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Research Paper

Integrated nutrient management in the system of rice intensification techniques (SRI) for *Kharif* rice (*Oryza sativa* L.) under middle Gujarat conditions

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ABSTRACT

An experiment was conducted during *Kharif* 2009 to integrated nutrient management in the system of rice intensification techniques (SRI) for *Kharif* Rice (*Oryza sativa* L.) under middle Gujarat conditions at insturatand farm, B.A. College of Agriculture. The results revealed that the treatment combination M_4N_3 recorded significantly higher grain yield (4032 kg ha^{-1}) over rest of the treatment combinations, it was found at par with M_4N_2. Economically treatment combination M_4N_2 was proved better with net realization (Rs. 30604 ha^{-1}) and BCR (1: 2.28), followed by treatment combination M_4N_3.

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Key words : Integrated nutrient management, System of rice intensification techniques, Rice, Organic manures, RDN

INTRODUCTION

It is the most important food crop of India and second most important crop of the world. It is raised on about one-tenth of the earth's arable land and is the single largest source of food energy to half of humanity particularly in Asia where rice is the staple food. Rice being high water requirement crop, there is a need to search for alternate methods to reduce water requirement without reduction in the yield. The introduction of new aerobic rice technology in rice cultivation has proved to get reasonably good yields with 2-3 irrigation, thus saving 30-40 per cent of water. System of rice intensification (SRI) is another emerging water saving technology (Laulanie, 1993). An INM plays a vital role in sustaining both the soil health and crop production on long term basis (Singh *et al.,* 2004). The INM primarily related to combined application of different sources of plant nutrients for sustainable crop production without degrading the natural resources.

MATERIALS AND METHODS

The field experiment was conducted during the *Khairf* season of 2009 at Anand, Gujarat. The soil was sandy loam with pH 7.5, organic carbon 0.32 (%), EC 0.20 dSm^{-1}, available P_2O_5 28.15 kg ha^{-1} and K_2O 211.48 kg ha^{-1}. The experiment was laid out in split plot design with organic manures in main plots and RDN in subplots. Treatments consisting of four organic manures *viz.,* M_1-FYM @ 10 t ha^{-1}, M_2-vermicompost @ 3 t ha^{-1}, M_3-poultry manure @ 2 t ha^{-1}, M_4- castor cake @ 1 t ha^{-1} and four levels of nitrogen control, 50, 75, 100 kg ha^{-1}. Rice variety GR-12 was transplanted at 25×25 cm spacing with one seedling $hill^{-1}$ during July and the crop was harvested during Nov. The nitrogen fertilizer was applied as per treatments through urea and phosphorus @ 25 kg ha^{-1} through SSP as basal dose to all the treatments. The remaining half dose of nitrogen was top dressed in two equal splits each at tillering and panicle initiation stages. Remaining all agronomic practices were followed as per recommendation of the crop.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as well as relevant discussion have been presented

Table 1 : Effect of organic manures and nitrogen levels on growth parameters of transplanted *Kharif* rice under SRI techniques

Treatments	Plant height (cm)			Total number of tillers hill^{-1}	Total number of productive tillers hill^{-1}	Number of panicles hill^{-1}	Dry matter accumulation at 40 DATP (g plant^{-1})
	30 DATP	60 DATP	At harvest				
Organic manures							
FYM 10 t ha^{-1}	54.40	84.25	97.56	33.80	31.86	27.81	1.36
VC 3 t ha^{-1}	55.89	83.75	89.50	33.51	29.16	27.31	1.26
PM 2 t ha^{-1}	56.83	85.75	97.94	34.06	30.34	28.81	1.30
CC 1 t ha^{-1}	58.10	96.13	99.56	37.49	34.13	30.81	1.40
S.E. ±	0.72	1.77	2.20	0.84	1.00	0.59	0.01
C.D. (P=0.05)	2.33	5.66	7.06	2.69	3.22	1.89	0.06
Nitrogen levels							
Control	55.53	86.88	92.38	32.96	28.75	28.19	1.30
50 % RDN	55.83	87.00	95.81	33.54	31.56	28.69	1.32
75 % RDN	56.63	87.44	97.44	35.98	31.64	28.75	1.33
100 % RDN	57.24	88.56	98.94	36.39	33.54	29.13	1.38
S.E. ±	0.67	1.11	1.38	0.61	0.87	0.45	0.01
C.D. (P=0.05)	NS	NS	3.96	1.74	2.51	NS	0.04

NS=Non-significant

under following heads :

Effect of organic manures:

Rice crop manured with castor cake @ 1 t ha^{-1} significantly increased the growth parameters *viz.,* plant height, total number of tillers hill^{-1}, total number of productive tillers hill^{-1}, number of panicles hill^{-1} and dry matter accumulation (Table 1) as well as yield attributes *viz.,* panicle length, panicle weight, test weight, grain and straw yield (Table 2).

This might be due to early availability of nitrogen by castor cake during vegetative growth of the plant under aerobic conditions provided under to SRI technique, which was reflected into significant increase in plant height at various growth stages. More over, the increased nutrient availability from the castor cake application might have increased the various endogenous hormonal levels in plant tissues, which might be responsible for enhanced total number of tillers hill^{-1}, total number of productive tillers hill^{-1} and number of panicles hill^{-1}. Grain and straw yield were significantly increased due to the application of castor cake @ 1 t ha^{-1} (M_4) over application of FYM @ 10 t ha^{-1} (M_1) and VC @ 3 t ha^{-1} (M_2), but it remained at par with (Poultry manure @ 2 t ha^{-1} (M_3). These results are in line with those reported by Kumar and Yadav (2008) and Bafna *et al*. (2010).

Effect of nitrogen levels:

Application of nitrogen significantly increased the growth parameters as well as yield attributes. The plant height increased progressively up to 100 % RDN over control. This acceleration in plant height with increased nitrogen application might be due to enhanced cell elongation and cell division which probably resulted in to large leaf area and the higher plant height. The findings confirm the observations of Zaheen *et al*. (2006) and Islam *et al*. (2008).

Significantly the higher total number of tillers hill^{-1}, total number of productive tiller hill^{-1}, total number of productive tillers hill^{-1}, dry matter accumulation, panicle length, panicle weight and test weight was recorded under 100 % RDN over control, which was found at par with N_2. An increase in total number of tillers hill^{-1} as well as in total number of productive tillers hill^{-1} under N_3 was higher to the tune of 9 % and 14 %, respectively over N_0 (control). This might be by virtue of an increase in growth parameters which promoted vegetative growth under application of higher dose of nitrogen tended to produce bulk of stover resulting from efficient utilization of plant nutrients, water, radiation and increased metabolic activities under SRI, which led to produce more dry matter production. This finding is in line with those reported by Rao *et al.* (2005).

The result of grain yield revealed that application of nitrogen being at par among themselves recorded significantly higher grain yield over control. Treatment N_3 (100 % RDN) recorded 19 % higher grain yield over N_0 (control). The beneficial effect of organic manures on N, P and K uptake might be attributed to their faster release of nitrogen during mineralization by virtue of propitious air-moisture proportion prevailed in the field due to SRI and there by resulting in higher N uptake by rice owing to higher grain yield. The cumulative effects of all growth

Table 2 : Effect of different treatments on yield attributes and grain yield of transplanted *Kharif* rice under SRI techniques

Treatments	Panicle length (cm)	Panicle weight (g)	Test weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
Organic manures					
FYM 10 t ha^{-1}	20.04	2.28	15.79	3247	7956
VC 3 t ha^{-1}	19.43	2.32	15.02	2837	8269
PM 2 t ha^{-1}	20.66	2.24	16.60	3245	9343
CC 1 t ha^{-1}	21.18	2.54	17.82	3615	9388
S.E. ±	0.38	0.08	0.45	147.53	267.73
C.D. (P=0.05)	1.22	NS	1.44	471.98	856.51
Nitrogen levels					
Control	19.26	2.26	15.48	2872	8011
50 % RDN	19.86	2.28	15.69	3174	8575
75 % RDN	20.96	2.34	16.85	3347	9008
100 % RDN	21.23	2.51	17.21	3550	9362
S.E. ±	0.29	0.06	0.42	128.33	206.44
C.D. (P=0.05)	0.84	0.17	1.20	368.07	592.10

NS=Non-significant

and yield attributing characters might also contributed to pronounced response of nitrogen application on grain yield. Such beneficial effect of nitrogen had also been reported by Banik and Bejbaruah, (2004) and Singh *et al*. (2006).

Economics:

From the economics of different treatment combinations treatment combination castor cake @ 1 t ha^{-1} with 75 % RDN incurred the maximum net realization of Rs. 30604 ha^{-1}, with BCR of 1:2.28 followed by treatment combination castor cake @ 1 t ha^{-1} with 100 % RDN with net realization and BCR of Rs. 30382 ha^{-1} and 1:2.25, respectively (Table 3). This might be contributed due to saving of 25 % nitrogen (25 kg N ha^{-1}) in the form of fertilizer coupled with the cheapest source of organic manure (Rs. 2250 t^{-1}) at the lowest rate (1 t ha^{-1}) of application. The similar trend was obtained by Nawlakhe and Jiotode, (2008).

Conclusion:

Thus, from the point of view of production and net profit from rice variety GR-12 cultivated under SRI techniques can be secured through application of castor cake @ 1 t ha^{-1} along with 75 % recommended dose of nitrogen in *Kharif* season under middle Gujarat Agro-climatic conditions.

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