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Influence of Different Levels and Combinations of N, P and K on the Yield of Grain and Straw in Certain High-yielding Paddy Strains*

by

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Introduction: A number of high fertility strains of paddy have been recently introduced and their fertiliser requirements are very high. But the optimum requirements of fertilisers for these varieties are not yet clearly known. Fertiliser recommendations are made at present somewhat empirically, due to lack of knowledge about the optimum dosages for these varieties. A clear idea of the specific fertiliser requirements for these varieties will greatly reduce the possible wastage of applied fertiliser, on one hand, and also bring about the full expression of the genetic potential of these varieties with reference to response to applied fertilisers. Hence the present study was planned and carried out with a view to furnish information on this aspect which is very urgently needed today, especially in the context of economising fertiliser use. With these objectives in mind a pot culture experiment was laid out on the soil from wetlands of Central Farm, Agricultural College, Coimbatore, with the paddy strains I.R. 8, Taichung (Native) 1, and CO. 32.

Materials and Methods: A pot culture experiment was conducted on the soil from wetlands, Central Farm of Agricultural College, Coimbatore, in the late samba season (September to December). There were 16 N, P and K combinations, with 4 levels of N, namely 40, 80, 120 and 160 kg/ha, two levels of P namely 40 and 80 kg P_2O_5/ha and two levels of potash at the rates of 40 and 80 kg K_2O/ha. In all, there were 48 pots, each filled with 7 kg of soil. The seedlings of the three high yielding paddy strains I.R. 8, Taichung (Native) 1 and CO. 32 were planted in the pots at the age of 30 days. During the crop growth, at regular intervals, soil samples were collected from the pots and were analysed for available N, P_2O_5 and K_2O. After the maturity of the crop, yields of grain and straw were recorded separately for each treatment. The grain and straw were analysed for the content of N, P_2O_5 and K_2O.

Results: The yield of grain in CO. 32 was significantly superior to those of the other two varieties. It was followed by Taichung (Native) 1 and I.R. 8 which were on par. There was a significant interaction between varieties and levels of N with regard to the yield of grain. As far as I.R. 8 and

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Taichung (Native) 1 were concerned, the yields of grain at the four different doses of N were not significantly different. But in the case of CO. 32, the largest yield was obtained with the lowest N dose *i. e.* 40 kg N/ha.

TABLE 1. *Yield data (Grams per pot)*

Treatment	I.R. 8 (V_1)		Taichung (Native) 1 (V_2)		CO.32 (V_3)	
	Grain	Straw	Grain	Straw	Grain	Straw
$N_1 P_1 K_1$	9.66	12.39	12.45	14.07	11.18	16.26
$N_1 P_1 K_2$	5.00	5.48	13.26	12.13	46.11	49.10
$N_1 P_2 K_1$	9.52	8.38	12.62	14.04	32.23	30.95
$N_1 P_2 K_2$	8.56	10.75	13 88	14.86	26.28	31.35
$N_2 P_1 K_1$	9.67	13.24	13.44	13.99	16.33	22.85
$N_2 P_1 K_2$	10.15	12.58	8.84	12.91	17.09	21.05
$N_2 P_2 K_1$	16.91	12.04	12.74	16.10	14.02	18.12
$N_2 P_2 K_2$	10.47	12.35	13.04	14.67	15.39	18.95
$N_3 P_1 K_1$	13.17	15.59	15.87	16.11	12.81	26.15
$N_3 P_1 K_2$	8.77	10.51	13.72	13.69	13.26	19.60
$N_3 P_2 K_1$	10.61	15.08	15.00	17.13	15 30	90.00
$N_3 P_2 K_2$	10.75	16.47	14.73	15.39	25.76	28.00
$N_4 P_1 K_1$	10.70	12.86	16.38	17.79	13.20	16.66
$N_4 P_1 K_2$	11.30	3.30	15.07	17.74	9.75	16.76
$N_4 P_2 K_1$	14.21	17.41	14.48	18.73	12.51	24.05
$N_4 P_2 K_2$	17.35	14.38	15.48	18.95	14 96	27.70

Grain yield Means Table (gms/pot)

Nitrogen	Varieties			Means of nitrogen
	V_1	V_2	V_3	
N_1	8.18	13.05	28.95	16.73
N_2	11.80	12.01	15.91	13.17
N_3	10.82	14.83	16.78	14.15
N_4	13.39	15.35	12 60	13.78
Means of varieties	11.05	13.81	18 51	

		Varieties	Varieties × Nitrogen
	S.E.	1.31	2.63
C.D.	P=0.05	3.84	7.69

Conclusion : (Varieties) V_3 $\overline{V_2\ V_1}$

Conclusion : (Varieties × Nitrogen)

(i) Varieties — Nitrogen

V_1	N_4	N_2	N_3	N_1
V_2	N_4	N_3	N_1	N_2
V_3	N_1	N_3	N_2	N_4

(ii) Nitrogen — Varieties

N_1	V_3	V_2	V_1
N_2	V_3	V_2	V_1
N_3	V_3	V_2	V_1
N_4	V_3	V_1	V_2

Straw yield Means Table (grams/pot)

Nitrogen	Varieties			Means of nitrogen
	V_1	V_2	V_3	
N_1	9.24	13.77	31.91	18.21
N_2	12.55	14.42	20.24	15.73
N_3	14.41	15.58	23.44	17.81
N_4	11.99	18.30	21.29	17.19
Means of varieties	12.04	15.52	24.22	

	S.E.	C.D. (P = 0.05)
Varieties	1.23	3.59
Varieties × Nitrogen	2.46	7.19

Conclusion : (Varieties) V_3 V_2 V_1

Conclusion : (Varieties × Nitrogen)

(i) Varieties — Nitrogen

V_1	N_3	N_2	N_4	N_1
V_2	N_4	N_3	N_2	N_1
V_3	N_1	N_3	N_4	N_2

(ii) Nitrogen — Varieties

N_1	V_3	V_2	V_1
N_2	V_3	V_2	V_1
N_3	V_3	V_2	V_1
N_4	V_3	V_2	V_1

In the matter of straw yield again, CO. 32 variety was considerably superior to the other two varieties. Next in the order of yield of straw came Taichung (Native) 1 and I.R. 8, which were on par. There was a significant interaction between varieties and doses of N. Regarding I.R. 8 and Taichung (Native) 1, the various levels of N application did not bring about any significant difference in straw yield. But in CO. 32, 40 kg N/ha was markedly superior to the other three higher doses of application.

Discussion : In the present investigation, it was found that CO. 32 variety surprisingly excelled the other two established high yielding varieties in the matter of the grain yield. It may be pointed out that at International Rice Research Institute, Los Banos (1963) Philippines, it was found that I.R. 8 and Taichung (Native) 1 were high fertility strains responding well to higher doses of N. This appearent anomaly might be due to dominance of seasonal and environmental influences over genetic influences in the matter of yield. This might also be due to the effect of the particular type of soil studied in this investigation.

The interaction of varieties and N was found to be statistically significant. Application of 160 kg N per hectare gave numerically higher yield in I.R. 8 and Taichung (Native) 1 but all the varieties were on par statistically. As regards CO. 32 paddy variety yield of grain at 40 kg N level was significantly superior to the other higher levels, the later being on a par. Bhat (1964) working on South Indian soils, found out that all fractions of N significantly contributed to yield. In the present investigation it was observed that yield was not influenced by potash and phosphorus levels. This was in agreement with the report made by Engelstad and Terman (1966) who noticed that rice crop response to N was generally greater than P and K_2O. Similar views were expressed by Mahapatra and Sahu (1961) who stated that response to application of P to rice was lower than for N. Rajaram (1964) reported that N fraction increased yield of grain more than P.

Regarding yield of straw, CO. 32 produced the highest yield compared to the other two varieties. Straw yield in CO. 32 variety was higher at 40 kg N level than for the higher dosages. The superiority of the lower dose of N noticed in the present study might be due to the interaction of the particular type of soil taken up for the study and the varieties tried.

Summary and Conclusion : An attempt was made to study the influence of different levels and combinations of N, P and K on the yield of grain and straw in certain high yielding paddy strains. A pot culture experiment was conducted with three paddy strains namely I.R. 8, Taichung (Native) 1 and CO. 32. There were 4 levels of N, 40, 80, 120 and 160 kg per hectare, two levels of P, 40 and 80 kg P_2O_5 per hectare, two levels of K, 40 and 80 kg K_2O per hectare. Initial analysis of the soil collected from Wetlands, Central Farm, Agricultural College, Coimbatore, was done. At periodical intervals during crop growth soil samples were taken from the pots and were analysed for available N, P and K. Yields of grain and straw were recorded for each treatment and variety. CO. 32 variety registered the highest grain yield among the three varieties studied. The grain yield in CO. 32 was highest at 40 kg N application per hectare. Yields were on par at 40 kg P_2O_5 and

80 kg P_2O_5 per hectare for all the varieties. Similar results were obtained for K application also.

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Influence of N Levels on N Fractions and Nitrate Reductase Activity in Rice

by

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Introduction: In rice cultivation, the general trend appears to be the application of more fertilizers, particularly nitrogenous, with the object of obtaining higher yields. Dastur and Malkani (1933) recorded that in certain rice varieties ammoniacal N decreased and nitrate N increased with the aging of crop and the *indica* varieties absorb more N than the *japonica* types. Ishizuka and Tanaka (1950) using N levels ranging from 0 to 200 ppm, observed increasing concentration of total N up to 60 ppm in the grains beyond which there was no change in the content of total N. In *indica* varieties, due to accumulation of more soluble N, the N metabolism itself gets disturbed at higher levels of N. A remarkable increase in total N content was noticed in rice by increasing N supply (Tanaka *et al.* 1964 and Murayama, 1965).

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