Agriculture for Sustainable Development 2(1):39-42, 2014/Article ISSN 2347-5358 (Print)/ 2349-2228 (Online)

Agriculture for Sustainable Development

http://www.sustainableagriculture.in

EFFECT OF ORGANIC SOURCES AND NITROGEN LEVELS ON GROWTH AND YIELD OF *KHARIF* RICE (*ORYZA SATIVA* L.) UNDER SRI TECHNIQUE

MAMTA MEENA*, M. V. PATEL, TANIA DAS[1] AND H. P.VERMA[2]

B. A. College of Agriculture, Anand Agricultural University, Anand (Gujarat)- 388 110, India

Received: 28.02.2014 **Revised accepted: 05.04.2014**

ABSTRACT

The field experiment was conducted at Agronomy Farm, B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat during the *kharif* season of the year 2009. The results revealed that initial and at harvest plant population was not influenced by organic manures. However, growth attributes such as plant height, total number of tillers/hill, total number of productive tillers/hill, number of panicles/hill, dry matter accumulation and test weight showed significant improvement due to impact of different organic manures at various growth stages. Significantly higher grain (3550 kg/ha) and straw yield (9362 kg/ha) were recorded with application of 100% RDN.

Keywords:

Organic Manures, Nitrogen, Rice, SRI Techniques

INTRODUCTION

Among cereal crops, rice (*Oryza sativa* L.*)*, belongs to the family *Gramineae*, is a major source of food after wheat for more than 2.7 billion people on a daily basis. It is the most important crop of India and second most important crop of the world. It is planted 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. Major growing states in the country are West Bengal, Andhra Pradesh, Chhattisgarh, Tamilnadu, Karnataka, Assam, Maharashtra, Orissa, Punjab and Gujarat. Rice consumes 70 % of water used in Agriculture; hence judicious use of water for rice production in a sustainable manner has become prime importance. SRI technology of rice cultivation increases rice production and raises the productivity of land, labour, water and capital through different practices. Under SRI technique seedlings of the age 11-12 days have been transplanted at the spacing of 25 × 25 cm. For one hectare of transplanting $1/5^{th}$ of seed rate is required compared to traditional system of rice cultivation. That means, instead of 25 kg/ha under traditional cultivation, it requires only 5 kg/ha seeds under SRI. Not only that, but instead of flooding the paddy field, soil should be kept moist during vegetative phase under SRI and only at later stages from panicle initiation till physiological maturity 5 cm water height should be maintained. Under SRI methodology is of interest, because of its potential to achieve higher yield at lower cost of production along with saving of 40 % water (Rao *et al.*, 2005; Anon, 2009). An integrated nutrient management plays a vital role in sustaining both the soil health and crop production on long term basis (Singh *et al.*, 2004). The integrated nutrient management primarily relates to combined application of different sources of plant nutrient (organic and inorganic) for sustainable crop production without degrading the natural resource on long term basis. Application of organic manure *viz.*, FYM, vermicompost, poultry manure and castor cake may serve as source of macro and micro nutrients as well as aggregating agent.

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 C 0.32 (%), EC 0.20 dS/m, available P_2O_5 28.15 kg/ha and K_2O 211.48 kg/ha. The experiment was laid out in split plot design (SPD) with organic manures in main plots and RDN in subplots. Treatments consisting of four organic manures *viz.*, M_1-FYM @ 10 t/ha, M_2-Vermicompost @ 3 t/ha, M_3-Poultry manure @ 2 t/ha, M_4-Castor cake @ 1 t/ha and four levels of nitrogen control, 50, 75, 100 kg/ha. Rice variety GR-12 was transplanted at 25 × 25 cm spacing with one seedling/hill during July and the crop was harvested during the month of November. The nitrogen fertilizer was applied as per treatments through urea and phosphorus @ 25 kg/ha through SSP as basal dose to all the treatments.

RESULTS AND DISCUSSION

Effect of organic manures on growth

The results indicate that differences in plant population at 20 DAT and at harvest due to different organic manures *Viz*., FYM, VC, PM and castor cake were found non-significant, indicating homogenous plant stand throughout the experimental period. The non significant results for plant population at 20 DAT and at harvest were might be due to the fact that organic manures improve physical, chemical as well as biological properties of the soil resulting into more survival of the seedlings (Ananda *et al*., 2006). Results indicate in respect to plant height (Table-1) indicated that the differences in plant height at 30, 60 DAT and at harvest due to different treatments of organic manures were significant.

An application of castor cake (castor cake @ 1 t/ha) recorded significant plant height increase in at 30, 60 DAT and at harvest, which remained at par with PM and VC at 30 DAT and with PM and FYM at harvest. The effect of organic manures was significant with respect to total number of tillers/hill, total number of productive tillers/hill and number of panicles/hill. Treatments M_4 (castor cake @ 1 t/ha) recorded significantly higher total number of tillers/hill (37.49) over rest of the treatments barring treatment M_1. The same treatment (M_4) recorded significantly the higher total number of productive tillers/hill (34.13), number of panicles/hill (30.13) and test weight (17.82) over rest of the treatments. This might be due to early availability of nitrogen by castor cake during vegetative growth of the plant under aerobic conditions provided due to SRI technique, which was reflected into significant increase in plant height at various growth stages. Result of dry matter accumulation at 40 DAT was significantly influenced due to different levels of organic manures. The application castor cake @ 1 t/ha (M_4) resulted in to significantly increase in dry matter accumulation (1.40 g/plant) at 40 DAT, it was at par with M_1. This could be due to better initial vigorous growth under the treatment M_4 accrued to better nourishment of the crop. These findings are in close conformity with Kumar and Yadav (2008).

Effect of organic manures on yield parameters

Being at par with M_3 (PM @ 2 t/ha), significantly higher grain and straw yields (3615 and 9388 kg/ha, respectively) were recorded under the treatment M_4 (castor cake @ 1 t/ha). An augmentation in grain as well as straw yield of rice might be the result of an vigorous vegetative growth enhancing plant height, total number of tillers/hill, total number of productive tillers/hill, number of panicles/hill and dry matter accumulation under M_4 (castor cake @ 1 t/ha). These results are in close agreement with those reported by Kumar and Yadav (2008).

Effect of nitrogen levels on growth

The differences in initial as well as at harvesting plant population due to different nitrogen levels were also found non-significant, indicating that the differences observed in growth and yield attributes were mainly due to treatment effect (Table-1). Intergradations effect of organic manures and nitrogen under SRI (Anon, 2009). Results on periodical observation on plant height at 30, 60 and at harvest revealed that nitrogen levels did not influenced the plant height during at 30 and 60 DAT. However, at harvest significantly higher plant height (98.94 cm) was recorded under N_4 (100 % RDN).

Data indicates that the total number of tillers/hill and total number of productive tiller/hill showed a significant increase with increasing levels of nitrogen (Table-). Treatment N_4 (100 % RDN) recorded significantly higher total number of tillers/hill (37.49), test weight (17.21) which remained at par with N_3 (75 % RDN). The similar treatment (N_4) also produced significantly higher total number of productive tillers/hill (33.54), but this time it was found at par with N_3 and N_2 (75 % and 50 % RDN). An increase in total number of tillers/hill as well as in total number of productive tillers/hill under N_4 was higher to the tune of 9 % and 14 %, respectively over N_0 (control). This increase might be attributed to more nitrogen supply over the entire crop growth period under congenial aerobic conditions provided under SRI, resulting in to more synthesis of photosynthesis and a positive source to sink relationship (Zaheen *et al.,* 2006; Islam *et al*., 2008).

The result in respect to dry matter accumulation at 40 DAT was significantly affected due to nitrogen. Significantly the highest dry matter accumulation (1.38 g/plant) was recorded under N_4, the increase being 6 % over N_0 (control). A perusal of the result of grain yield revealed that application of nitrogen being at par among them recorded significantly higher grain yield over control. Treatment N_4 (100 % RDN) recorded 19 % higher grain yield over N_0 (control).

Effect of nitrogen levels on yield parameter

The application of nitrogen @ N_4 (100 % RDN) which is had a linear and significant impact on straw yield of rice over control (Table-2). 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. Such beneficial effect of nitrogen had also been reported Banik and Bejbaruah, (2004); Singh *et al*. (2006).

Table 1 Plant population and plant height of rice as influenced by organic manures and nitrogen levels of transplanted *kharif* rice under SRI techniques

Treatment	Plant population (Net/plot)		Plant height (cm)		
	20 DAT	At harvest	30 DAT	60 DAT	At harvest
Organic Manures					
M_1- FYM: 10 t/ha	181	170	54.40	84.25	97.56
M_2-Vermicompost: 3 t/ha	176	162	55.89	83.75	89.50
M_3-Poultry manure: 2 t/ha	177	164	56.83	85.75	97.94
M_4- Castor cake: 1 t/ha	185	173	58.10	96.13	99.56
CD (*P*=0.05)	NS	NS	2.33	5.66	7.06
Nitrogen Levels					
N_0- Control	176	163	55.53	86.88	92.38
N_1- 50% RDN	178	166	55.83	87.00	95.81
N_2- 75% RDN	181	166	56.63	87.44	97.44
N_3- 100% RDN	183	174	57.24	88.56	98.94
CD (*P*=0.05)	NS	NS	NS	NS	3.96

Table 2 Effect of organic manures and nitrogen levels on growth and yield attributes of transplanted *kharif* rice under SRI techniques

Treatment	Tillers/hill		Panicles/hill	Test weight (g)	Dry matter production at 40 DAT (g)	Yield (kg/ha)	
	Total	Productive	30 DAT	60 DAT		Grain	Straw
Organic Manures							
M_1- FYM: 10 t/ha	33.80	31.86	27.81	15.79	1.36	3247	7956
M_2-Vermicompost: 3 t/ha	33.51	29.16	27.31	15.02	1.26	2837	8269
M_3-Poultry manure: 2 t/ha	34.06	30.34	28.81	16.60	1.30	3245	9343
M_4- Castor cake: 1 t/ha	37.49	34.13	30.81	17.82	1.40	3615	9388
CD (*P*=0.05)	2.69	3.22	1.89	1.44	0.06	472	857
Nitrogen Levels							
N_0- Control	32.96	28.75	28.19	15.48	1.30	2872	8011
N_1- 50% RDN	33.54	31.56	28.69	15.69	1.32	3174	8575
N_2- 75% RDN	35.98	31.64	28.75	16.85	1.33	3347	9008
N_3- 100% RDN	36.39	33.54	29.13	17.21	1.38	3550	9362
CD (*P*=0.05)	1.74	2.51	NS	1.20	0.04	368.1	592.1

CONCLUSIONS

Thus, from above findings, it can be concluded that application of castor cake @ 1 t/ha along with 75% RDN gave better production and higher profit from rice variety GR 12 in kharif season grown under SRI technique in middle Gujarat conditions.

REFERENCES

Ananda, M.G., Ananda, M.R., Reddy, V.C. and Ajayakumar, M.Y. 2006. Influence of different organic sources on yield and its components and

benefit: cost ratio of paddy (*Oryza sativa* L.) and groundnut (*Arachis hypogaea* L.) in paddy-groundnut cropping system. *Crop Research*. **31**(3): 329-333.

Anonymous. 2009. Recommendation approved by 5th Combined Agresco meeting, Vol.-I, held at SDAU, Sardarkrushinagar. pp.22-27.

Banik, P. and Bejbaruah, R. 2004. Effect of vermicompost on rice (*Oryza sativa* L.) yield and soil fertility status of rainfed humid sub-tropics. *Indian Journal of Agriculture Sciences.* **74**(9):488-491.

Islam, M.S., Akhter, M.M., Rahman, M.SQ., Banu, M.B. and Khalequzzaman. 2008. Effect of nitrogen and number of seedlings per hill on the yield and yield components of *T. Aman* rice (BRRI Dhan 33). *International Journal of Sustainable Crop Production.* **3**(3):61-65.

Kumar, J. and Yadav, M.P. 2008. Effect of conjunctive use of organic, inorganic and bio-fertilizers on growth and yield attributes, yield and nutrient uptake in hybrid rice. *Research on Crops*, **9**(3): 511-513.

Rao, Y., Singh, R.M. and Patra, A.K. 2005, System of Rice Intensification as a method of stand Establishment in rice. *American Eurasian Journal of Agricultural and Environment Sciences.* **5**(2):189-195.

Singh, R., Prasad, K. and Singh, D.K. 2006. Effect of soil conditioners and fertilizer doses on yield and yield attributes of rice (*Oryza sativa* L.) in rice-wheat sequence. *Crop Research*. **31**(3):343-345.

Singh, T., Shivay, Y.S. and Singh, S. 2004. Effect of date of transplanting and nitrogen on productivity and nitrogen use indices in hybrid and non hybrid aromatic rice. *Acta Agronomica Hungarica*, **52**(3):245-252.

Zaheen M., Tahir, H.A., Ehsan S.M., Ali, R.I., Ashraf, Mirza, M. and Ahmad, M. 2006. Effect of N levels on yield and yield components of Basmati 2000. *Journal of Agricultural Research.* **44**(2): 15-119.