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Effect of Different Levels of Nitrogen at Critical Growth Phases on Rice

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ABSTRACT

With the object of studying the response of the rice variety IR-20 to different levels of nitrogen and to find out the best time of application for getting maximum return, an experiment was conducted. The study revealed that application of nitrogen in four splits, half basal and the remaining half in three equal parts at tillering, ear initiation and just before reduction division stage gave the highest yield and 145 kg N/ha was the economic level for getting maximum return.

INTRODUCTION

Fertilizer recommendation for IR-20, a high yielding variety is very high and it ranges from 120 to 160 kg N/ha. Response to nitrogen varies depending on factors like climate, soil fertility, method of cultivation, the amount of nutrients supplied and the variety grown (Ishizuka, 1965). A clear idea of the specific fertilizer requirement for this variety will greatly reduce the possible wastage of applied fertilizers and bring out the yield potentialities of this variety. Hence an investigation was undertaken to study the pattern of response of IR-20 to graded doses of nitrogen and also to assess the optimum economic level of nitrogen.

MATERIALS AND METHODS

The investigation was taken up during *Rabi* season, 1970 in the wet lands of the Agricultural College Farm Madurai. The experiment was laid out in a 5×4 split plot design and replicated four times. Eighty kg in each of super phosphate and muriate of potash was applied uniformly to all the experimental plots as a basal dressing. Nitrogen was applied in the form of urea as per treatment schedule. Half the dose of nitrogen was applied as basal dressing and the rest in two and three splits at various stages of crop growth. The main plot and sub-plot treatments with symbolic notations are as follows:

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Main plot treatments: 5 levels of nitrogen. No—0 kg N per ha (control), N1—50 kg N per ha, N2—100 kg N per ha, N3—150 kg N per ha, N4—200 kg N per ha.

Sub-plot treatments: Time of Nitrogen application. T1—Fulldose as pre-plant basal application (control). T2 — $\frac{1}{2}$ basal + $\frac{1}{2}$ at tillering phase (25 DAP) T3 — $\frac{1}{2}$ basal + $\frac{1}{4}$ at tillering phase + $\frac{1}{4}$ at panicle initiation stage (42 DAP), T4 — $\frac{1}{2}$ basal + 1/6 at tillering phase + 1/6 at panicle initiation stage + 1/6 just before reduction division stage (18 days before flowering).

Twenty seven days old seedlings were planted adopting a spacing of 20 × 10 cm with two seedlings per

TABLE 1. Influence of nitrogen on yield

	Yield (kg/ha)		Productive tillers/hill	Panicle length (cm)	Filled grain per ear	1000 grain weight (g)	Plant height (cm)
	Grain	Straw					
Levels of Nitrogen							
N_0	3942	4405	5.73	21.86	83.89	19.701	86.54
N_1	5016	5250	6.85	23.53	84.04	20.416	95.34
N_2	5613	6020	7.35	23.36	87.22	20.091	00.68
N_3	5839	6447	8.49	23.37	92.63	20.955	101.71
N_4	5882	6593	8.69	24.02	100.76	20.808	103.95
S. E.	100.0	88.3	0.30	0.37	4.67	0.18	1.60
C. D. (5%)	300.0	250.0	0.91	1.13	N. S.	0.551	4.95
Time of application							
T—1	5028	5517	7.23	23.05	87.69	20.449	96.46
T—2	5158	5958	7.57	22.54	82.03	20.438	97.61
T—3	5163	5858	7.30	23.44	90.14	20.522	99.05
T—4	5695	5642	7.60	23.86	98.98	20.649	97.46
S. E.	116.6	116.6	0.17	0.28	4.28	0.17	0.65
C. D. (5%)	316.6	N. S.	N. S.	0.79	N. S.	N. S.	N. S.

hill. The stand of the crop was good through out the period of crop growth.

RESULTS AND DISCUSSION

Observations were recorded on crop growth, yield components and the yield of grain and straw. The data were statistically analysed. It could be seen from table 1 that the plant height increased with increasing doses of nitrogen and maximum height was recorded by 200 kg N which was on par with 150 and 100 kg N/ha. With regard to tiller number, though 200 kg N/ha recorded the maximum number, it was on par with 150 kg of N/ha. Panicle length and the weight of 1000 grains were influenced by nitrogen application, but the treatments 50, 100, 150 and 200 kg N/ha were all on par. This finding was in agreement with the earlier report of Lenka (1969) and Ramanujam and Sakharam Rao (1971). The nitrogen application had no significant effect on grain number, whereas it increased the grain yield significantly. The treatments N4, N3 and N2 were on par but were superior to the treatments N1 and N0. Nitrogen also influenced the straw yield significantly and the treatments N4 and N3 though were on par, were significantly superior to N2, N1 and N0 respectively.

It is evident from table 2 that among various characters like plant height, productive tillers, panicle length, number of filled grains and 1000 grains weight, panicle length alone was significantly influenced by split application. Nitrogen applied in four split (T4) recorded maximum length of panicle and it was on par with three splits (T3) but was superior to single as well as two splits. The results of this study confirm with the earlier findings of change (1968). The maximum grain yield of 5695 kg per ha was recorded by the treatment T4 (4 splits) and was significantly superior to T3, T2 and T1. The results of the study are also in agreement with the findings of Matsushima and Seizo (1966) and Choi and Lee (1968). The split application had no significant effect on straw yield.

No interaction existed between nitrogen and time of application.

Economics: The economics of nitrogen fertilization for IR-20 was worked out and the data are presented below:

Levels of nitrogen kg/ha	Yield kg/ha	Value of produce Rs.	Cost of fertilizer	Added profit Rs.	Added cost Rs.
0	3942	2,562	—	—	—
50	5016	3,260	104	698	104
100	5613	3,648	208	388	104
150	5839	3,795	312	147	104
200	5882	3,823	416	28	104

It could be seen from the table that the yield increased, with the increased levels of nitrogen. The added profit, through gradually decreased with the increased dose of nitrogen, was higher than the added cost up to 150 kg N/ha. At 200 kg N, the added profit was less than the added cost. Therefore the economic level remained around 150 kg N/ha.

To find out the optimum level of nitrogen, the orthogonal polynomial of second degree equation of the type ($Y = 0.06948\ x^2 + 23.302\ x + 3970.4$) was obtained. The optimum level was 145 kg N/ha.

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