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Yield and Quality of I R 8 Rice (*Oryza sativa* L.) as Influenced by Fertilization

BY

R. KRISHNASAMY[1], G. V. KOTHANDARAMAN[2] G. JEYARAJ[3] and K. K. KRISHNAMOORTHY[4]

ABSTRACT

A field experiment was conducted with four levels of N and three levels of P_2O_5 and K_2O alone and in combination to study their effect on the yield and quality of IR 8 rice. The results revealed that the maximum yield of grain was obtained at the level of 180 kg N/ha and beyond this level there was no response for nitrogen. Increased application of N increased the crude protein and true protein content of the rice grain. Phosphorus, potassium and magnesium content of the grain were increased by the application of phosphorus. Carbohydrate content of the grain was not influenced by the application of fertilizers.

INTRODUCTION

The present trend of increasing rice production involves the use of high analysis fertilizer and high yielding varieties. High yielding varieties are introduced with the main objectives of obtaining better response to fertilizer and increasing yield. But from the health point of view and nutrition aspects, the quality of crop produce by the way of nutrient content needs to be considered. The rice variety IR 8 responds to higher levels of fertilization (Ross and Rajagopalan, 1968; Kalyanikutti *et al.*, 1969 and Ranganathan *et al.*, 1970). There is sufficient evidence that N application increases the protein content of rice grain (Chavan and Magar, 1971 and Honyo, 1971). The present investigation was undertaken to study the effect of different levels of N, P_2O_5 and K_2O on the yield and quality of rice grain.

MATERIALS AND METHODS

A field experiment was conducted with four levels of N at O, 180, 360 and 540 kg/ha three levels of P_2O_5 at O, 90 and 180 kg/ha and K_2O at O, 90 and 180 kg/ha alone and in combination to study their effect on the yield and quality of paddy IR 8 variety at the wet lands of Tamil Nadu Agricultural University farm, Coimbatore. Nitrogen was applied in the form of urea. Phosphorus and potassium were applied as super-phosphate and muriate of potash respectively. Half of N and full dose

1 & 3 Instructors, 2. Assistant Professor and 4. Professor and Head, Department of Soil Science and Agricultural Chemistry, Tamil Nadu Agricultural University, Coimbatore-641003.

of P_2O_5 and K_2O were applied at planting. The other half of N was applied at 65th day as top dressing. The crop was harvested and the yield of grain and straw were recorded. Rice grain was analysed for its nutritive value. Crude protein was arrived at by multiplying the total N content by a factor 6.25 and true protein was estimated by using Stutzer's reagent method. The total carbohydrate was estimated by the colorimetric method of Somogyi (1952).

RESULTS AND DISCUSSION

Yield of grain, crude protein, total carbohydrate content and the nutrient elements, P, K and Mg are given in Table 1 and 2 respectively.

a) Yield :

The statistical analysis of grain yield indicated that the maximum grain yield due to N application was obtained at 180 kg N/ha. The rice variety IR 8 has not given any significant response to the N application beyond the level of 189 kg N/ha. A manurial schelude of 180kg N/ha will be optimum for IR8 on the response to N application. Similar result was also obtained by Ahemed and Abdul Faiz (1969) and Rangiah (1973).

TABLE 1. Yield of grain, content of crude protein, true protein and total carbohydrate in IR 8 rice grain (On oven dry basis)

Treatments	N_0				N_1			
	Yield(kg/plot)	Crude protein (per cent)	True protein (per cent)	Total carbohydrate (per cent)	Yield(kg/plot)	Crude protein (per cent)	True protein (per cent)	Total carbohydrate (per cent)
$P_0 K_1$	4.17	6.65	3.13	68 75	5.15	7 35	7.00	71.88
$P_0 K_2$	4.34	7.52	3.56	75 00	7.26	9.10	6.20	67.19
$P_0 K_3$	4.37	6.82	3.90	65.62	6.36	7.00	4.75	71.80
$P_1 K_1$	4.06	7.35	3 30	76.56	6.08	8 62	7.00	65.62
$P_1 K_2$	5.02	6.83	5.70	64 00	6.81	8.05	6.50	71.90
$P_2 K_2$	3.86	7.52	6 50	65.62	5.74	8 23	5.40	57.81
$P_2 K_1$	4.21	7.00	4.12	73.44	6.65	7.87	6 90	67.19
$P_2 K_2$	4.77	7.55	3.10	71.88	6.35	7.51	7.37	71.88
$P_2 K_3$	4.42	7.52	3.20	70.31	7.16	9.53	7.00	65.62

Table 1 [Continued]

Treatment	N_3				N_4			
	Yield(kg/plot)	Crude protein (per cent)	True protein (per cent)	Total carbohydrate (per cent)	Yield [kg/plot]	Crude protein [per cent]	True protein [per cent]	Total carbohydrate [per cent]
$P_0 K_1$	5.96	9.45	7.10	76.56	4.59	11.37	9.40	70.75
$P_0 K_2$	4.75	10.15	8.75	78.12	5.80	10 85	8.20	73.44
$P_0 K_3$	5.80	6.30	6.00	71.50	4.32	11.72	9 50	68.60
$P_1 K_1$	5.58	8.75	3.56	65.62	5.28	12.42	10.06	71.88
$P_1 K_2$	5.48	7.53	6.62	67.19	5.85	10.15	8.00	65.62
$P_2 K_2$	5 40	8.05	6.70	69.20	5.40	9.45	7.75	71.88
$P_2 K_1$	5.83	9.45	7.25	73.44	5.43	10.68	7.10	73 44
$P_2 K_2$	5.64	9.45	7.00	68.75	4 33	12.25	8.75	71.00
$P_2 K_3$	5.07	9.63	4.19	75.00	5.96	8.75	7.01	73 44

N_0 — 0 kg/ha, N_1 — 180 kg/ha, N_2 — 360 kg/ha, N_3 — 540 kg/ha.

P_0 — 0 kg/ha, P_1 — 90 kg/ha, P_2 — 180 kg/ha.

K_0 — 0 kg/ha, K_1 — 90 kg/ha, K_2 — 180 kg/ha.

a) **Yield** (kg/plot)

N_0	N_1	N_2	N_3
4.36	6.38	5.57	5.17

N_1 N_2 N_3 N_0

b) **Crude protein** (percentage)

N_0	N_1	N_2	N_3
7.19	8.14	8.75	10.85

N_3 N_2 N_1 N_0

c) **True protein** (percentage)

N_0	N_1	N_2	N_3
4.06	6.52	6.46	8.42

N_2 N_1 N_2 N_0

b) Protein content :

The results of analysis revealed that the maximum content of crude protein (10.85per cent) and true protein (8.42 percent) of the rice grain was obtained by the application of N at 540 kg/ha. The results revealed the significant in-

fluence of N application on the protein content in rice grain. Among the N levels N_3 (540 kg/ha) was significantly superior to other levels N_2 and N_1. It is evident that increase in N dose increases the crude and true protein content of rice grain. This is confirmed with the results obtained by Chavan and Magar (1971), Honyo (1971) and Gupta and Das (1962). There was a significant positive correlation between the amount of crude protein and true protein in rice ($r = 0.711^{**}$).

c) Total carbohydrate :

There is no variation in the total carbohydrate content in the rice grain and the total carbohydrate content was not influenced by any of the treatments. Muthusamy *et al.* (1973) also reported that increased N application did not show any marked effect on the carbohydrate content of high yielding rice varieties.

Content of nutrient elements .

The results showed that maximum content of phosphorus

TABLE 2. Content of potassium, magnesium and calcium in IR 8 rice grain (on oven dry basis)

Treatment	N_0				N_1			
	Phosphorus [per cent]	Potassium [per cent]	Magnesium [per cent]	Calcium [per cent]	Phosphorus [percent]	Potassium [per cent]	Magnesium [per cent]	Calcium [per cent]
$P_0 K_0$	0.20	0.50	0.29	0.44	0.24	0.65	0.24	0.44
$P_0 K_1$	0.24	0.60	0.29	0.24	0.25	0.55	0.24	0.28
$P_0 K_2$	0.18	0.50	0.17	0.24	0.19	0.55	0.24	0.24
$P_1 K_0$	0.23	0.55	0.31	0.44	0.21	0.55	0.29	0.36
$P_1 K_1$	0.26	0.55	0.26	0.40	0.23	0.45	0.22	0.28
$P_1 K_2$	0.26	0.55	0.26	0.40	0.25	0.60	0.34	0.40
$P_2 K_0$	0.28	0.65	0.26	0.40	0.28	0.65	0.24	0.32
$P_2 K_1$	0.27	0.60	0.29	0.36	0.31	0.55	0.34	0.44
$P_2 K_2$	0.32	0.55	0.31	0.44	0.27	0.55	0.24	0.32

Table 2 [Continued]

Treatments	N_2				N_3			
	Phosphorus [per cent]	Potassium [per cent]	Magnesium [per cent]	Calcium [per cent]	Phosphorus [per cent]	Potassium [per cent]	Magnesium [per cent]	Calcium [per cent]
$P_0 K_0$	0.21	0.50	0.24	0.40	0.24	0.55	0.17	0.20
$P_0 K_1$	0.23	0.55	0.22	0.32	0.25	0.55	0.17	0.36
$P_0 K_2$	0.20	0.55	0.36	0.48	0.24	0.55	0.24	0.36
$P_1 K_0$	0.26	0.65	0.22	0.40	0.25	0.56	0.22	0.32
$P_1 K_1$	0.26	0.55	0.24	0.40	0.24	0.40	0.24	0.36
$P_1 K_2$	0.27	0.60	0.29	0.36	0.23	0.55	0.36	0.40
$P_2 K_0$	0.25	0.60	0.26	0.40	0.33	0.65	0.22	0.28
$P_2 K_1$	0.31	0.55	0.26	0.28	0.30	0.60	0.38	0.44
$P_2 K_2$	0.29	0.55	0.31	0.44	0.26	0.45	0.29	0.44

d) **Phosphorus** (percentage)

P_0	P_1	P_2
0.22	0.25	0.29
P_2	P_1	P_0

e) **Potassium** (percentage) N. S.

P X K on Potassium content

	P_0	P_1	P_2
K_0	0.55	0.56	0.64
K_1	0.56	0.49	0.57
K_2	0.54	0.57	0.52

f) **Magnesium** (percentage)

P_0	P_1	P_2
0.24	0.27	0.28
P_2	P_1	P_0

(0.29 per cent) and magnesium (0.28 per cent) in grain was obtained by the application of P at 180 kg/ha. Significant increase in the phosphorus and magnesium content by the increased application of phosphorus. Similar results were obtained by Basker *et al.* (1971) in the rice grain. Potassium

content in rice grain was not influenced by the application of potassium. Though potassium application did not seem to influence the potassium content in grain, phosphorus in combination with potassium increased the potassium content in rice grain. Calcium content of the grain was not influenced by the application of fertilizers.

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