INFLUENCE OF DIFFERENT SOURCES OF NITROGEN ON GRAIN YIELD AND ECONOMICS OF RICE (*ORYZA SATIVA L.*) UNDER CAUVERY DELTA REGION OF TAMIL NADU

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ABSTRACT

A field experiment was conducted during samba season (September 2006 to January 2007) at experimental farm, Faculty of Agriculture, Annamalai University to study the influence of different sources of nitrogen on grain yield and economics of rice. The experiment was conducted in randomized block design and replicated thrice. The experiment comprised eight treatments includes absolute control (No fertilizer and no organic manure), recommended dose of fertilizer alone and graded dose of fertilizer nitrogen along with different organic manures *viz.*, Green manure, Vermicompost and Pressmud . Use of different sources and combination sources of nitrogen had significant influence on yield attributes and yield of rice. The results of the experiment showed that application of 100% RDN along with vermicompost @ 5 tonnes ha^{-1} significantly recorded higher yield attributes, maximum grain and straw yield and higher gross return, net returns and return $rupee^{-1}$ over other organic manure in combination with inorganic fertilizer which was followed by application of 75% RDN along with vermicompost @ 5 tonnes ha^{-1}.

Key words: Rice, Recommended dose of Nitrogen, Vermicompost, Green manure and Pressmud
gross return, net returns and return $rupee^{-1}$

INTRODUCTION

Rice is one of the most important staple cereal foods in human nutrition and major food grain for more than a two third of the world's population. In world, 90% rice is produced and consumed in Asian countries. It is the major source of calories for 40 per cent of the world population (Ahmad Ranjha, 2001). Currently, the world population is increasing at alarming rate but there is no scope to increase the net cultivable land for crop production. Exploiting the production potential of high yielding rice varieties through agronomic management is one of the alternatives to feed the ever rising population. For this, fertilizers have contributed substantially to the spectacular increase in rice yield. However, growing crop with indiscriminate use of fertilizers has resulted into degradation of lands owing to low yields with poor quality of produce. The use of inorganic fertilizer to sustain cropping was found to increase yield only for

some few years but on long-term, it has not be effective and leads to soil degradation (Satyanarayana *et al.*, 2002). On the other hand, continuous application of organic fertilizer alone on rice field resulting low yield and low N and K content at the mid-tillering stage of rice plant (Javier *et al.*, 2004). This implies that the need of integrated nutrient management for rice production. INM practices are a holistic management system, which promotes sustainable agriculture and enhances agro-ecosystem health. Organic manures like green manure, pressmud and vermicompost deserves priority for sustained production and better utilization in intensive cropping system. Vermicompost is a rich source of enzymes, antibiotics, immobilised micro flora and growth hormones like gibberellins which regulate the growth of plants and microbes. (Usha Kumari *et al.*, 2006). Green manure is considered as good source of nitrogen and it increases the availability of P, K and secondary and trace elements in the soil. Incorporation of *Sesbania* green manuring over the years before transplanting of rice helps in improving DTPA-extractable micronutrient cations of the soil (Nayyar and Chhibba, 2000). Combined use of organic manures and inorganic fertilizers help in maintaining yield stability through correction of marginal deficiencies of secondary and micronutrients, enhancing efficiency of applied nutrients and providing favourable soil physical conditions (Panda, 2005). Keeping this as an overview, study was conducted to find out the influence of different sources of nitrogen on grain yield and economics of rice (*oryza sativa L.*) under cauvery delta region of Tamil nadu.

MATERIAL AND METHODS

Field experiment was conducted during samba season (September 2006 to January 2007) at Experimental farm, Faculty of Agriculture, Annamalai University, Annamalai Nagar and Tamil Nadu. The experimental soil was deep clay, low in available N, medium in available P_2O_5 and high in available K_2O with pH of 7.5. The experiment comprised of eight treatments *viz.*, T_1 - Control (No fertilizer and no organic manure), T_2 - 100% RDN (Recommended dose of nitrogen), T_3 - T_2 + Green manure @ 6.25 t ha^{-1}, T_4 - 75% RDN + Green manure @ 6.25 t ha^{-1}, T_5 - T_2 + Vermicompost @ 5 t ha^{-1},T_6 - 75% RDN + Vermicompost @ 5 t ha^{-1}, T_7 - T_2 + Pressmud @ 10 t ha^{-1}, T_8 - 75% RDN + Pressmud @ 10 t ha^{-1}. The experiment was conducted in a randomized block design and replicated thrice. The following organic manures were used in the study *viz.*, **g**reen manure, vermicompost and pressmud. The seeds of *Sesbania rostrata* were obtained from the Experimental Farm, Annamalai University and grown in a plot adjoining to the experimental field. After 45 days green manure was cut and incorporated in the respective plots as per the treatment schedule. Vermicompost was collected from Experimental Farm, Annamalai University and used for the experiment as per the treatment schedule. The pressmud was collected from M.R.Krishnamurthy Sugar Mill, Sethiathope, Cuddalore district, Tamil Nadu and dumped under shade for curing. After six month it was used for experiment as per the treatment schedule. The recommended dose of NPK fertilizers was 150:50:50 kg ha^{-1}. Fertilizers were applied according to the experimental treatments. Nitrogen, phosphorous and potassium were supplied through urea (46 per cent N), single super phosphate (16 per cent P_2O_5) and muriate of potash (60 per cent K_2O), respectively. Twenty-eight days old seedlings of CO 43 rice variety were transplanted in puddle field at a spacing of 20 x 15cm. Matured rice crop from the net plot area

was harvested, threshed and grains were separated, cleaned, dried and the grain yield was recorded at 14 per cent moisture content.

Economic analysis

Gross return

Gross return was calculated using grain yield of rice on market price and expressed in Rs ha^{-1}.

Net return

Net return was calculated by deducting the cost of cultivation from gross returns as detailed below and presented in Rs ha^{-1}.

Net return = Gross return – total cost of cultivation

Return $rupee^{-1}$ invested

Return $rupee^{-1}$ invested was calculated based on gross returns and cost of cultivation as given.

$$\text{Return rupee}^{-1}\text{ invested} = \frac{\text{Gross return (Rs. ha}^{-1})}{\text{Cost of cultivation (Rs. ha}^{-1})}$$

The observations recorded during the course of investigation were tabulated and analyzed statistically to draw a valid conclusion. The data were analyzed as per the standard procedure for ANOVA (Gomez and Gomez 1984).

RESULTS AND DISCUSSIONS

Yield Attributes and Yield

All the treatments exerted significant influence on yield attributes and yield of rice over the control. Application of 100% RDN + vermicompost @ 5 t ha^{-1} (T_5) significantly recorded maximum productive tillers m^{-2} of 396.00 and filled grains $panicle^{-1}$ of 82.63. This might be due to rapid mineralization of N from inorganic fertilizer and steady supply of nutrients from vermicompost might have met the N requirement throughout the crop growth and especially at the critical stages of crop growth, which manifested the higher yield attributes of rice. Similar kind of results was also reported by Murali and Setty (2001) in rice. With regard to grain yield and straw yield, 100% RDN + vermicompost @ 5 t ha^{-1} (T_5) applied plots significantly recorded higher grain and straw yield of 5.74 and 6.66 t ha^{-1}, respectively. This might be due to the fact that vermicompost offer a balanced nutritional release pattern to plants, providing nutrients such as available N, soluble K, exchangeable Ca, Mg and P that can be taken readily by plants (Edwards, 2004) and greater microbial diversity and activity resulting in higher grain and straw production. This is in accordance with the reports of Yadvinder Singh *et al*. (2003). It was followed by treatment T_6 (75% RDN + vermicompost @ 5 t ha^{-1}). The least productive tillers m^{-2} and filled grains $panicle^{-1}$, grain and straw yield were recorded under control (T_1).

ECONOMIC ANALYSIS

Among the treatments, the maximum gross returns of Rs. 43510 and net returns of Rs. 21855 were observed with 100% RDN + vermicompost @ 5 t ha^{-1}. Also the same treatment registered higher return

rupee^{-1} invested of 2.01. The aforesaid treatments registered higher yield attributes *viz.*, productive tillers m^{-2}, number of filled grains and panicle^{-1}, which are directly reflected on increased yield of rice. These might be the reason for increased profitability in the rice crop. The present results are in agreement with the findings of Babu Mathew (2001). This was followed by T_6 (75% RDN + vermicompost @ 5 t ha^{-1}), which registered gross returns of Rs. 41115, net returns of Rs.20005 and return rupee^{-1} of Rs.1.95. The lowest gross returns of Rs. 15880 , net returns of Rs.4360 and return rupee^{-1} of Rs1.38 registered under T_1 (control).

Thus it can be concluded that application of 100% recommended dose of nitrogen along with vermicompost @ 5 t ha^{-1} can be an effective integrated nitrogen management practices that can be recommended to the farmers of coastal tracts of Tamil Nadu for higher productivity and sustainability besides enhancing monetary returns in rice.

Table 1. Influence of different sources of nitrogen on yield attributes, grain and straw yield and economic analysis in rice

Treatments	Productive tillers m^{-2}	Filled Grains panicle^{-1}	Grain Yield (t ha^{-1})	Straw yield (t ha^{-1})	Total cost of cultivation Rs	Gross Income Rs.	Net income Rs.	Return rupee^{-1} invested
T_1	193.50	59.46	2.07	2.78	11520	15880	4360	1.38
T_2	296.50	66.83	3.47	4.41	15170	26495	11325	1.75
T_3	362.00	77.83	4.91	5.85	19435	37295	17860	1.92
T_4	347.00	76.05	4.62	5.58	18900	35130	16230	1.86
T_5	396.00	82.63	5.74	6.66	21655	43510	21855	2.01
T_6	380.00	80.72	5.42	6.35	21110	41115	20005	1.95
T_7	339.00	74.83	4.41	5.42	18195	33580	15385	1.85
T_8	321.50	72.73	4.14	5.13	17660	31545	13885	1.79
$S.E_D$	7.43	0.89	0.14	0.11	-	-	-	-
CD (p=0.05)	14.86	1.78	0.28	0.21	-	-	-	-

(Treatment details: T_1 - Control (No fertilizer and no organic manure), ,T_2 - 100 % RDN (Recommended dose of nitrogen),T_3 - T_2 + GM -(Green manure), @ 6.25 t ha^{-1}, T_4 - 75 % RDN + GM -(Green manure), @ 6.25 t ha^{-1}, T_5 - T_2 + VC (Vermicompost) @ 5 t ha^{-1}, T_6 - 75 % RDN + VC (Vermicompost) @ 5 t ha^{-1}, T_7 - T_2 + PM (Pressmud)@ 10 t ha^{-1} and T_8 - 75 % RDN + PM (Pressmud)@ 10 t ha^{-1}

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