

# Evaluation of rice genotypes and effect of reclamation practices on growth and yield of lowland rice in coastal saline alluvial soils

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## ABSTRACT

Field experiments were conducted during samba 2004 in farmer's field at Prathaparamapuram, Nagapattinam district, Tamil Nadu to evolve cost effective strategies for enhancing rice productivity through tolerant genotypes and management practices in coastal saline soil conditions. The experiment was conducted with four varieties namely, CR 1009, CO 43, TRY 1 and Dandi with four reclamation practices viz., application of farm yard manure @ 12.5 t ha<sup>-1</sup>, green leaf manure *Calotropis gigantea* 6.25 t/ha<sup>-1</sup>, leaching and without any reclamation practices as control. Farm yard manure had higher impact on yield attributes than green leaf manure and leaching. The application of farm yard manure improved the number of productive tillers m<sup>-2</sup>, panicle length, filled grains panicle<sup>-1</sup> and test weight of grains. CO 43 with farm yard manure application recorded the highest grain yield and was followed by CO 43 with green leaf manure application and TRY 1 with farm yard manure addition.

**Key words :** Reclamation, Farm yard manure, Leaching, Green leaf manure.

## INTRODUCTION

Rice is one of the major staple food crops that have been cultivated for over 10,000 years. Globally, rice ranks second to wheat, but in terms of food crop, rice provides more calories per hectare than any cereal crop. In India, rice is the major food grain crop that ranks first in total production. The average productivity in India is 2.92 t ha<sup>-1</sup>. Tamil Nadu is one of the major rice cultivating state with the major rice growing tracts in the deltaic region of the Cauvery river.

Salinity is one of the obstacles in high production of rice in the deltas and coastal fringes. It is a serious impediment to growth of irrigated rice (Ponnamperuma, 1977). Rice is the major crop that is cultivated in most of the coastal areas during the north east monsoon season (Kothandaraman, 1987). Govindaraju and Balakrishnan (2002) observed that increasing salinity level contributed to significant decline in growth and yield attributes.

In problem soils, amendments were found to increase growth attributes of rice (Kadu *et al.*, 1991). The grain yield of rice was improved due to leaching (Aich *et al.*, 1996). Bandyapoadhyay and Bandyapoadhyay (1984) found that farm yard manure application produced higher yield of rice in coastal saline soils. Green leaf manuring is also a suitable amendment for rice grown in saline soils. The present study was undertaken to study the effect of reclamation on growth and yield in different varieties of rice.

## MATERIALS AND METHODS

Field experiments were conducted in farmers' field, Nagapattinam on a sandy clay loam soil with pH 7.6 and E.C. 4.26 under lowland conditions during rabi 2004. The soil was low in available nitrogen (130.8 kg/ha<sup>-1</sup>), high in available phosphorus (24.34 kg/ha<sup>-1</sup>) and high in available potassium (305.2 kg/ha<sup>-1</sup>). The organic carbon status was

low (0.28%). The rainfall received during the cropping period was 1757mm in 47 rainy days. The experiment was laid out in Factorial Randomised Block Design with three replications with the following treatments

<u>Varieties</u>	<u>Treatments</u>
V <sub>1</sub> CR 1009	T <sub>1</sub> FYM application 12.5 t/ha <sup>-1</sup>
V <sub>2</sub> CO 43	T <sub>2</sub> Green leaf manure ( <i>Calotropis gigantea</i> ) 6.25 t/ha <sup>-1</sup>
V <sub>3</sub> TRY 1	T <sub>3</sub> Leaching
V <sub>4</sub> Dandi	T <sub>4</sub> Control

A common dose of NPK 150: 50: 50 kg/ha<sup>-1</sup> along with 25 kg/ha<sup>-1</sup> ZnSO<sub>4</sub> was applied for varieties Co 43, TRY 1 and CR 1009 and 120: 38: 38 kg ha<sup>-1</sup> NPK for Dandi. The varieties were transplanted with 20 x 15 cm spacing in 5 x 3.9 m plots with a buffer channel of 30 cm around all plots. Irrigation was done to maintain standing water of 5 cm depth. The entire dose of P was applied basally and N and K were applied basally and the remaining was applied in two equal splits at tillering and panicle initiation.

## RESULTS AND DISCUSSION

The results of the study indicate that there was a favourable effect of management practices on growth and yield of lowland rice. Application of farm yard manure had significantly greater influence on growth and yield followed by green leaf manure and leaching over control.

### Growth attributes :

The plant height was influenced by the treatments. Among varieties, TRY 1 had the maximum plant height of 104.4 cm and among the treatments; farm yard application produced the maximum plant height of 93.7 cm. The LAI was improved with the adoption of reclamation practices. The application of farm yard manure 12.5 t/ha<sup>-1</sup> had the highest LAI followed by green leaf manure 6.25 t/ha<sup>-1</sup> and

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leaching. In the initial stages, the varieties CR 1009, CO 43 and TRY 1 recorded significantly higher LAI than Dandi. But, at the later stage, CO 43 had the highest LAI followed by other varieties. The interaction effect was significant throughout the crop growth. The interaction effect being significant, at 75 DAT, the variety CO 43 with farmyard manure application recorded higher LAI of 5.95 and was comparable with CO 43 with green leaf manure application (Table 1).

The effect of reclamation practices was well pronounced over no reclamation practices on the crop growth rate. CO 43 with farm yard manure was comparable with TRY 1 and farm yard manure in the CGR at 50-75 DAT. The interaction between treatments and varieties was significant in improving the total number of tillers  $m^{-2}$  at all

adoption of reclamation practices (Table 2). The interaction effect of reclamation practices and varieties were significant in the number of productive tillers  $m^{-2}$ . The combination  $V_2T_1$ , CO 43 with farm yard manure application produced the highest number of productive tillers followed by  $V_2T_3$ , CO 43 with green leaf manure application. Conspicuous enhancement in the length of panicle was observed due to the reclamation practices. CO 43 with farm yard manure application produced significantly lengthier panicle (23.5 cm) and was at par with CO 43 with green leaf manure (22.4 cm) and TRY 1 with farm yard manure application (21.8 cm). The adoption of reclamation practices produced an increase in the number of grains panicle<sup>-1</sup> over control. Application of farm yard manure produced significantly higher number of grains (118.70). The interaction effect

Table 1 : Effect of treatments on the growth attributes of lowland rice

Treatments		Plant height (cm)	LAI 75 DAT	CGR ( $g\ m^{-2}\ day^{-1}$ )	Total tillers	DMP Harvest ( $t\ ha^{-1}$ )
$V_1$	$T_1$	87.3	4.28	7.01	351	6.18
$V_1$	$T_2$	81.4	3.52	6.58	326	5.59
$V_1$	$T_3$	84.2	3.97	7.15	320	6.03
$V_1$	$T_4$	77.8	3.26	6.55	309	5.00
$V_2$	$T_1$	94.6	5.95	7.53	483	10.50
$V_2$	$T_2$	88.7	4.26	6.95	374	7.91
$V_2$	$T_3$	91.3	5.43	6.88	456	9.11
$V_2$	$T_4$	85.4	3.95	6.32	358	5.42
$V_3$	$T_1$	110.7	4.87	7.45	419	9.61
$V_3$	$T_2$	102.8	4.18	6.65	362	7.55
$V_3$	$T_3$	105.6	4.52	6.82	383	8.54
$V_3$	$T_4$	98.3	3.78	6.14	275	6.34
$V_4$	$T_1$	80.2	3.78	7.11	274	7.09
$V_4$	$T_2$	72.3	3.37	6.77	242	6.20
$V_4$	$T_3$	76.5	3.44	6.95	253	6.72
$V_4$	$T_4$	70.1	3.16	6.36	223	5.98
CD						
	V	0.81	0.09	0.043	25.69	0.55
	T	0.81	0.09	0.043	25.69	0.55
	V x T	NS	0.17	0.085	51.37	1.10

stages of crop growth. The variety CO 43 with farm yard manure application recorded the highest number of tillers  $m^{-2}$ . The DMP increased with the advancement of crop growth as evidenced from the lowest DMP at 25 DAT and the highest at harvest stage. The interaction between reclamation and varieties was significant at all stages of crop growth. The highest DMP was produced by CO 43 with farm yard manure application ( $10.5\ t/ha^{-1}$ ) and was comparable with TRY 1 with farm yard manure application ( $9.61\ t/ha^{-1}$ ).

#### Yield attributes :

The number of productive tillers  $m^{-2}$  increased with the

being significant, the combination of CO 43 with farm yard manure produced the highest total number of grains panicle<sup>-1</sup> ( $144.1$ ) followed by TRY 1 with farm yard manure application with  $132.8$  grains panicle<sup>-1</sup>. The combination of CO 43 with farm yard manure application produced  $129.5$  filled grains panicle<sup>-1</sup> followed by TRY 1 with farm yard manure application producing  $114.7$  filled grains panicle<sup>-1</sup>.

There was significant interaction between reclamation practices and varieties and this was evident from the fact that the combination of  $V_2T_1$ , variety CO 43 with farm yard manure application recorded significantly higher grain yield of  $5.16\ t/ha^{-1}$  followed by  $V_2T_3$ , CO 43 with green leaf manure. The treatment combination of  $V_4T_4$  Dandi with no

reclamation practices recorded the lowest grain yield of 2.97 t/ha<sup>-1</sup>. The combination of V<sub>2</sub>T<sub>1</sub>, CO 43 with farm yard manure application recorded the highest straw yield of 6.15 t/ha<sup>-1</sup> and was comparable with V<sub>3</sub>T<sub>1</sub> TRY 1 with farm yard manure application with an yield of 5.75 t/ha<sup>-1</sup>. The least straw yield was recorded in V<sub>4</sub>T<sub>4</sub>, Dandi with no reclamation practices.

The reclamation practices viz., farm yard manure 12.5 t/ha<sup>-1</sup>, green leaf manure (*Calotropis gigantea*) 6.25 t/ha<sup>-1</sup> and leaching significantly enhanced the crop growth attributes such as plant height, LAI, CGR and DMP as compared to control. The varietal difference was also

characters such as plant height, LAI, total number of tillers m<sup>-2</sup> and DMP were increased by the application of farm yard manure and green leaf manure. Krishnamoorthy *et al.* (1995) observed that farm yard manure alone as organic management practices increased the DMP of the rice at all the stages of crop growth.

The application of farm yard manure significantly increased the yield attributes viz., productive tillers, panicle length, total grains panicle<sup>-1</sup>, filled grains panicle<sup>-1</sup>, filled grain percentage, test weight and yield of grain and straw. There was a significant interaction effect in productive tillers,

Table 2 : Effect of treatments on the yield attributes and yield of lowland rice.

Treatments	Productive tillers m <sup>-2</sup>	Panicle length (cm)	Yield (t ha <sup>-1</sup> )	
			Grain	Straw
V <sub>1</sub> T <sub>1</sub>	330	18.3	3.75	3.95
V <sub>1</sub> T <sub>2</sub>	306	16.6	3.17	3.88
V <sub>1</sub> T <sub>3</sub>	301	17.4	3.44	4.03
V <sub>1</sub> T <sub>4</sub>	295	15.4	3.12	3.89
V <sub>2</sub> T <sub>1</sub>	468	23.5	5.16	6.15
V <sub>2</sub> T <sub>2</sub>	352	19.6	4.06	5.11
V <sub>2</sub> T <sub>3</sub>	431	22.4	4.72	5.73
V <sub>2</sub> T <sub>4</sub>	335	16.5	3.95	4.65
V <sub>3</sub> T <sub>1</sub>	395	21.8	4.56	5.75
V <sub>3</sub> T <sub>2</sub>	341	19.3	3.58	5.23
V <sub>3</sub> T <sub>3</sub>	363	20.5	4.28	5.52
V <sub>3</sub> T <sub>4</sub>	258	15.6	3.07	5.09
V <sub>4</sub> T <sub>1</sub>	256	18.9	3.54	4.47
V <sub>4</sub> T <sub>2</sub>	226	15.7	3.11	4.52
V <sub>4</sub> T <sub>3</sub>	238	16.2	3.32	4.38
V <sub>4</sub> T <sub>4</sub>	207	14.4	2.97	4.22
CD				
V	25.13	0.94	0.07	0.08
T	25.13	0.94	0.07	0.08
V x T	50.26	1.88	0.15	0.16

exhibited in the crop growth characteristics. The interaction effect between the reclamation practices and varieties was significant with respect to growth attributes except plant height. For the LAI, CO 43 with farm yard manure application and CO 43 with green leaf manure recorded a significant increase in the LAI and were comparable with each other. With respect to the DMP and total tillers m<sup>-2</sup> the treatment combinations CO 43 with farm yard manure application and TRY 1 with farm yard manure application were similar in their effect and were better than other combinations. The increase in growth attributes due to adoption of management practices (farm yard manure and green leaf manure) might be because of the nutrient release due to addition of manures and buffering nature of the organic manures that reduce the harmful effects of the salts and by improving the soil conditions. This was in accordance with the findings of Arokiaraj (1988) who reported that growth

panicle length and grain yield. The treatment combination CO 43 with farm yard manure application recorded the highest number of productive tillers, panicle length, grain and straw yields followed by CO 43 with green leaf manure. In case of straw yield, TRY 1 with farm yard manure application was comparable with CO 43 with farm yard manure application. The increase in the yield parameters and ultimately the yield might be attributed to the better crop growth, enhanced source and sink relationship and better yield attributing characters. Sharma (1997) observed that in rice, the highest grain yield was obtained by application of farm yard manure alone as well as in combination with other amendments.

## CONCLUSION

There is a significant impact on yield by the adoption of improved varieties and reclamation practices in coastal

saline soils. Among the varieties, CO 43 performed better and among reclamation practices, farm yard manure was beneficial. The variety CO 43 with farm yard manure recorded the highest yield but ultimately, CO 43 with green leaf manure gave the highest benefit cost ratio.

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