

Effect of Fertilizer Doses and Varietal Variations on Soil Constituents, Nutrient Uptake and Yield of Rice Varieties

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Effects of incremental doses of fertilizer were seen in available nitrogen content than in the other constituents. Growth characters were found to increase with increase in nitrogen doses except in number of grains per ear as well as in 1000 grain weight. The dose 200 kg nitrogen/ha has contributed much to increase in grain yield. There appeared to be a gradual increase in uptake of nitrogen, phosphorus and potassium with increase in nitrogen levels.

The influence of varietal variation was not seen in soil constituents, but only in growth characters. Jaya and IR. 8 recorded a greater height than Padma. Jaya showed higher number of effective tillers than IR. 8. In ear length and number of grains per ear, IR. 8 surpassed the variety Jaya, but in 1000 grain weight both of them were on par.

No varietal variation was seen in uptake of nitrogen. Varieties IR. 8 and Jaya behaved more or less in a similar manner in the matter of uptake of phosphorus and potassium.

A knowledge of the response of different soils of Tamil Nadu to fertilizers will not only help in selecting fertilizers which produce the best response, but will also help in the optimum use of fertilizers. In South India very little work has been done on nutrient uptake by paddy varieties. The effect of fertilizer incremental doses and behaviour of each variety in respect of paddy growing soils on soil available nutrients and plant aspects are discussed in the present paper.

MATERIALS AND METHODS

A pot culture experiment was laid out on four representative paddy soils

from Aduthurai, Ambasamudram, Coimbatore and Tirurkuppam, with paddy varieties IR 8, Jaya and Padma. In all, 60 pots were used for the experiment (4 soils x 5 levels of nitrogen and 3 varieties). Five levels of nitrogen (0, 50, 100, 150 and 200 kg/ha) as ammonium sulphate were applied in triple split applications. Phosphorus and potassium at the rate of 50 kg P₂O₅ and K₂O/ha as super phosphate and muriate of potash were applied as basal dressing in a single dose to all the pots. A common dosage of 6,500 kg/ha of green manure was super imposed on these treatments. Soil samples drawn at transplanting, tillering, flowering and post-harvest

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stages were analysed for available nutrients. The growth characters, yield data and uptake of nutrients were recorded and statistically analysed.

RESULTS AND DISCUSSION

Soil constituents

The increased levels of nitrogen application increased the available nutrient content in the soil irrespective of soil variability (135, 139, 140, 147 and 148 ppm respectively). In the case of other available nutrients of the soil this effect was not seen. No varietal variation effect was seen in soil constituents.

Plant aspects

Growth characters : The increased nitrogen application increase the plant height up to 150 kg nitrogen/ha; (56, 60, 62, 64 and 61 cm respectively). Effective tiller numbers increased with the enhanced doses of nitrogen as observed by Oshima (1962). The incremental fertilizer doses did not have any influence on number of grain per ear as well as 1000 grain weight. Chaudhuri (1968) also stated that the weight of 1000 grain showed no definite relation with nitrogen supply. Chaffiness was generally influenced by higher nitrogen doses. As stated by Baba (1964) this

TABLE I. Yield data (gram per pot)

Particulars	Grain					Straw				
	N ₀	N ₁	N ₂	N ₃	N ₄	N ₀	N ₁	N ₂	N ₃	N ₄
ADUTHURAI										
IR. 8	10.36	12.48	11.71	24.78	42.68	35.24	37.05	44.02	46.52	52.05
Jaya	11.73	15.25	23.26	25.72	28.19	38.52	37.54	38.56	43.55	48.54
Padma	15.03	8.95	21.50	26.10	26.65	32.62	35.06	41.05	41.06	40.08
AMBASAMUDRAM										
IR. 8	21.79	22.12	25.37	28.66	33.11	38.04	42.08	44.05	54.06	51.08
Jaya	21.77	21.97	25.69	30.70	39.22	39.05	40.08	45.55	49.56	55.58
Padma	19.35	14.06	20.93	22.34	26.72	35.28	40.08	41.08	34.10	47.20
COIMBATORE										
IR. 8	19.73	22.10	36.20	34.35	34.25	45.52	49.55	52.08	54.10	60.00
Jaya	19.09	24.09	29.11	31.91	43.92	47.10	51.22	55.24	57.08	59.12
Padma	15.50	14.07	20.00	26.32	28.59	42.12	44.24	48.18	48.50	45.89
TIRURKUPPAM										
IR. 8	17.70	15.71	20.80	15.66	43.69	36.12	35.54	43.68	55.50	60.00
Jaya	13.95	19.95	22.15	24.49	36.96	35.12	40.52	40.81	47.58	47.84
Padma	24.05	13.08	18.10	24.52	25.20	37.22	47.42	54.64	45.50	42.58

Nitrogen levels kg/ha : N₀=0; N₁=50; N₂=100; N₃=150; N₄=200

might be due to the accumulation of more soluble and non-production nitrogen at higher nitrogen levels which would affect the production of grains. The varieties Jaya and IR. 8 recorded greater height than Padma (62, 62, and 59 cm respectively). All the three varieties behaved alike in the matter of response to incremental doses of nitrogen. Jaya showed a large number of effective tillers than IR. 8, whereas IR. 8 surpassed Jaya in ear length and number of grains per ear. But in the case of 1000 grain weight both of them were on par.

Yield: The maximum grain yield was obtained for 200 kg nitrogen/ha followed by other levels (Table I). The

trend was found to be linear with increasing nitrogen levels. No response was found at lower doses of nitrogen in the present study. This was in conformity with the findings of Ray and Sarma (1969) who stated that high yielding varieties have high potential to produce only at a high fertility level. All India Co-ordinated Rice Improvement Project (Anon., 1969) also reported that the varieties of IR. 8, Jaya and Padma showed a good response up to 200 kg nitrogen/ha and the trend was linear with the nitrogen levels.

In the present study Jaya recorded maximum grain yield followed by IR. 8 and Padma. Shastri (1969) stated that the magnitude of nitrogen response for

TABLE II Uptake of Nitrogen by Paddy (mg/pot)

Particulars	Uptake in grain					Uptake in straw				
	N ₀	N ₁	N ₂	N ₃	N ₄	N ₀	N ₁	N ₂	N ₃	N ₄
ADUTHURAI										
IR. 8	184	158	346	563	517	253	518	798	527	909
Jaya	149	434	323	375	445	652	706	673	737	776
Padma	237	110	220	560	265	201	901	441	745	249
AMBASAMUDRAM										
IR. 8	621	210	576	692	546	639	621	913	454	927
Jaya	221	444	387	260	820	809	454	383	838	871
Padma	538	411	438	495	559	332	626	156	470	782
COIMBATORE										
IR. 8	361	462	687	629	627	428	372	677	703	773
Jaya	242	381	645	645	779	647	430	965	646	352
Padma	354	321	418	384	507	547	332	626	119	286
TIRURKUPPAM										
IR. 8	260	355	369	348	369	295	199	851	111	693
Jaya	142	253	491	620	702	131	177	472	538	607
Padma	484	338	493	637	655	442	563	694	372	1016

Nitrogen level kg/ha : N₀=0; N₁=50; N₂=100; N₃=150; N₄=200

Jaya was better than IR. 8. In straw yield also a similar trend was observed.

Uptake of nutrients: A gradual rise with increase in nitrogen levels was seen in grain, straw as well as total uptake of nitrogen (Table II). Sircar and Mukherji (1959) observed a distinct relationship between supply and uptake of nitrogen. There appeared to be a gradual increase in uptake of phosphorus with increase in nitrogen levels (Table III). Mehrotra *et al.* (1961) also observed that increased nitrogen application increased the phosphorus uptake. The nitrogenous fertilizer probably promoted the transformation of phosphorus compounds into soluble forms and presumably increase the root surface area. This

TABLE III. Uptake of phosphorus by Paddy (mg/pot)

Particulars	Uptake in grain					Uptake in straw				
	N ₀	N ₁	N ₂	N ₃	N ₄	N ₀	N ₁	N ₂	N ₃	N ₄
ADUTHURAI										
IR. 8	22	29	37	30	62	11	7	9	14	21
Jaya	20	10	51	57	65	12	11	12	13	10
Padma	36	21	58	68	56	13	32	25	16	20
AMBASAMUDRAM										
IR. 8	61	51	63	69	83	11	21	13	16	15
Jaya	50	50	62	71	98	12	12	14	15	28
Padma	52	40	50	62	86	21	43	37	27	43
COIMBATORE										
IR. 8	63	51	87	79	89	27	25	16	16	17
Jaya	49	55	75	77	108	14	15	17	17	17
Padma	40	35	56	71	63	38	40	24	39	14
TIRURKUPPAM										
IR. 8	38	38	60	45	108	11	11	22	44	18
Jaya	33	56	64	64	77	11	16	12	14	24
Padma	72	46	62	66	81	11	47	60	50	38

Nitrogen level kg/ha : Vide Table IV

TABLE IV. Uptake of Potassium by Paddy (mg/pot)

Particulars	Uptake in grain					Uptake in straw				
	N ₀	N ₁	N ₂	N ₃	N ₄	N ₀	N ₁	N ₂	N ₃	N ₄
ADUTHURAI										
IR. 8	20	94	112	154	203	694	737	541	1200	1403
Jaya	74	76	174	131	175	428	740	663	1359	835
Padma	93	45	134	162	133	628	603	809	805	541
AMBASAMUDRAM										
IR. 8	111	137	126	171	169	651	774	868	1130	695
Jaya	71	114	128	153	196	765	790	784	852	1228
Padma	97	78	77	73	134	998	549	785	672	642
COIMBATORE										
IR. 8	222	166	181	213	212	624	857	958	936	1155
Jaya	95	121	150	159	272	692	702	1016	988	875
Padma	57	52	74	132	143	733	1030	488	659	446
TIRURKUPPAM										
IR. 8	72	78	104	183	227	495	654	647	1088	832
Jaya	70	124	111	998	229	478	446	1159	871	821
Padma	149	82	112	93	161	551	526	945	673	835

Nitrogen levels kg/ha : N₀=0; N₁=50; N₂=100; N₃=150 N₄=200.

effect can account for the higher phosphorus uptake.

The uptake of potassium increased with the higher levels of nitrogen. In the case of straw uptake and total uptake of 150 kg nitrogen/ha level registered maximum uptake of potassium (Table IV). Loganathan (1969) obtained a very close positive correlation between total uptake of nitrogen and total uptake of potassium.

The influence of varietal variation was not seen in the uptake of nitrogen (Table II). Variety Padma showed greater uptake of phosphorus than other varieties, in straw as well as total uptake of phosphorus (Table III). The production of large number of effective tillers by Padma might be the reason for the maximum percentage as well as uptake of phosphorus in that variety. Enyi (1969) stated that effective tillers increase with the increased phosphorus supply. The behaviour of IR. 8 and Jaya was more or less same as regards uptake of potassium (Table IV). Variety Padma consistently expressed its significantly inferior ability to take up potassium in grain, straw and both taken together.

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