https://doi.org/10.29321/MAJ.10.A03399

Madras agric. J. **61** (8) : 289—292, August 1974

Effect of Plant Density and Rate of Nitrogen Application on IR 20 Rice

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ABSTRACT

The field experiments conducted in split plot design with six levels of nitrogen and two spacings revealed that 15 × 10 cm spacing with two seedlings per hill and application of 200 kg N/ha were the best to get most economic return.

INTRODUCTION

Optimum plant population and nitrogen level are prime factors for increased grain yields of upright leaved dwarf *indica* rice varieties Medium sized, slender grained rice IR. 20 variety has got a broad spectrum of resistance to a number of the major pests and diseases. It is probably at present one of the most widely planted high yielding varieties in Tamil Nadu. Optimum plant density and level of nitrogen have to be worked out for most economic return. The present investigation was taken up to study the influence of levels of nitrogen, spacing and also number of seedlings per hill.

MATERIALS AND METHODS

The experiment was carried out at the wetlands of Agricultural College and Research Institute, Coimbatore, of the Tamil Nadu Agricultural University during *kharif* 1970 and repeated during *kharif* 1971 with IR. 20 rice. In a split plot design six levels of nitrogen viz., 0, 50, 100, 150, 200 and 250 kg per ha were alloted to the mainplots and two spacings 20 × 10 cm and 15 × 10 cm each coupled with three seedling numbers 2, 4 and 6 per hill were alloted to the sub-plots and there were four replications.

All the plots were supplied with a uniform basal application of 50 kg each of P_2O_5 and K_2O per ha. In the mainplot treatments, half the dose of nitrogen was applied basally and the other half top dressed 30 days after transplanting. Nurseries were raised with good viable seeds of IR 20 rice. Well grown seedlings were utilized for the experiments. Adequate irrigation and necessary plant protection measures were adopted.

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TABLE 1. Influence of levels of nitrogen on plant characters and on yield components

Levels of nitrogen (kg/ha)	Mean height of plant (cm)	Productive tillers per hill.	Panicle length	Number of Grains per panicle	1000-grain weight	Straw yield (kg/ha)
0	62 08	6.67	19.2	85.0	23 72	8,924
50	71 83	7 29	20.2	97.2	24.44	11,149
100	74.58	8.42	20.5	98 6	24.67	11,719
150	80.58	8.46	21.0	107.8	25.72	16,678
200	82.42	10.25	21.8	110.4	25.26	16,378
250	82.33	9,89	21.6	108.2	25.61	19,432
SE	1.55	0.58	0.18	1.27	0.19	800
CD	4.67	1.74	0 51	3.88	0.58	2,410

RESULTS AND DISCUSSION

Mean height of plants recorded at maturity stage is presented in Table 1. The higher levels tried viz., 250, 200 and 150 kg N/ha were on par and plants are significantly t aller than the other lower levels. The results are in line with most of the workers who also observed increased plant height with applied nitrogen (Patel, 1967 and Ramakrishnan, 1965). Mean number of productive tillers is presented in Table 1. Here again applied nitrogen has increased the number of tillers; however, no influence was exerted either by the two spacings or the number of seedlings on the earbearing tillers. Increased tiller number with increased nitrogen application has also been recorded by Kiuchi and Tshizaka (1961).

Increased nitrogen levels (Table 1) also increased number of fertile grains per panicle This has already been recorded in the works of Palchoudhury (1969) and Kalyanikutti *et al.* (1969). Mean weight of 1000 grains is presented in Table 1. In this study the weight of 1000 grains also increased due to fertilizer application but the increase beyond 150 kg N/ha has no influence. The spacing as well as the number of seedlings per hill had no brearing on the weight of 1000 grains. Increased nitrogen influenced the weight of 1000 grains of rice. (Sreenivasalu and Pawar, 1965).

Nitrogen levels had increased the panicle length; the highest levels of N 200 and N 250 recording the maximum mean length of panicle. Increased panicle length due to nitrogen level has

TABLE 2. Grain yield (kg/ha) of rice IR. 20 as influenced by the rates of nitrogen and spacing

Nitrogen levels kg/ha	Grain yield (kg/ha)			Grain yield (kg/ha)			Pooled analysis		
	10 × 15 cm	10 × 20 cm	Kharif 1970 Mean	10 × 15 cm	10 × 20 cm	Kharif 1971 Mean	10 × 15 cm	10 × 20 cm	Mean
N 0	3449	3314	3381	2957	2307	2632	3204	2810	3007
N 50	4793	4496	4644	4023	3189	3606	4408	3845	4126
N 100	5645	5412	5528	4877	4032	4454	5262	4720	4991
N 150	5563	5339	5451	5434	4610	5022	5498	4976	5257
N 200	6326	5814	6070	5997	5376	5686	6163	5595	5879
N 250	6199	5984	6091	5795	5174	5484	5998	5580	5788
Mean	5329	5060		4847	4115		5089	4583	
SE	170	88		116	47		103	49	
CD (P=0.5)	516	258		344	133		301	139	

already been reported by several workers Palchoudhury, (1969) and Kalyanikutty *et al* (1965). As could be expected the straw yield, which is closely related to the height of plant and tiller count, has been influenced by the applied nitrogen. The straw yield increased with increase in nitrogen level. The data on the mean yield of straw per hectare is presented in Table 1.

Grain yield:

During *kharif* '70 the grain yield increased with each incremental dose of nitrogen (Table 2). The highest two levels of nitrogen N 250 and N 200 recording almost identical yield have recorded significantly higher yield over the other levels. So also the yield at N 100 and N 150 were on par and were significantly higher than N 50 which inturn was superior to N O level.

Kharif '71 yield data exhibit yield increase wito each incremental dose of nitrogen upto 200 kg N/ha beyond which the response has been negative. The same pattern is maintained in the pooled analysis indicating that the law of diminishing return operates at about 200 kg N/ha. Thus the cumulative effect of increased number of productive tiller, greater number of grains per

panicle the length of panicle and increased straw yield as influenced by the applied nitrogen has been reflected in the increased grain yield However at the highest level tried viz., 250 kg N/ha the increase in tiller number and plant height has increased the straw yield at the expense of grain yield. At International Rice Research Institute, IR. 20 responded upto 120 kg N ha (Barker, 1971). Under Coimbatore conditions positive response had been recorded by Srinivasan *et al.* (1968) upto 200 kg N/ha in IR. 8.

Of the two spacings tried closer spacing of 10 × 15 cm has out yielded the wider spacing of 10 × 20 cm in both the years and also in the pooled analysis. IR. 20 being a dwarf *indica* with upright leaves requires adequate plant population for higher yield has been brought out by this study. The number of seedlings per hill failed to evoke any influence on the grain yield. Two seedlings per hill may be sufficient for planting IR. 20. The interaction effect of spacing and nitrogen rate was significant. In the pooled analysis the highest grain yield of 6163 kg/ha has been recorded by the treatmental combination of 200 kg N/ha with 10×15 cm spacing. The effect of nitrogen levels on the grain yield being spectacular, the response curves using orthogonal polynomials were fitted and was found to be quadratic. With the cost benefit ratio the economic dose of nitrogen was also worked out and it was found to be 200 kg N/ha.

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