

Manurial Experiment on Rice with Low Fertility Soil of East Thanjavur Region

By

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ABSTRACT

A field experiment was conducted at the State Seed Farm, Thirukadavur in East Thanjavur Region to find out the effect of method of application of nitrogen with and without green manure on rice ADT 27. In a high open textured low fertility soil with poor internal drainage, application of green manure individually or in combination with nitrogen was not found to be beneficial. Inorganic fertilizers at the recommended levels of 70, 52 and 35 kg of N, P_2O_5 and K_2O /ha without green manuring registered significantly high yields. Placement of fertilizer N and its split application was not advantageous. Urea and ammonium sulphate were found to be equally effective.

INTRODUCTION

Sandy loams and sandy soils along the East Coast of Thanjavur district are low in fertility. In earlier experiments conducted in the State Seed Farm, Thirukadavur, the yield obtained was low and there was no response to N application. Possibly there was loss of N due to leaching and denitrification as the soil is light textured on top and the drainage below is very poor. This experiment was therefore designed to find out whether the utilisation of N could be improved by placement or split application of N with and without green manure.

MATERIALS AND METHODS

A field experiment was laid out in the year 1970 in the State Seed Farm, Thirukadavur, with the rice variety ADT 27. The soil physico-chemical properties and fertility status of the experimental field are furnished in

Table 1 and 2. A split plot design was adopted for the study. The treatments were follows:

Main Plot Treatments:

M₁ — Control

M₂ — Green leaf alone at 5600 kg/ha

M₃ — Ammonium sulphate to supply 70 kg N/ha

M₄ — Urea to supply 70 kg N/ha

M₅ — Green leaf 5600 kg/ha + Ammonium sulphate at 70 kg N/ha

M₆ — Green leaf 5600 kg/ha + Urea at 70 kg N/ha

Sub plot treatments:

Treat- ment		Fertilizer N application Kg / ha	
		Basal application	Top dressing (Days after transplanting)
			15 40
S ₁	35 (broadcast)	35	—
S ₂	35 (placement)	35	—
S ₃	25 (broadcast)	25	20
S ₄	25 (placement)	25	20

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All the treatments received phosphorus at 52 Kg P_2O_5 /ha and potassium at 35 Kg K_2O /ha as basal application. Daincha was applied as green leaf manure a week before transplanting. Rice seedlings of 24 days age were transplanted with a spacing of 25 x 10 cm. The fertilizer placement was done just below the soil surface during planting. The grain and straw yields were recorded at harvest.

RESULTS AND DISCUSSION

The profile study of soil, given in Table 1, shows that the soil is sandy loam at the surface with the percentage of clay increasing with depth. There is no internal drainage as shown by the poor permeability of the sub-surface soil. This has resulted in alkalinity developing in the sub-soil as shown by the soil reaction and exchangeable

sodium status. The chemical analysis of the surface and sub-surface soil furnished in Table 2 shows the presence of adequate quantities of total N, P and K. The available N status is equal in surface and subsurface soil while the available P is slightly higher in the surface soil and available K higher in the sub-surface soil.

The data on grain yield are presented in Table 3. The treatments which received N alone or N with green manure have registered significantly higher grain yields than control or green manure alone, the increase in yield being about 70 per cent. The treatments which received the N fertilizer alone registered higher yields than the treatments receiving N fertilizer and green manure, although this difference did not attain the level of statistical significance.

TABLE 1. Analysis on soil physics — Chemical properties

Particulars	Depth in cm			
	0—24	24—41	41—70	70—100
Clay %	19.0	26.2	34.4	40.7
Silt %	5.4	4.4	10.3	12.6
Coarse sand %	28.9	37.1	39.2	29.7
Fine sand %	39.2	35.0	19.5	18.2
Texture	SL	SCL	SC	C
Apparent specific gravity	1.34	1.35	1.46	1.09
Pore space	47.2	52.9	45.3	43.0
Volume expansion	19.7	27.3	23.8	75.0
Maximum water holding capacity	38.2	43.5	40.3	44.7
Permeability cc / hour	62	26	1	1
pH	7.7	9.1	9.1	9.0
E. C. milli mols / cm	0.28	0.31	0.22	0.23
Total CEC me/l 100g soil	11.1	14.5	23.2	32.3
Exchangeable Ca me / 100 g soil	3.2	12.0	13.0	11.0
Exchangeable Na me / 100 g soil	1.2	8.2	7.8	9.7

SL — Sandy loam ; SCL sandy clay loam ; SC — sandy clay ; C — clay

TABLE 2. Fertility status of the experimental field

Analysis of soil sample	0.15 cm.	15.30 cm.
Total N %	0.113	0.065
Total P ₂ O ₅ %	0.099	0.076
Total K ₂ O %	0.89	0.87
Organic Carbon %	0.55	0.47
Available N ppm	196	196
Available P ppm	2.6	1.6
Available K ppm	90	125
pH	7.3	7.6
E. C. (milli mhos/cm)	0.2	0.2

TABLE 3. Effect of source and method of N application on grain yield

Main Plots	Mean yield of grain (Kg/ha)
M ₁ — Control	1745
M ₂ — Green manure alone (at 5,600 kg / ha)	1722
M ₃ — Ammonium sulphate (at 70 kg N / ha)	3211
M ₄ — Urea (at 70 kg. N / ha)	3227
M ₅ — Green manure + Ammonium sulphate	3070
M ₆ — Green manure + Urea	2994
Sub - plots	
S ₁ — Basal broadcast, top dressing once	2649
S ₂ — Basal placement, top dressing once	2696
S ₃ — Basal broadcast, top dressing in two splits	2654
S ₄ — Basal placement, top dressing in two splits	2647
'F' Test	
1. Main plot treatments — S. ED = 197.6; CD (P = 0.05) = 440.154	
2. Sub-plot treatments — N. S.	
3. Interaction — N. S.	

There was no marked difference in grain yield due to different sources of nitrogen viz., urea and ammonium sulphate. Prasad and Shukla (1970) reported that when weather conditions immediately after fertilizer application are good and no heavy rains are expected, all chemical N carriers may be equally suitable. Placement of fertilizer N and its application as top dressing in one or two split doses did

not result in any increase in yield over the broadcast application with a single top dressing 15 days after transplanting. Thakur and Saxena (1970) reported that split off application of N (1/2 at planting and 1/2 after one month) gave the highest yield and that urea and ammonium sulphate were equally effective. Ragupathy and Raj (1973) have reported that in a sandy loam soil under flooded condition, the availability

of nitrate nitrogen might be high and the accumulation of ammonical nitrogen might be very low with the application of green manure, as compared to the heavier loam soil. The surface soil being sandy loam, the green manure applied might have decomposed rapidly with the production of more nitrate nitrogen. Further, the special practice of intensive flood system of irrigation through canal source also might have caused appreciable loss of nitrate N by leaching. Sahoo *et al.* (1970) have reported that under heavy application of organic and green manures, continuous submergence depressed grain yield and nutrient uptake which could be improved through provision of drainage possibly because of removal of toxic products resulting from anaerobic decomposition of organic matter.

The present investigation thus indicates that green manuring of rice under ill drained conditions is not beneficial. Placement of fertilizer N and its split application does not also improve the yield.

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