio of different strains of paddy receiving different doses of nitrogen.

Paddy Strain	Doses of N (Kg/ha)	Grain yield (Kg/ha)	Straw yield (Kg/ha)	G/S Ratio
IR 8	60	5237	5882	0.89
	80	5967	6487	0.92
	100	6623	6845	0.97
Tainan 3	60	4606	6825	0.68
	80	5393	7207	0.74
	100	5584	7328	0.75
Ptb 9	60	4988	8098	0.62
	80	5160	9637	0.53
	100	5173	9178	0.57
C. D. at 5% level				
Varieties and levels of nitrogen		182	215	0.04
Combinations of N and V		319	372	0.06

Table 5. Productivity and efficiency of nitrogen utilization by different varieties receiving different doses of nitrogen.

Paddy strain	Doses of N (kg/ha)	Productivity (kg grain per hectare per day)
IR 8	60	50.35
	80	57.37
	100	63.69
(Mean)		57.14
Tainan 3	60	43.04
	80	50.39
	100	52.18
(Mean)		48.54
Ptb.9	60	49.88
	80	51.60
	100	55.73
(Mean)		51.07

Efficiency of nitrogen utilization (kg grain / kg N applied)		
	Levels of N kg/ha	
Variety	(60-80)	(80-100)
IR 8	46.5	32.8
Tainan 3	39.3	8.5
Ptb 9	8.6	0.6

Table 2 shows that the varietal effects on the mean number of tillers per square metre were highly significant at all stages. But varieties x nitrogen interaction was not significant at any stage. The effect due to levels of nitrogen was significant at 20 and 60 days after planting. I R8 had the maximum number of tillers at all stages. Increased levels of nitrogen steadily and significantly increased the number of panicles per unit area in case of I R 8 and Tainan 3, but for Ptb 9, higher levels of nitrogen had no significant effect on the number of panicles.

Table 3. Mean length of panicles, number of grains per panicle, percentage of filled grains and weight of 1000 grains of different strains of paddy receiving different doses of nitrogen.

Faddy strain	Doses of N (Kg/ha)	Length of panicles *(cm)*	No. of grains per panicle	Percentage of filled grains	Weight of 1000 grain (gm)
!R 8	60	21.5	88	93.8	34.06
	80	21.7	103	82.5	34.6,4
	100	21.9	105	93.2	34.83
Tainan 3	60	20.3	82	84.5	29.09
	80	19.6	98	89.7	29.16
	100	20.0	103	89.2	28.47
Ptb 9	60	23.1	125	88.1	26.43
	80	22.8	124	86.6	26.43
	100	23.7	136	90.2	26.56
C. D. at 5% level					
Varieties and levels of Nitrogen		2.1	10	20	0.71
Combinations N and V		1.2	18	3 5	1.24

From Table 3 which gives the data on other yield contributing characters such as number of grains per panicle, percentage of filled grains and 1000 grain-weight it may be seen that in all these cases, the varietal effect alone was significant.

Table 4 which gives the mean yields of grain and straw and the G.S ratio shows that the effects due to nitrogen variety and nitrogen x variety interaction were significiant for all the three characters. IR 8

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