

EFFECT OF DIFFERENT ORGANIC MANURES IN COMBINATION WITH INORGANIC FERTILIZERS ON GROWTH AND YIELD OF RICE

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ABSTRACT: Two field experiments were conducted at Kilinochchi to study the effects of inorganic fertilizers, compost, green manure (Glyricidia) and the combined use of these organic and inorganic fertilizers on growth and yield of rice. All three fertilizers, namely inorganic fertilizer, compost and green manure significantly increased the grain yield. However glyricidia has a marked effect on growth and yield of rice compared to inorganic fertilizer or compost. The highest grain yield was obtained for the treatment of green manure, 15 mt/ha in combination with 25% of the recommended inorganic fertilizer. There was no significant difference in yield among treatments of 100% recommended inorganic fertilizer, 10 mt/ha compost in combination with 50% inorganic fertilizer and 15 mt/ha compost in combination with 25% rec. inorganic fertilizer. However 1000 grain weight was not significantly affected by treatments. Recommended levels of inorganic fertilizers were 85kg N/ha, 55kg P₂ O₅/ha and 45kg K₂ O/ha.

Introduction

Due to the global energy crisis the cost of fuel based chemical fertilizers has increased tremendously. Feasibility of usage of artificial fertilizers has become a serious concern to developing countries due to the high cost of fertilizers, fuel and energy (Singh 1978). Availability of inorganic fertilizers is uncertain to Northern region of Sri Lanka due to the prevailing disturbed situation. However to obtain increased rice production through intensive farming increased supply of nutrients is essential. To cope with this increased demand it is essential to find natural organic resources which would provide nutrients to rice plants.

Glyricidia is a tree legume which is quick growing and found extensively in the dry zone live fences. In Sri Lanka research using glyricidia as green manure has been successful in coconut palm (Liyanage and Jayasundara 1987). Research in Kerala involving glyricidia with goat manure and glyricidia with pig manure gave better results than inorganic fertilizers in rice (Joseph and Kuriakose 1983).

Korea, China and Philipines have demonstrated the tremendous yield advantage that could be obtained by use of rice straw composting programme (Parr 1978). In Sri Lanka also research work was directed to the potential use of compost in rice cultivation and found to be successful (Premaratne and Gunasena 1987).

This study was undertaken to evaluate the effect of glyricidia and compost and their combined effect with inorganic fertilizer when compared with inorganic fertilizer on growth and yield of rice.

Materials and Methods

Two field experiments were conducted at Kilinochchi, during wet season (maha) 1991/92 and 1992/93, in a randomized complete block design with three replicates. Experiments were conducted under rainfed condition with supplementary irrigation. The treatments employed are shown in Table 1.

Compost was made by the pit method using cowdung, straw and crop residues. Green manure glyricidia was incorporated into the soil two weeks before transplanting. The rice variety BG 350 was transplanted at a spacing of 20 cm x 20 cm. The total quantity of compost, P_2O_5 and K_2O fertilizers were applied as a basal dressing at the time of transplanting. N was applied in split doses, one basal and two top dressings. The other cultural operations for rice were followed throughout the duration of the experiment. Seedlings were transplanted on 25 November 1991 and harvested on 15 February 1992, in the first experiment. In the second experiment seedlings were transplanted on 15 November 1992 and harvested on 3 February 1993.

Plant growth records of plant height and tiller number were taken from each plot. At maturity harvesting was carried out eliminating two border rows of plants from each plot. Grain yield of each plot was weighed. Straw weight from each plot was taken after drying.

Table 1

Number	Treatments
T1	100% NPK inorganic fertilizers at recommended level.
T2	Compost 15 mt/ha
T3	Green manure 15 mt/ha
T4	Compost 10 mt/ha + 50% NPK inorganic fertilizers at recommended level.
T5	Green manure 10 mt/ha + 50% NPK inorganic fertilizers at recommended level.
T6	Compost 15 mt/ha + 25% NPK inorganic fertilizers at recommended level.
T7	Green manure 15 mt/ha. + 25% NPK inorganic fertilizers at recommended level.
T8	Control.

Recommended levels of inorganic fertilizers were 85 kg/ha, 55 kg P₂O₅/ha and 45 kg K₂O/ha.

Results and Discussion

The effect of treatments on growth components are shown in Fig. 1 (plant height), Fig 2 (dry shoot weight) and Fig. 3 (tiller numbers). All combinations of green manure treatments increased the dry shoot (straw) weight of rice plants by 49% compared with control and NPK treatment at recommended level by 300%. The effect of compost on straw weight however was similar to the 100% NPK treatment. The plant height again increased by all treatments of green manures by 35 - 70% but the response to compost and 100% NPK treatments remained similar and showed only marginal increase over the control.

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Effect of Different Organic Manures

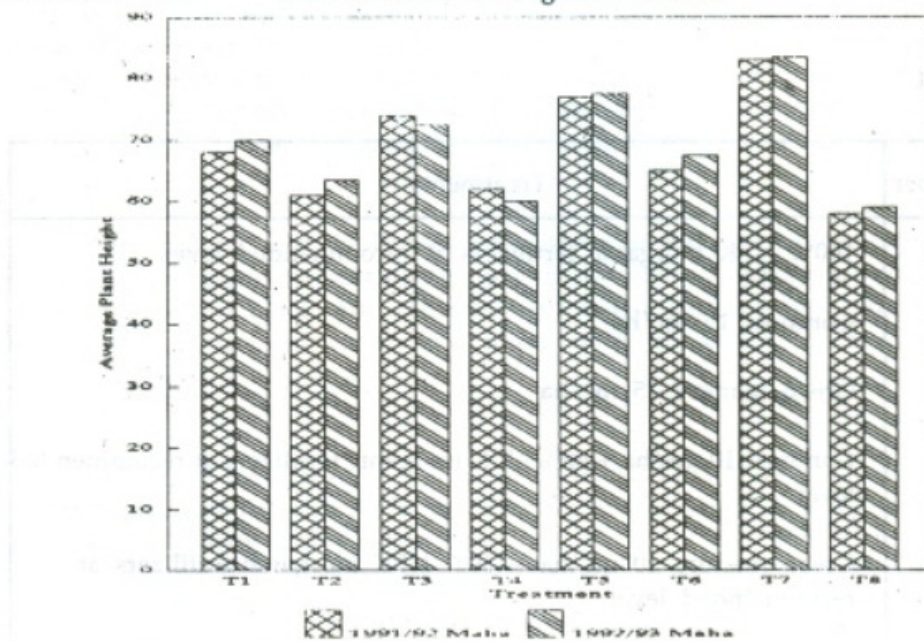


Fig.1 Average plant height 6 weeks after transplanting

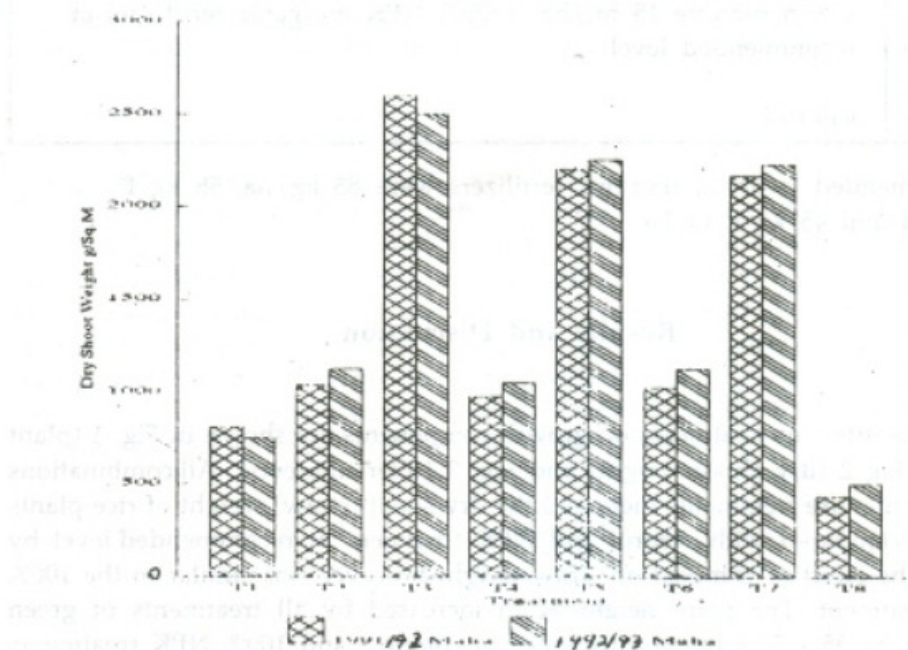


Fig. 2. Average dry shoot weight/sq. m.

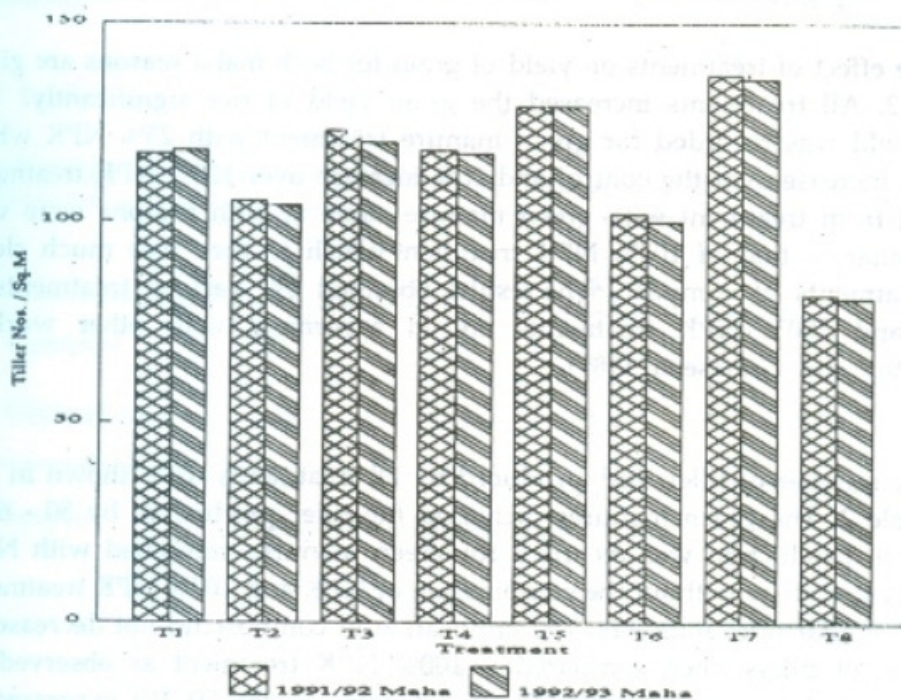


Fig. 3. Average tiller nos./6 weeks after transplanting

Table - 2

Treatment effect on yield and yield components

Types of fertilizers and level	1991/92 Maha			1992/93 Maha		
	Grain yield kg/ha.	No. of Tillers gm.	TGW yield	Grain yield kg/ha.	No. of Tillers/m2 gm.	TGW
100% NPK at rec. level	4756	351	27.2	4813	354	26.8
15mt/ha Compost	4154	315	27.2	4267	312	26.7
15mt/ha Green manure	4894	369	23.1	4789	360	22.4
50% NPK + 10mt/ha Compost	4377	324	26.5	5258	331	25.5
50% NPK + 10mt/ha Green manure	5276	387	25.7	5324	391	25.6
25% NPK + 15mt/ha Compost	4323	306	25.6	4422	300	25.5
25% NPK + 15mt/ha Green manure	388	23.1				
Control	2949	246	26.6	3109	237	25.6
Level of significance	514.9	15.9		504	16.2	
L.S.D. (0.05)						

The effect of treatments on yield of grain for both maha seasons are given in Table 2. All treatments increased the grain yield of rice significantly. The highest yield was recorded for green manure treatment with 25% NPK which gave 80% increase over the control and 10% increase over 100% NPK treatment. The yield from treatment with green manure alone at both seasons were very much similar to that of 100% NPK treatment which in turn was much closer to all treatments of compost. The results obtained by various treatments of compost and 100% NPK treatments are in agreement with other workers (Premaratne and Gunasena 1987).

The number of tillers/m² produced by all treatments were shown in Fig. 3 and Table 2. The green manures increased the tiller production by 50 - 60%, the highest production was recorded for green manures combined with NPK. The compost with or without the combination of NPK and 100% NPK treatments produced similar tiller numbers. The application of compost did not decrease the production of tillers when compared to 100% NPK treatment as observed by Premaratne and Gunasena 1987. Thousand grain weight (TGW) expressed in gram did not show any significant differences between treatments.

The green manure glyricidia produced yield components and yields of grain greater than other treatments. The growth and yield by compost was similar to the 100% NPK. The effect of all these treatments showed increased growth and yield of paddy compared to the control.

The glyricidia contains higher percent of N and K₂O than compost as shown in Table 3 and therefore produced better growth and yield compared to compost. Thus both compost and glyricidia can be used for cultivation of paddy. The severe drawback is the huge amount of these materials required (10 - 15 mt/ha) and their cost of transport. However it is clear from the results that glyricidia and compost could be used to reduce the use of inorganic fertilizers. The farmers could make use of various combinations of organic manures (Glyricidia, Compost) and inorganic fertilizers to reduce the cost involved in the use of expensive inorganic fertilizers alone.

Table - 3

Average nutritional composition of Compost and Green manure

	N%	P ₂ O ₅ %	K ₂ O%
Compost	0.6	0.45	0.5
Glyricidia	4.16	0.44	2.6

Source - Tropical Agriculturist Vol. 145

- CRI Leaflet - 9

References

- Josep, P.A. and Kuriakose, T.F., (1982) An integrated nutrient supply system for higher rice production. *International Rice Research Newsletter* 10 (2): 22.
- Liyanage, L.V.K. and Jayasundera, H.P.S. (1987) Potential for use of nitrogen fixing trees in coconut plantations (78-85) In Ed. H.P.M. Gunasena *Proceedings of nitrogen fixation and soil fertility*. Faculty of Agriculture, Peradeniya.
- Parr, J.F. (1978) Use of compost in Korea. In organic materials as fertilizers. *FAO Soil Bull.* No. 27, 121.
- Premaratne, K.P. and Gunasena, H.P. (1987) Effect of inorganic fertilizers and compost on yield and quality of rice 59-64 In Ed. H.P.M. Gunasena *Proceedings of nitrogen fixation and soil fertility*. Faculty of Agriculture, Peradeniya.
- Singh. A. (1978) Use of organic material and green manure as fertilizers in developing countries. In organic materials as fertilizers, *FAO soil Bull* No. 27, 121.

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