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Effect of Irrigation Levels and Forms of Manures on Rice Varieties IR 8 and IR 20

BY

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ABSTRACT

A field experiment in rice conducted during *kharif* 1970–71 revealed that submergence of land throughout the growing period with a depth of 5 cm water was necessary for higher grain yields. Water requirements from planting to harvest were 1417 mm and 1217 mm for the rice varieties IR 8 and IR 20 for the above treatment. Ammonium sulphate influenced grain yields better than the organic manures on equal nitrogen basis i. e. 187.5 kg N/ha and it gave higher production per Kg of N and higher out turn per rupee of expenditure among the manures tried.

INTRODUCTION

Rice grown in 36.97 million hectares in India, is accounted for over a third of the world's rice area. It utilisis nearly 45 per cent of the irrigation resources of the country (Dastane *et al.*, 1970). As the water need of rice is many times greater than that of other crops, a precise knowledge regarding optimum water regime is essential for evolving efficient and economic irrigation practices. The successful introduction of new varieties assumes significance for formulating proper manurial recommendation as it responds to high fertilization.

Excessive water at early stages of rice growth is detrimental to tillering but essential for seed formation (Chakladar, 1946). Lang *et al.* (1960) worked out in detail the water requirement of rice from the time of transplanting to the ripening stage of the crop. Matsushima (1962) found no reduction in yield when the soil was allowed to dry during the period from final emergence of bearing tillers to spikelet differentiation. However, Enyi (1963) observed that it was best to flood rice throughout its growth period but where water is limited, flooding for 4 to 8 weeks after transplanting alone gave satisfactory yields. Recent works showed that higher yields in rice can be obtained with 5 cm depth of water (Dastane *et al.*, 1970). If the soil profile remains saturated or partly saturated land submergence might not be essential (Mane and Dastane, 1971).

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MATERIALS AND METHODS

The trial was laid out in the wetland of the Tamil Nadu Agricultural University, Coimbatore during *kharif* 1970-71 in a split plot design with four replications. The soil is black clay, rich in available NPK. During the crop period the mean fortnightly maximum temperature ranged from 27.3°C to 31.5°C and minimum temperature ranged from 20.7°C to 23.6°C. The percentage of relative humidity was from 80 to 96. Sunshine hours were from 3.5 to 8.9 and evaporation was from 3.7 mm to 7.5 mm. The average water table was below 8 m. Net plot size was 5.0 × 3.6 m and a spacing of 20×10 cm between plants was adopted. The specified depth of water was maintained in the plots by having graduated bamboo pegs fixed in the field. Quantity of water was measured through 90° triangular weir. The main plot treatments consisted of three irrigations and two varieties as detailed below:

Irrigation

I_1 — Submergence 5.0 cm depth throughout the crop growth period; I_2- Non-submergence-No standing water (Irrigation to avoid hairline cracks); I_3 - Non - submergence and submergence - Non - snbmergence upto 52nd day from the date of planting and submergence from 53rd day of planting to grain maturity.

Variety

V_1 – IR 8, V_2 – IR 20

The sub-plot treatments were M_1 – Farm yard manure (36 t/ha); M_2 – Green manure (Sunnhemp - 25 t/ha); M_3 - Groundnut cake (2.8 t/ha) and M_4 - Fertilizer (Ammonium sulphate - 0.9 t/ha). They were applied on equal total nitrogen basis i. e. 187.5 kg/ha.

No basal dressing of manure was applied to the nursery. Top dressing of ammonium sulphate was done at the rate of 0.5 kg N per 40 m² one week before pulling out the seedlings. Farm yard manure, fresh sunnhemp plants and powdered oil cake were applied 20 days, 12 days before transplanting respectively, Ammonium sulphate was applied in two doses, two-thirds at the time of transplanting and one-third 30 days after transplanting. Phosphorus and potassium were applied to all the treatments in the form of superphosphate and muriate of potash at the rate of 87.5 kg/ha as basal dressing.

RESULTS AND DISCUSSION

Effect on the yield and yield components

The yield and yield components data are presented in Table 1. The results indicated that submergence of land with a depth of 5 cm throughout the crop growth was significantly superior to the other two irrigation treatments, while non submergence upto flower initiation and submergence thereafter, was significantly superior to non submergence throughout. The plant height, number of green leaves, number of productive tillers, ear length, number of filled grains recorded also supported the superiority of submergence of land throughout the crop

TABLE 1. Effect of irrigation levels, varieties and forms of manures on the yield and yield components of rice

	Irrigation			Varieties		Manures			
	I_1	I_2	I_3	V_1	V_2	M_1	M_2	M_3	M_4
1.	5620.00	4890.00	5299.00	5713.00	4825.00	4173.00	5334 00	5619.00	5952.00
C.D.	243.5			179.6		125.0			
2.	6099.00	5102.00	5428.00	5131,00	5955.00	3739.00	5766.00	6452.00	6160.00
C.D.	291.8			242.8		231.5			
3.	83.58	76.99	80.13	73.32	87 01	74.84	80.89	82.48	82.46
C.D.	1.90			0.51		1.74			
4.	71.09	48.88	55.91	65.02	52.23	48 25	60 20	61.21	64 13
C.D.	9.65			7.88		6 09			
5.	10.58	8.74	9.24	8.92	10.13	7.65	9.78	10.16	10.48
C.D.	1.18			0.96		0.68			
6.	25.0037	24.7483	25.0925	29.6404	20 2558	24.4276	25.0975	25.1304	25.1371
C.D.	0.2782			0.2290		0.5386			
7.	23.35	21.98	22.22	20.35	24.47	22,03	22.31	22.39	22.71
C.D.	0.48			0.39		0.20			
8.	625.25	484.15	556.91	517.31	593.35	445 54	575.38	581.04	615.79
C.D.	51.66			41.89		27.51			
9.	1 : 0.95	1 : 1	1 : 1	1 : 1.14	1 : 0.83	1 : 1.12	1 : 0.95	1 : 0.89	1 : 0.98
				0.05		0.15			

1. Grain yield (kg/ha) 2. Straw yield (kg/ha) 3. Plant height at harvest 4. No. of green leaves at flowering 5. No. of productive tillers 6. 1000-grain weight in gm 7. Ear length (cm) 8. No. of filled grains 9. Grain straw ratio.

growth. This shows that submergence of land is necessary for higher yields in rice. Chandra Mohan (1965) and Kalyanikutty *et al.* (1970) have reported similar findings. In yield potential the variety IR 8 was superior to IR 20 due

TABLE 2. Economics of application of manures to high yielding varieties IR 8 and IR 20

Manure	Quantity applied kg/ha	Total Expenditure Rs.	Cost of per kg of N Rs.	Grain Mean yield kg/ha	Production per kg kg of N	Outturn per rupee of expenditure
Farm yard manure	36321	503	2.7	4173	22 5	8.3
Green manure (Sunnhemp)	25034	600	3.2	5334	28 8	8.9
Groundnut cake	2786	1968	10.6	5619	30.3	2.9
Ammonium sulphate	899	508	2.7	5932	32.0	11.7

to higher 1000 grain weight. But in straw yield the variety IR 20 had yielded more straw than IR 8. Ammonium sulphate appeared to be superior to the other kinds of manures when applied on equal nitrogen basis i. e. 187.5 kg N/ha. The increased plant height, number of green leaves, productive tillers, 1000-grain weight, ear length, number of filled grains were responsible for the higher yield in ammonium sulphate treatment. Sethi *et al* (1956) had reported that artifical fertilizer was found to be superior to natural manures which the present findings corroborate.

Water requirement

Water requirements of rice IR 8 and IR 20 in the treatment submergence throughout were 1417 mm and 1217 mm respectively. This included the effective rainfall of 228 mm received during the crop growth. Recent findings as reported by Dastane *et al.* (1970) showed that water needs of rice crop ranged from 950 to 2150 mm depending upon the place, season and duration of the crop. In the present study no interaction was seen between manures and irrigation.

Economics of manures

The cost benefit ratio worked out for the different manures are presented below in Table 2.

It may be seen that production of grain per kg of N applied, ammonium sulphate ranked first followed by groundnut cake, green manure and farm yard manure. For a rupee spent on manures, the out turn was 2.9 kg of grain in the case of groundnut cake which was a low value. Outturn from ammonium sulphate was 11.7 kg of grain, the highest value among all manures.

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