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Original Research Article

Performance of INM Modules and Different Cultural Practices on Growth, Yield and Yield Attributes of Basmati Rice

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Keywords

Rice, INM, SRI, Yield, Growth and Yield attributes

A B S T R A C T

The present investigation was carried out during kharif season of 2014 and15. The entitled performance of different integrated nutrient management modules in different cultural practices on growth, yield and yield attributes on crop variety Pusa Basmati-1. SRI cultivation practices were recorded maximum growth parameter (plant height, shoots m^{-2}) and yield attributing (no. of grains per panicle, length of panicle, no. of panicle m^{-2} and test weight) as compared to conventional transplanting and minimum by broadcasting method. The grain yield (39.53 and 41.3 q ha^{-1}) was observed with SRI practices which were higher as over to other cultural practices. Beside the application of T_3 (75%NPK+Zn+25%GM-N) were found tallest plant height and more no. of shoots followed by T_1 (100%NPK + Zn) and T_2 (75%NPK+Zn +25% FYM-N). The grain yield was recorded under T_3 (36.52 and 38.16 q ha^{-1}) which was superior to other INM treatments while grain yield was significantly lower with treatment T_5 (30.15 and 31.51 q ha^{-1}) over rest of the INM modules during both the year of experimentation.

Introduction

Basmati rice is an important agricultural export commodity of India. Moreover, emergence of a sizeable middle income group and a perceptible change in their food habit has increased the demand of quality rice like basmati in India. Basmati rice is expected to respond to SRI techniques to overcome the low productivity constraint. Literature indicates very vital role of seedling age, spacing and nutrient management practices on growth and productivity of rice in SRI method. The above factors of productivity need to be optimized with different rice varieties especially basmati rice under different agro-climatic zones for achieving high grain yield. System of Rice Intensification (SRI) is another alternative practice to solve the water crisis and as a methodology for increasing the productivity of irrigated rice by changing the management of plant, soil, water and nutrients because continuous use of conventional practices is depleted nutrient, closely planting and high requirement of water causes decrease production and productivity of rice. The rice yield could be tripled by adopting SRI method compared to traditional method of cultivation mainly due to planting of seeding before third phyllochron leads to higher productive tillers and yield (Andrainaivo, 2002). Integrated nutrient management (INM) aims to improve soil health and sustain high level of productivity and production (Prasad *el al.,* 1995). Organics supply nutrients at the peak period of absorption, and also provide micro nutrients and modify soil physical behavior as well as increase the efficiency of applied nutrients (Pandey *et al.,* 2007). Farmyard manure (FYM) is being used as major source of organic manure in field crops as it supplies all essential plant nutrients and increases activities of microbes (Sutaliya and Singh, 2005). Limited availability of FYM is however an important constraints in its uses as source of nutrients (Sharma *et al.,* 2006). Sunnhemp and *Dhaincha* are popular legumes for green manuring in rice and can accumulate up to 100 kg N ha^{-1} in 50-55 days. Incorporation of these green manures *in situ* before transplanting rice supplies about 45-60 kg N ha^{-1}, besides providing a significant residual effect to the succeeding crops. Under INM practices is not only increase production but increase with fertility and productivity of the soil.

Materials and Methods

The experiment was laid out at Instructional Farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during *kharif* season of 2014 & 2015, which is situated on Faizabad- Raibarely road about 42 km away from Faizabad city. Experimental site falls under subtropical climate in Indo-Gangetic plains having alluvial calcareous soil and lies between 24.4^0 - 26.56^0 North latitude and 82.12^0 - 83.98^0 East longitude with an elevation of about 113 m from mean sea level. The experimental field was well leveled having good irrigation and drainage facilities. The source of irrigation was the tube well. The experiment was conducted on the Instructional farm of the university using Split Plot Design (SPD) having three replication and fifteen treatments combination while under main treatment three C1 – SRI (System of Rice Intensification), C_2 - Conventional method and C_3 - Broad casting and five under sub treatment like: T_1 - 100% NPK + Zn, T_2 - 75% NPK + Zn + 25% FYM-N, T_3 - 75% NPK + Zn + 25% G.M-N, T_4 - 50% NPK + Zn + 25% FYM-N + 25% GM-N and T_5 - 75% FYM-N + 25% GM-N with NPK splitting and with organic manure and green manure on different doses (Table 1).

Results and Discussion

Growth characters

Application of INM modules with 75%NPK+Zn+25%GM-N significantly the plant height and shoot m^{-2} in SRI as compare to conventional transplanting and broadcasting in Table No.2 and 3. The plant height increase number of shoots m^{-2} at 55 DAS, 80 DAS, 105 DAS and at harvest stage. SRI might have recovered fast due to lower planting shock and started absorbing nutrients and water to support faster growth and hence higher plant height were observed in SRI in comparison to transplanting method. As effect of INM modules concern, the tallest plant height was observed by T_3-75% NPK + Zn + 25% GM-N followed by T_1-100% NPK + Zn over other INM treatment respectively. It may be due to attribute to the better availability of nutrients due to incorporation of green manure, it also improve the physical condition of soil thereby improving efficiency of utilization of native as well as applied nutrients. The higher number of shoots m^{-2} in SRI was reported as compare to other culture practices. it may be due to attributed to wider spacing (25 x 25) for plants and also

12 days seedlings adopted in new site more speedly than other cultural practices which resulted greater tiller production. The green manure in INM treatments improved the physical condition of soil and enhanced the availability of nutrients from applied as well as soil sources which helps to increase number of shoots m^{-2} under T_3 followed by T_1 and T_2 over rest of the INM treatments. These results are conformity with the findings of Ghosh *et al.*, (2014), Sujata *et al.*, (2014) and Ghosh *et al.*, (2015).

Yields attributes and yield

Significantly effect of INM modules and cultural practices on increase number of panicle m^{-2}, length of panicle, number of grains panicle m^{2} and test weight (Table no. 4). The higher yield attributing characters were recorded with SRI method compare than conventional and broad casting practices. SRI may be because transplanting of young seedling (12 day old) with more spacing (25 x 25 cm) exhibited taller plant at early growth stages and had greater tiller production than common transplanting seedling (25 days) spacing (20 x 10 cm). The young seedling avoid transplanting shock quickly and established themselves well at early stage that helped early promoting of growth and yield attributes as compared to transplanting and broadcasting.

As the effect of INM modules, the maximum number of panicle m^{-2}, length of panicle, number of grain panicle^{-1} and test weight were recorded under treatment T_3-75% NPK + Zn + 25% GM-N followed by T_1-100% NPK + Zn over other INM treatments. The superiority of the treatments may be explained on the basis of balanced nutrient supply with organic and inorganic which enhance cell division, photosynthesis and reproductive phase which resulted more number of grains per panicle, number of panicle m^{-2}, length of panicle and test weight. The higher growth attributes might because of improved physical condition of soil, thereby improving the efficiency and utilization of native as well as applied nutrients. Similar result was also reported by Awan *et al.*, (2000), Ghosh *et al.*, (2014) and Shankar and Laware (2011).

Table.1 The treatments and their symbols used in layout

A.	**Cultivation practices**	**Symbol used**
1.	SRI (System of Rice Intensification)	**C_1**
2.	Transplanting method	**C_2**
3.	Broad casting	**C_3**
B.	**Integrated nutrient management modules (Sub plot)**	**Symbols used**
1.	100%NPK + Zn	**T_1**
2.	75%NPK+Zn +25% FYM-N	**T_2**
3.	75%NPK+Zn+25%G.M-N	**T_3**
4.	50% NPK +Zn+25%FYM-N +25% GM-N	**T_4**
5.	75% FYM-N + 25% GM-N	**T_5**

Table.2 Effect of INM modules on plant height at different age of basmati rice under various cultivation practices

	Plant height (cm)											
	55 DAS			80 DAS			105 DAS			Harvest stage		
Treatments	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled	2014	2015	Pooled
A. Cultivation practices												
C_1	78.9	80.3	79.6	96.9	98.5	97.7	104.9	107.2	106.1	105.7	108.1	107.0
C_2	75.9	77.3	76.6	93.3	94.8	94.1	100.9	103.2	102.1	101.8	104.0	103.7
C_3	68.5	69.7	69.1	84.1	85.5	84.8	91.0	93.1	92.	91.9	93.9	92.3
SEm ±	1.5	1.4	1.0	1.9	1.6	1.2	1.7	1.8	1.5	1.7	1.8	1.5
C D(P=0.05)	6.0	5.5	3.4	7.4	6.6	4.1	6.9	7.3	4.4	6.9	7.3	4.4
B. Integrated nutrient management modules												
T_1	76.7	78.0	77.4	94.2	95.7	95.0	101.9	104.2	103.1	102.8	105.0	104.0
T_2	75.2	76.5	75.9	92.4	93.9	93.1	99.9	102.2	101.1	100.8	103.0	102.8
T_3	77.4	78.8	78.1	95.1	96.7	95.9	102.9	105.2	104.1	103.8	106.1	105.9
T_4	73.0	74.2	73.6	89.6	91.1	90.4	97.0	99.1	98.1	97.8	100.0	99.1
T_5	70.0	71.2	70.6	86.0	87.4	86.7	93.0	95.1	94.0	93.9	95.	94.9
SEm ±	1.6	1.7	1.1	2.0	2.0	1.4	2.1	2.3	1.5	2.1	2.3	1.5
C D(P=0.05)	4.8	4.9	3.3	5.9	5.8	4.0	6.1	6.7	4.4	6.9	6.7	4.4

Table.3 Effect of INM modules on Number of shoots m^{-2} at different age of basmati rice under various cultivation practices

	Number of shoots m^{-2}											
	55 DAS			80 DAS			105 DAS			Harvest stage		
Treatments	2014	2015	Polled	2014	2015	Polled	2014	2015	Polled	2014	2015	Polled
A. Cultivation practices												
C_1	330.4	343.3	336.8	414.1	423.0	418.6	444.2	451.3	447.8	435.3	442.3	438.2
C_2	285.6	296.8	291.2	358.0	365.6	361.8	384.0	390.1	387.0	376.3	382.3	379.2
C_3	224.0	232.8	228.4	280.8	286.8	283.8	301.2	306.0	303.6	295.1	299.8	296.7
SEm ±	6.0	5.2	3.9	7.5	6.4	4.9	8.1	6.8	5.3	7.9	6.7	5.2
C D P=0.05)	23.7	20.4	13.0	29.7	25.2	16.1	31.9	26.9	17.3	31.2	26.3	17.4
B. Integrated nutrient management modules												
T_1	288.4	299.7	249.0	361.5	369.2	365.3	387.8	393.9	390.8	380.0	386.1	383.0
T_2	282.8	293.9	288.3	354.5	362.0	358.3	380.2	386.3	383.3	372.6	378.0	375.0
T_3	291.2	302.6	296.9	365.0	372.8	368.9	391.5	397.8	394.6	383.7	389.8	386.6
T_4	274.4	285.1	279.7	343.9	351.3	347.6	368.9	374.8	371.9	361.5	367.3	364.4
T_5	263.2	273.5	268.3	329.9	336.9	333.4	353.9	359.5	356.7	346.8	352.3	349.3
SEm ±	6.0	6.1	4.3	7.6	7.5	5.3	8.1	8.1	5.7	8.01	7.9	5.4
C D (P=0.05)	17.5	17.7	12.2	22.0	21.9	15.2	23.6	23.3	16.2	23.1	22.9	16.0

Table.4 Effect of INM modules on No. of panicle/ m^2, Length of panicle (cm), No. of grains per panicle and test weight of basmati rice under various cultivation practices

Treatments	No. of panicle/ m^2			Length of panicle (cm)			No. of grains per panicle			Test weight (g)		
	2014	2015	Polled	2014	2015	Polled	2014	2015	Polled	2014	2015	Polled
A. Cultivation practices												
C_1	348.1	354.0	351.0	24.6	25.0	24.8	98.9	100.8	99.8	22.1	22.6	22.3
C_2	300.9	306.0	303.4	24.2	24.6	24.4	93.9	95.8	94.9	21.9	22.4	22.1
C_3	236.0	240.0	238.0	23.4	23.8	23.6	84.5	86.2	85.4	21.7	22.1	21.9
SEm ±	5.8	6.2	4.2	0.4	0.4	0.3	1.9	1.7	1.3	0.4	0.4	0.3
C D (P=0.05)	22.9	24.4	13.9	NS	NS	1.1	7.6	6.8	4.2	NS	NS	1.0
B. Integrated nutrient management modules												
T_1	303.8	309.0	306.4	24.7	25.1	24.9	95.8	97.7	96.8	22.0	22.5	22.3
T_2	297.9	303.0	300.4	23.9	24.3	24.1	91.6	93.4	92.5	21.9	22.4	22.2
T_3	306.8	312.0	309.4	24.9	25.3	25.1	98.6	100.6	99.6	22.2	22.7	22.5
T_4	289.1	294.0	291.5	23.5	23.9	23.7	89.8	91.5	90.6	21.7	22.2	22.0
T_5	277.3	282.0	279.6	23.3	23.7	23.5	86.5	88.2	87.3	21.5	22.0	21.8
SEm ±	7.3	7.0	5.0	0.5	0.5	0.3	2.0	2.1	1.4	0.4	0.5	0.3
C D (P=0.05)	21.3	20.2	14.0	NS	NS	1.1	5.9	6.0	4.1	NS	NS	1.0

Table.5 Effect of INM modules on Grain yield, straw yield and harvest index of basmati rice under various cultivation practices

Treatments	Grain yield (q/ha)			Straw yield (q/ha)			Harvest index (%)		
	2014	2015	Polled	2014	2015	Polled	2014	2015	Polled
A. Cultivation practices									
C_1	39.5	41.3	40.4	55.5	57.5	56.5	41.5	41.7	41.6
C_2	33.9	35.5	34.7	50.0	51.7	50.8	40.4	40.7	40.6
C_3	27.0	28.2	27.6	41.0	42.5	41.8	39.6	39.8	39.7
SEm ±	0.6	0.5	0.4	1.0	0.9	0.6	0.7	0.6	0.4
C D(P=0.05)	2.6	2.3	1.5	3.9	3.6	2.2	2.9	2.6	1.6
B. Integrated nutrient management modules.									
T_1	35.5	37.1	36.3	50.6	52.4	51.5	41.0	41.3	41.0
T_2	33.8	35.3	34.6	49.0	50.7	49.8	40.7	40.9	41.0
T_3	36.5	38.1	37.3	51.2	53.0	52.1	41.5	41.7	41.6
T_4	31.4	32.9	32.2	47.1	48.7	47.9	40.0	40.2	40.1
T_5	30.1	31.5	30.8	46.3	48.0	47.1	39.3	39.6	39.4
SEm ±	0.8	0.8	0.5	1.0	1.1	0.8	0.7	0.7	0.3
C D(P=0.05)	2.4	2.5	1.6	3.9	3.4	2.3	2.0	2.0	0.9

The maximum grain yield, straw yield and harvest index were recorded under C_1-SRI as compared to other cultural practices (Table no. 4). These result may be causes to attributed to the higher growth and yield attributing characters in SRI, the younger seedling might have adopted the transplanting shock quickly and established themselves well from very early stage that help in promoting early growth and yield contributing characters which may be responsible for better growth and higher grain and straw yield and harvest index as compared with planting of older seedling. As the INM modules are concern, the maximum grain, straw yield and harvest index are observed under T_3-75% NPK + Zn + 25% GM-N followed by T_1-100% NPK + Zn over rest of the treatments while minimum value was obtained under T_5 compare than other INM treatments. It may be attributed to maximum growth and yield contributing characters were recorded in T_3 followed by T_1. The higher yields in GM-N based INM treatment as compared to FYM-N based INM treatment may be because FYM-N slowly mineralized as compared to GM-N. Thus the availability of nutrients by FYM becomes slower than GM. Further many other growth promoting substances also release during decomposition of green manure. This might be because the Sesbania green manure slowly but continuously maintains nitrogen supply during most of rice growing season. Further organic manure alone in combination with inorganic fertilizer might prevent nutrient losses due to its slow release and might supply nutrient in optimum amount with crop demand responsible for increase in grain, straw yield and harvest index. Similar result was also reported by Ghosh *et al.*, (2014) and Ghosh *et al.*, (2015).

It was concluded that highly effect of INM modules with cultural practices on growth parameter, yield attribute and yield .The maximum grain yield were recorded with T_3 (75% NPK + Zn + 25% GM-N) followed by T_1 (100% NPK + Zn) compare to other INM modules while highly significantly effect of C_1 SRI as growth, yield attribute and yield were observed to conventional and broadcasting method of Basmati rice during 2014 and 15.

References

Andrianaivo, B, Evaluations of the System of Rice Intensification in Fianarantsoa Province of Madagascar. In: Assessments of the System of Rice Intensification (SRI): Proceedings of the International Conference, Sanya, China, April 1-4, 2002, ed. by N. Uphoff *et al.*, pp. 140-142, 2002.

Awan, I.U.; Jaskani, A.G. and Nadeem, M.A. (2000). Nitrogen use efficiency in rice (*Oryza sativa* L.) as affected by green manuring plant Dhaincha (*Sesbania aculeate L*.). *Pak. J. Bio. Sci.*, 3(11): 1827- 1828.

Datta, SK, and Khush, GS, Improving rice to meet food and nutritional needs – Biotechnological approaches. *Journal of Crop Production*. 6(1&2): 224-229, 2002.

Ghosh, D.C., Ghosh, M. Garnayak L. M. and Panigrahi Trinath (2015). Growth analysis of basmati rice varieties and its impact on grain yield under SRI. *International Journal of Plant, Animal and Environmental Sciences;* May 2015, Vol. 5 Issue-3, pp. 101-109.

Ghosh, D.C., Ghosh, M. Garnayak L. M. Panigrahi Trinath and Bastia D.K. (2014). Productivity and profitability of basmati rice varieties under SRI. *International Journal of Bio-Resource and Stress Management;* 2014, 5(3) pp. 333-339.

Pandey, P. C., Kumar, V.; and Rathi, A. S.

(2007). Effect of inorganic fertilizers and FYM on productivity of rice and soil fertility in long term rice-wheat cropping system. *Progressive Research*; 3(1): 76-78.

Prasad, B., Prasad, R. (1995). Nutrient management for sustained rice and wheat production in calcareous soil amended with green manures, organic manure and zinc (ENG). *Fertilizer News*, 40(3): 39-41.

Shankar. L. Laware (2011). Effect of organic fertilizer on growth and yield components in rice (*Oryza sativa* L.*) Journal of agricultural science*; 3 (3): 217-224.

Sharma, RP, Raman, KR, Pathak, SK, Jha, RN and Chattopadhyaya (2006). Effect of crop establishment methods and tillage and practices on crop productivity, profitability and soil health of rice wheat cropping system. *Farming Systems Research and Development*, 12, (1&2): pp.42-46.

Sujatha, K. Mosha, G. Subbaiah and P. Prasuna Rani (2014). Residual soil fertility and productivity of rice (*Oryza sativa* L.) As influenced by different organic sources of nitrogen. *International journal of plant, animal and environmental sciences*; 5 (2): 266-289.

Sutaliya, R. and Singh, R.N. (2005). Effect of planting time, fertility level and phosphate-solubilizing bacteria on growth, yield and yield attributes of winter maize (*Zea mays*) under rice (*Oryza sativa*) maize cropping system. *Indian Jpurnal of Agronomy*, 50(3): 173-75.