The Bioscan 9(2): 595-597, 2014
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

EFFECT OF ORGANIC AND INORGANIC SOURCES OF NUTRIENT ON YIELD, YIELD ATTRIBUTES AND NUTRIENT UPTAKE OF RICE CV. PRH-10

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KEYWORDS
Rice
Yield
Organic and inorganic sources of nutrient
Vermicompost.

Received on :
18.05.2013

Accepted on :
18.03.2014

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ABSTRACT
A field experiment was carried out during *kharif* season 2011 to study the effect of organic and inorganic sources of nutrient on yield, yield attributes and nutrient uptake of rice cv. PRH-10. Application of organic and inorganic sources of nutrient in combination remarkably increased yield, yield attributes and nutrient uptake of rice than alone. 125% RDF + 5 t/ha vermicompost recorded significantly higher yield, yield attributes and nutrient uptake in comparison to other treatments and this was followed by 100% RDF + 5 t/ha vermicompost. 125% RDF + 5 t/ha vermicompost was increased the number of panicles (20.50%), panicle length (23.12%), panicle wt. (13.02%), 1000 grain wt. (12.90%), grain yield (31.15%), straw yield (37.12%), protein content (18.77%), N uptake in grain (36.81%) and straw (42.81%), P uptake in grain (32.62%) and straw (31.56%) and K uptake in grain (35.46%) and straw (25.39%) over control. The lower yield, yield attributes, gross return and nutrient uptake was recorded in control.

INTRODUCTION

Rice (*Oryza sativa* L.) is the most imported crop in India and is also the hub of food security of the global population. At global level, rice is grown on an area of about 155.62 million ha with production and productivity of 461 million tonne and 4.09 tonne/ha, respectively. India ranks first in respect of area 44.50 million ha second in production 102.75 million tonne, only after China, but the productivity of rice is very low only 2.20 tonne ha^{-1} (Anonymous, 2012). The adoption of modern farming practices and integrated nutrient management are essential to produce crops in line with the observed global standards of quantity and quality. Owing to high grain yield, wetland rice removes a substantial amount of major and minor nutrients from the soil, and deficiency of either nutrient reduces its grain yield. But with the present day high yielding cultivars, which have higher nutrient requirements, the use of inorganic fertilizers has increased considerably leading to decline in the use of organic materials (Hossain and Singh, 2000) The impact of increased fertilizer use on crop production has been large, but ever increasing cost of energy is an important constraint for increased use of inorganic fertilizer (Alim, 2012).

It is widely recognized that neither use of organic manures alone nor chemical fertilizers can achieve the sustainability of the yield under the modern intensive farming. Contrary to detrimental effects of inorganic fertilizers, organic manures are available indigenously which improve soil health resulting in enhanced crop yield. However, the use of organic manures alone might not meet the plant requirement due to presence of relatively low levels of nutrients. Therefore, 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). Results have also shown that integrated nutrients management increases the yield and nutrient uptake (Mohanty *et al*., 2013). The efficiency of nutrient use may be raised by the combined use of organic and inorganic fertilizers. Organic fertilizers not only act as the source of nutrients, but also provide micronutrients and modify soil-physical behaviour as well as increased the efficiency of applied nutrients (Pandey *et al*., 2007). Aromatic rice occupies a pivotal position in world because of their high quality. Traditional tall varieties of basmati constitute a sizable proportion of export, but their productivity is very low as compared to non basmati varieties. The recently developed aromatic rice variety 'PRH-10' which has yield potential of 7-8 tonne ha^{-1}. Rice variety 'PRH-10' is a fist kind of scented hybrid in India which can have a great potential in future to replace the 'Pusa Basmati-1'. Therefore, in view of the importance of the problems from the national point, the present research work was conducted with the objective of to study the effect of organic and inorganic sources of nutrient on yield, yield attributes and nutrient uptake of rice.

MATERIALS AND METHODS

Field experiment was conducted during *kharif* season 2011 at Agricultural Research Farm of Institute of Agricultural

Table 1: Effect of organic and inorganic sources of nutrient on yield attributes, yield and protein content of rice

Treatment	Panicles/m^2 (No.)	Panicle length (cm)	Panicles wt. (g)	1000 grain wt. (g)	Grain yield (t/ha)	Straw yield (t/ha)	Protein content (%)
Control	211.86	23.27	3.15	18.6	4.03	6.23	7.3
75% RDF	215	23.33	3.23	19.03	4.23	6.6	7.61
100%RDF	220.61	25.5	3.26	19.19	4.38	7.02	7.77
125%RDF	223.04	25.63	3.3	20.08	4.56	7.49	7.87
2.5 t/ha vermicompost	217.3	24.88	3.23	19.33	4.37	6.76	7.68
5 t/ha vermicompost	219	25	3.27	20	4.47	7.33	7.93
75% RDF + 2.5 t/ha vermicompost	222.81	26.28	3.27	20.18	4.75	7.72	8.28
100%RDF + 2.5 t/ha vermicompost	223.06	26.8	3.3	20.27	4.79	7.78	8.39
125%RDF + 2.5 t/ha vermicompost	237.43	27.5	3.37	20.41	4.84	7.78	8.56
75% RDF + 5 t/ha vermicompost	228.26	27.19	3.33	20.36	4.94	8.07	8.5
100%RDF + 5 t/ha vermicompost	254.33	28.6	3.5	20.48	5.14	8.31	8.6
125%RDF + 5 t/ havermicompost	255.46	28.65	3.56	21	5.28	8.54	8.67
SEm$^+$	6.83	0.83	0.09	0.37	0.14	0.23	0.29
CD (P=0.05)	20.04	2.45	0.25	1.09	0.42	0.68	0.84

Table 2: Effect of organic and inorganic sources of nutrient on N, P and K uptake of rice

Treatment	Nitrogen uptake (kg/ha)		Phosphorus uptake (kg/ha)		Potassium uptake (kg/ha)	
	Grain	Straw	Grain	Straw	Grain	Straw
Control	43.38	27	6.56	7.32	14.24	100.45
75% RDF	45.19	27.25	7.02	7.53	15.28	102.18
100%RDF	47.3	27.82	7.3	7.9	15.34	102.53
125%RDF	48.39	28.31	7.41	8.03	16.13	104.29
2.5 t/ha vermicompost	48.32	27.55	7.35	7.95	15.86	103.43
5 t/ha vermicompost	49.56	29.71	7.42	8.19	16.72	104.58
75% RDF + 2.5 t/ha vermicompost	50.39	27.79	7.63	8.2	17.24	106.26
100%RDF + 2.5 t/ha vermicompost	50.65	30.15	7.88	8.57	17.44	108.35
125%RDF + 2.5 t/ha vermicompost	51.33	30.56	8.06	8.6	17.78	110.45
75% RDF + 5 t/ha vermicompost	53.7	33.15	8.46	9.05	18.2	110.7
100%RDF + 5 t/ha vermicompost	54.46	34.52	8.69	9.09	19.23	114.97
125%RDF + 5 t/ha vermicompost	59.35	38.56	8.7	9.63	19.29	125.95
SEm$^+$	1.9	0.6	0.3	0.3	0.8	4.7
CD (P=0.05)	6.1	2	0.9	1	2.5	14.9

Sciences, Banaras Hindu University, Varanasi located at 25º47′ N latitude, 83º03′ E longitude and at altitude of 128.93 MSL from Indo-Gangetic region of eastern U.P. The soil of experimental site was sandy clay loam, neutral in reaction (pH 7.5), low in organic carbon (0.34%), available nitrogen (219 kg/ha), medium in available phosphorus (32.3 kg/ha and) available potassium (180 kg/ha). The experiment was laid out in randomized block design having 12 treatments *viz*, Control (T_1), 75% RDF (T_2), 100% RDF (T_3), 125% RDF (T_4), 2.5 t/ha vermicompost (T_5), 5 t/ha vermicompost (T_6), 75% RDF + 2.5 t/ha vermicompost (T_7), 100% RDF + 2.5 t/ha vermicompost (T_8), 125% RDF + 2.5 t/ha vermicompost (T_9), 75% RDF + 5 t/ha vermicompost (T_{10}), 100% RDF + 5 t/ha vermicompost (T_{11}) and 125% RDF + 5 t/ha vermicompost (T_{12}) and replicated thrice. Recommended fertilizer 120:60:40 kg/ha of N, P_2O_5 and K_2O, respectively as per recommendation were applied through Urea, DAP and muriate of potash as per treatments. Half dose of nitrogen and full dose of phosphorus and potassium were applied basally. Remaining half N dose was applied in two equal splits once at tillering and rest panicle initiation stages. However, vermicompost was applied at three day before transplanting. Seedlings of 25 days of 'PRH 10' scented hybrid rice were transplanted, keeping 1 seedling/hill at 20 X 10 cm spacing on 30 July in 2011 under puddle conditions. The crop was harvested at the end of October. The other agronomic practices were followed as per standard recommendations.

Experimental design, Data collection and Analysis

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 "Analysis of Variance" (ANOVA) as described by Gomez and Gomez (1984). The significance of treatments was tested by 'F' test (Variance ratio). Standard error of mean (SEm ±) was computed in all cases. The difference in the treatment mean were tested by using critical difference (CD) or least significant difference (LSD) at 5% level of probability.

Protein content (%)

Protein content (%) in grain was worked out by multiplying the nitrogen content in grain by the factor 6.25 (A.O.A.C., 1970).

Nutrient uptake

Nutrient uptake/removal in grain and straw of the crops were calculated in kg ha^{-1} in relation to yield ha^{-1} by using the following formula (Jackson, 1967)

Nutrient uptake (kg/ha) = Nutrient content (%) × yield (q/ha)

RESULTS AND DISCUSSION

Result revealed that the application of organic and inorganic source of nutrient in combination increased the yield attributes (Table 1). The yield attributes were increased with increasing level of RDF and vermicompost alone and in combination. Application of 125% RDF + 5 t/ha vermicompost significantly recorded higher yield attributes *viz*, number of panicle/m^2 (256.66), panicle length (28.65 cm), panicle wt. (3.56 g) and 1000 grain wt. (21.00 g) and followed by treatment 100% RDF + 5 t/ha vermicompost than other combination and significantly superior over control, RDF and vemicompost alone. The minimum yield attributes *viz*, number of panicle/ m^2 (211.66), panicle length (23.27 cm), panicle wt. (3.10 g) and 1000 grain wt. (18.60 g) were recorded in control. 125% RDF + 5 t/ha vermicompost was recorded 20.50%, 23.12%, 13.02% and 12.90% more number of panicles, panicle length, panicle wt. and 1000 grain wt. respectively, over control. Similar finding were also reported by Ramalakshmi *et al*. (2012); Alim, (2012). The higher yield attributes is might be due to higher levels of inorganic fertilizers have been increases the activity of photosynthesis and enzymes which responsible for transformation of energy, carbohydrates, fat metabolism and respiration of plant. Organic manures acting as slow release source of N are expected to more closely match with N and supply of other nutrients with demand of rice crop and this could reduce the N losses and also improved the nutrient use efficiency particularly of nitrogen (Becker *et al*., 1994). Therefore, 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).

Significantly higher grain yield (5.29 t/ha), straw yield (8.54 t/ ha) and protein content (8.67%) were recorded under 125% RDF + 5 t/ha vermicompost than control, RDF and vermicompost alone. This was followed by treatment 100% RDF + 5 t/ha vermicompost. Minimum grain yield (43.26 qha^{-1}), straw yield (69.29 qha^{-1}) and protein content (7.30%) were recorded under control. The application of 125% RDF + 5 t/ha vermicompost increased the grain yield (31.15%), straw yield (37.12%) and protein content (18.77%) over control. 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. It also enhances the process of tissue differentiation i.e. from somatic to reproductive phase leading to higher grain and straw yield. Accumulation of protein in grain under adequate N supply might be accounted to continuous availability of nitrogen for protein synthesis. This was also may be due to the higher yield attributes under this treatment. The results are also in conformity with findings of Kumar and Singh (2006); Hossaen *et al*. (2011); Mohanty *et al*. (2013).

Data in Table 2 show that amount of NPK uptake by crops as influenced by different organic and inorganic sources of nutrient. The amount of NPK uptake by rice remarkably increased due to the combined use of organic and inorganic sources of nutrient. Remarkably higher uptake of NPK was obtained in treatment receiving 125% RDF + 5 t/ha vermicompost. The percent increased of N, P and K uptake in grain and straw was 36.81%, 42.81%, 32.62%, 31.56%, 35.46% and 25.39% respectively, over control. The lower uptake was noticed in control plot. The higher NPK uptake may be due to higher yield received in these treatment similar finding also given by Sathish *et al*. (2011); Ramalakshmi *et al*. (2012).

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