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PERFORMANCE OF HYBRID RICE (*ORYZA SATIVA* L.) TO INTEGRATED NUTRIENT MANAGEMENT (INM) IN PARTIALLY RECLAIMED SODIC SOIL

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ABSTRACT
A field experiment was carried out at Instructional Farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during *kharif*, 2011 to study the performance of hybrid rice (*Oryza sativa* L.) to integrated nutrient management in partially reclaimed sodic soil. The experiment was laid out in Randomized Block Design with three replications. The seven treatments consisted with different integrated nutrient management combinations. The maximum plant height (113.73 cm), panicle length (19.67 cm), number of grains panicle^{-1} (75.10), test weight (23.20 g), grain yield (69.16 q ha^{-1}) and straw yield (83.12 q ha^{-1}) were recorded with 75% RDF + 25% FYM-N which were significantly superior over 75% RDF and 50% RDF + 50 % FYM-N, minimum was recorded with 100 % N through FYM. The higher N, (1.07%) P (0.27%) and K (1.02%) content were recorded with the application 75% RDF + 25% FYM-N followed by 100 % RDF. The maximum gross income (Rs. 70489.4 ha^{-1}), net returns (Rs. 43242.61) ha^{-1} and B: C ratio (1.64) were recorded with the treatment 75% RDF + 25% FYM-N followed by the treatment 100 % RDF.

INTRODUCTION

Rice (*Oryza sativa* L.), being one of the richest source of starch and food for one third world's population (Prasad *et al.*, 2010). Production of rice ranks second among the food grain, and half of the world population subsist on rice by receiving the highest calories (26.2%) intake from it (Anonymous, 2005). Utter Pradesh is the largest rice growing state after West Bengal in the country, where rice is grown over an area of 5.63 m ha with production and productivity of 11.94 mt and 21.20 q ha^{-1} respectively, (Anonymous, 2012). Hybrid rice gives about 15-20% more yield than promising high yielding commercial rice varieties. Salt affected (sodic) soils have excess soluble salt or excess exchangeable sodium (Na^+) or both in root zone that it adversely affect crop growth besides toxicity, create physiological imbalance in growing plant. In India about 72 lakh ha of land is affected by salinity and alkanity, its maximum area is in North India, only in U.P. 13 lakh ha soil is affected by salts (Singh, 2008). The use of adequate dose of organic source coupled with chemical fertilizers is expected to ensure optimum growth condition under intensive agriculture using rice hybrid (Singh, *et al.*, 2004). FYM, a by-product of dairy farm, is a potential source of plant nutrients. Organic resources are largely biological in origin and they have several nutrients in their composition, which on decomposition are released into soil. Organic fertilizers not only act as the source of nutrients, but also provide micronutrients and modify soil-physical behavior as well as increased the efficiency of applied nutrients (Pandey *et al.*, 2007). It has been well established that the applied organic sources not only increase soil fertility but also improve soil physical conditions, which help in proper growth of plant and increased water holding capacity, aeration, permeability, soil aggregation, nutrient holding capacity and decreased bulk density and soil crusting due to the continuous use of organic manure (Das, 2011). Consequently, in order to make the soil well supplied with all the plant nutrients in the readily available form and to maintain good soil health, it is necessary to use organic manures in conjunction with inorganic fertilizers to obtain optimum yields (Ramalakshmi *et al.*, 2012).

MATERIALS AND METHODS

A field experiment was conducted at Instructional Farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad Uttar Pradesh during the *kharif,* 2011 to study the the performance of hybrid rice (*Oryza sativa* L.) to integrated nutrient management in partially reclaimed sodic soil. The soil of experimental field (0-15 cm) was pH (1:2.5) 8.9, EC 0.40 dSm^{-1} at 25°C, organic carbon 0.25 %, available N 192.0, P 14.21 and K 245.90 kg ha^{-1}. The seven treatments consisted (T_1),-100% RDF (150 N, 60 P_2O_5, 60 K_2O kg ha^{-1}), (T_2)-75% RDF, (T_3)-50% RDF, (T_4)-75% RDF + 25% FYM-N, (T_5)-50% RDF + 50% FYM-N, (T_6)-25% RDF +

75% FYM-N and (T_7)-100% FYM-N through Farm yard manure (FYM). The experiment was laid out in Randomized Block Design with three replications. The Hybrid rice variety ARIZE-6444 was taken as test crop. Seed of hybrid rice was sown @ 17 kg ha^{-1}. Farm yard manure was incorporated according to the treatments at the time of field preparation and mixed thoroughly. One-third of nitrogen and full dose of phosphorus and potassium were applied as per treatments at the time of transplanting and remaining dose of nitrogen was applied in two equal splits at tillering and panicle initiation stages through urea. Total nitrogen content in grain and straw were estimated by modified Kjeldahl method (Anonymous, 1975). Total P content were determined by Vanadomolybdo-phosphoric yellow colour method and K by using flame photometer as described by Jackson, 1973.

The data were analyzed as per the standard procedure for Analysis of Variance (ANOVA) as described by Gomez and Gomez (1984). The significance of treatments were tested by 'F' test (Variance ratio). Standard error of mean (SEm±) was computed in all cases. The difference in the treatment mean was tested by using critical difference (CD) at 5% level of probability.

RESULTS AND DISCUSSION

Growth and yield attributes

The data presented in Table 1 revealed that the plant height, number of effective tillers $hill^{-1}$, number of seeds $panicle^{-1}$ and test weight were affected by the application of INM. It manifested that the maximum plant height (113.73 cm) was recorded in T_4-75% RDF + 25% FYM-N which was found statistically at par with T_1-100% RDF through chemical fertilizers (111.40 cm) and T_5-50% RDF +50% through FYM. The treatment T_4-75% RDF+ 25% FYM found significantly superior over rest of the treatments. The plant height increased with inorganic fertilizer alone and in combination with organic sources was due to increased availability of nutrients in adequate amount in hybrid rice. These results corroborate with the finding of Singh *et al.*, (1998). Hence, inorganic fertilizers in combination with organic manures caused the greater translocation of photosynthates from source to sink site that resulted higher yield contributing characters of rice (Barik *et al.*, 2008).

The number of effective tillers $hill^{-1}$ was highest with 100% RDF (6.07) followed by T_4, T_5 and T_3 (5.95, 5.50 and 5.20) respectively, while T_7-100% FYM was recorded minimum number of effective tillers $hill^{-1}$ (4.29). The probable reason may be the higher uptake of nutrient particularly nitrogen and phosphorus. The conformity of finding was also corroborated by Jagdish and Yadav (2009).

An examination of data manifed that the number of seeds $panicle^{-1}$ affected by treatments. The maximum number of seeds $panicle^{-1}$ (75.10) was observed with T_4-75% RDF + 25% FYM which was significantly superior over the T_3, T_6 and T_7 and statistically at par rest of the treatments. The minimum number of seeds $panicle^{-1}$ (61.95) was recorded under T_1-100% N through FYM. The similar result has also shown that integrated nutrients management remarkably increased yield, yield attributes of rice than alone Kumar *et al.* (2014).

The data obviously revealed that the test weight was affected with various treatments. The maximum test weight (1000 seed weight) was noticed 23.20 g with the application T_4- 75% RDF + 25% FYM followed by T_5- 50% RDF + 50% FYM-N (23.10 g). The minimum test weight (22.60 g) was found with the T_3-50% RDF. These results also corroborated with the finding of

Table 1: Effect of various treatments on growth, yield attributes and nutrients content (%) in plant after harvest of hybrid rice*

Symbol	Treatment	Plant height (cm)	No. of effective tillers $hill^{-1}$	No. of seeds $Panicle^{-1}$	Test weight (g)	Nitrogen content	Phosphorus content	Potassium content
T_1	100% RDF	111.40	6.07	71.40	23.03	1.03	0.26	1.02
T_2	75% RDF	106. 33	5.20	66.12	23.00	0.93	0.24	0.94
T_3	50% RDF	104.00	4.40	63.34	22.60	0.84	0.23	0.86
T_4	75% RDF + 25% FYM	113.73	5.95	75.10	23.20	1.07	0.27	1.03
T_5	50% RDF + 50% FYM	108.83	5.50	69.90	23.10	1.04	0.24	0.96
T_6	25% RDF + 75% FYM	106.17	4.74	65.90	23.00	0.93	0.24	0.92
T_7	100% FYM	102.67	4.29	61.95	23.00	0.86	0.23	0.89
	SEm±	2.06	0.34	2.61	0.18	0.04	0.01	0.02
	CD (p= 0.05)	6.33	1.06	8.01	NS	0.12	NS	0.05

*Mean data of nutrient content in grain and straw

Table 2: Effect of INM on yield and economics of under various treatments of hybrid rice

Symbol	Treatments	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Cost of cultivation(Rs. ha^{-1})	Gross return (Rs. ha^{-1})	Net return (Rs. ha^{-1})	B: C ratio
T_1	100% RDF	66.68	81.01	25723.59	68066.2	43242.61	1.64
T_2	75% RDF	53.20	65.62	24694.37	54424.4	29730.03	1.20
T_3	50% RDF	42.36	53.56	23665.80	43503.0	19837.20	0.83
T_4	75% RDF + 25% FYM	69.16	83.12	28464.73	70489.4	42024.67	1.47
T_5	50% RDF + 50% FYM	58.47	78.30	31685.88	60557.0	27871.12	0.87
T_6	25% RDF + 75% FYM	47.91	56.20	34507.03	48665.2	14158.22	0.41
T_7	100% FYM	41.40	50.09	37528.18	42235.8	4707.62	0.12
	SEm±	3.11	2.47				
	CD (P= 0.05)	6.78	5.39				

Geetadevi *et al.,* (2000).

Nutrient concentration

A cursory glance over the data presented in Table 1 clearly indicated that nitrogen, phosphorus and potassium content in plant were affected by various treatments. The higher concentration of N (1.07%), P (0.27%) and K (1.02%) plant were obtained with the application of the T_4- 75% RDF + 25% FYM which was statistically at par with T_1 in case of N content. The minimum N (0.84%), P (0.23%) and K (0.86%) content were observed by the application of T_3- 50% RDF through chemical fertilizer alone. Similar trend was obtained in K content with T_4 which was also at par with T_1 (1.02%). The combination of organic and inorganic sources significantly increased N, P and K concentration compared to inorganic fertilizer. These results conformity with findings reported by Manoj Dutta, *et al.,* (2010).

Crop yield

An examination of data from Table 2 manifested that maximum grain (69.16 q ha^{-1}) and straw yield (83.12 q ha^{-1}) were recorded under the treatment receiving T_4 and this was followed by 100 % RDF while significantly higher rest of over treatments. The minimum grain yield (41.40 q ha^{-1}) was recorded fewer than 100% N, P and K applied though FYM. The higher yield associated with higher level of inorganic fertilizers in combination with organic manures may be due to its greater availability and uptake of macro and micro-nutrients and active participation in carbon assimilation, photosynthesis, starch formation, translocation of protein and sugar, entry of water into plants root and development etc. Similar findings have also been reported by Choudhary *et al.,* (2014)

Economics

The data presented in Table 2 evident that higher gross returns (Rs. 70489.4 ha^{-1}) was found with T_4-75% RDF + 25% FYM followed by T_1- 100% RDF (Rs. 68066.2 ha^{-1}). However, highest net returns Rs. 43242.61 ha^{-1} and benefit: cost ratios 1.64 were obtained with the T_1- 100% RDF. The minimum net return of ¹ 4707.62 ha^{-1} and maximum cost of cultivation of Rs. 37528.18 ha^{-1} was computed in the treatment T_7-100% FYM-N. The cost of cultivation increased with increased dose of Farmyard manure.

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