ADVNACE RESEARCH JOURNAL OF CROP IMPROVEMENT
Volume 2 Issue 1 (June, 2011) Page : 108-111

Received : *May, 2011;* ***Accepted :*** *June, 2011*

Research Paper

Effect of rice (*Oryza sativa* L.) to integrated nutrient management on yield attributes, yield and microbial population under system of rice intensification

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ABSTRACT

The experiment was laid out in simple Randomized Complete Block Design (RCBD) with ten treatments replicated thrice. The treatments consisted of 100%, 75%, 50% and 25% recommended doses of nutrients (RDN) through chemical fertilizers and 25%, 37.5% and 50% RDN through organic sources like Farm yard manure, poultry manure and neem cake. Significantly higher number of productive tillers per hill (33.4), number of filled grains per panicle (154.3), panicle length (21.07 cm), panicle weight (4.59 g) and thousand grain weight (22.77 g) was recorded with recommended dose of nutrients (120:60:40kg N:P:K ha^{-1}) along with 10 tonnes of FYM ha^{-1}.

Arun Kumar, J. S., Dawson, Joy, Kumar, Akhilesh and Haricharan Reddy, K. (2011). Effect of rice (*Oryza sativa* L.) to integrated nutrient management on yield attributes, yield and microbial population under system of rice intensification. *Adv. Res. J. Crop Improv.,* **2** (1) : 108-111.

Key words : Organic, Inorganic, INM, SRI, Rice

INTRODUCTION

Rice (*Oryza sativa* L.) is the principal food crop to billions of people around the world. India occupies a pride place in rice production among the food crops cultivated in the world. About 90 per cent of rice grown in the world is produced and consumed in Asian countries, China and India accounting more than half of the total acreage. India has the largest area (43.77 million hectare) among rice growing countries and stands second in production (96.43 million tonnes) with a productivity of 2203 kg ha^{-1} (Anonymous, 2008). Rice production is the most water consuming system and utilizes about 60 per cent of total available irrigation water. To meet the water crisis head on, valuable gains can be achieved by growing rice with less water. Therefore, there is a need to develop an alternate system that requires less water. SRI is a new concept of growing rice. It is a production system, which concentrates on as controlled supply of water, planting younger seedlings and providing wider spacing. The concept of organic farming has been gaining momentum with the use of different manures and crop residues in order to increase the productivity of crop as well as the soil fertility status. So, the present investigation on response of rice to INM on yield attributes, yield and economics of SRI for achieving maximum production has been carried out.

MATERIALS AND METHODS

Field experiment was conducted during *Kharif* season of 2010 at Central Research Farm, Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad. The soil of the experimental site was sandy loam with pH (7.7) and medium in organic carbon (0.4%). The experiment was laid out in a Randomized Complete Block Design with ten treatments replicated thrice. The treatments were recommended dose

of nutrient (120:60:40 NPK kg ha^{-1})+ 10 tonnes of FYM ha^{-1} (T_1), 75% of RDN through inorganic + 25% through FYM (T_2), 75% of RDN through inorganic + 25% through neem cake (T_3), 75% of RDN through inorganic + 25% through poultry manure (T_4), 50% of RDN through inorganic + 50% through FYM (T_5), 50% of RDN through inorganic + 50% through neem cake (T_6), 50% of RDN through inorganic + 50% through poultry manure (T_7), 25% of RDN through inorganic + 37.5% through FYM and 37.5% through neem cake (T_8), 25% of RDN through inorganic +37.5% through FYM and 37.5% through poultry manure (T_9), 25% of RDN through inorganic + 37.5% through neem cake and 37.5% through poultry manure (T_{10}). Observations were recorded for various yield attributes and yield.

RESULTS AND DISCUSSION

The results obtained from the present investigation have been discussed in the following sub heads :

Yield attributes:

The yield attributes like number of productive tillers hill^{-1}, filled grains panicle^{-1}, panicle length (cm), panicle weight (g) and thousand grain weight (g) differed significantly due INM in SRI (Table 1). Application of recommended dose of nutrient (120:60:40 kg N:P:K ha^{-1}) along with 10 tonnes of FYM ha^{-1} recorded higher number of productive tillers per hill (33.4), number of filled grains per panicle (154.3), panicle length (21.07 cm), panicle weight (4.59 g) and thousand grain weight (22.7 g). However, it was at par with 50 % of RDN through inorganic + 50 % through poultry manure (33.0, 150.3, 20.87, 4.51 and 22.1 g of productive tillers hill^{-1}, filled grains panicle^{-1}, panicle length, panicle weight and 1000 grain weight, respectively), 50% of RDN through inorganic + 50% through neem cake (31.6, 150.1, 20.1, 4.39 and 21.6 g of productive tillers hill^{-1}, filled grains panicle^{-1}, panicle length, panicle weight and 1000 grain weight, respectively), 75% of RDN through inorganic + 25% through poultry manure (30.3, 148.3, 19.75, 4.19 and 21.1 g of productive tillers hill^{-1}, filled grains panicle^{-1}, panicle length, panicle weight and 1000 grain weight, respectively) and 75% of RDN through inorganic + 25% through neem cake (30.2, 146.8, 20.64, 4.13 and 20.6 g of productive tillers hill^{-1}, filled grains panicle^{-1}, panicle length, panicle weight and 1000 grain weight, respectively). These results are in conformity with the findings of Alagesan (1997) who proved the positive correlation between N application and formation of productive tillers. Use of higher dose of nitrogen, phosphorus and potassium through organic sources might have helped in inducing good vegetative growth (Dhurandher and Tripathi, 1999) and this produced higher number of panicles leading to higher yield. Increase in filled grain and thousand-grain weight under increased nitrogen levels might be due to N induced enhancement in photosynthetic activity and these resulted in the translocation of photosynthates and amino acids from the leaves and culms to the grain. This work is in accordance with findings of Dhyani and Mishra (1994).

Grain yield:

Grain yield was significantly influenced by INM in SRI (Table 1). Significantly higher grain yield (52.6 q ha-

Table 1: Yield parameters and yield of rice as influenced by INM in SRI

Treatments	Panicle length (cm)	Productive tillers hill^{-1} (No.)	Filled grains panicle^{-1}	1000 grain weight (g)	Grain yield (q ha^{-1})
T_1- Recommended Dose of Nutrient (RDN) + 10 tones of FYM ha^{-1}	21.07	33.4	154.3	22.77	52.63
T_2-75% of RDN + 25% through FYM	19.28	29.1	144.6	20.13	44.26
T_3-75% of RDN + 25% through Neem cake	19.66	30.2	146.8	20.64	44.95
T_4-75% of RDN + 25% through Poultry manure	19.75	30.3	148.3	21.17	46.46
T_5-50% of RDN + 50% through FYM	18.81	28.5	139.2	19.74	40.59
T_6-50% of RDN + 50% through Neem cake	20.17	31.6	150.1	21.65	48.86
T_7-50% of RDN + 50% through Poultry manure	20.87	33.0	150.3	22.05	50.97
T_8-25% of RDN + 37.5% FYM and 37.5% Neem cake	17.94	26.2	130.4	17.81	37.01
T_9-25% of RDN + 37.5% FYM and 37.5% Poultry manure	18.61	27.7	136.3	19.04	39.93
T_{10}-25% of RDN + 37.5% neem cake and 37.5% Poultry manure	19.04	28.9	142.3	20.07	43.23
S.E. ±	0.54	1.1	2.64	0.73	2.73
C.D. (P=0.05)	1.61	3.3	7.93	2.17	8.19

Table 2: Microbial population after harvest of crop as influenced by INM in SRI

Treatments	Total bacteria No. X10^6 CFU/g	Fungi No. X 10^4 CFU/g	Actinomycetes No. X10^4 CFU/g	Nitrogen fixers No. X 10^5 CFU/g	P-solubilizers No. X10^5 CFU/g
T_1- Recommended Dose of Nutrient (RDN) + 10 tonnes of FYM ha^{-1}	140.8	20.8	31.8	37.8	41.7
T_2-75% of RDN + 25% through FYM	146.1	19.3	31.9	23.9	16.9
T_3-75% of RDN + 25% through Neem cake	145.6	18.3	27.5	42.8	33.3
T_4-75% of RDN + 25% through Poultry Manure	147.7	19.9	29.8	29.4	30.0
T_5-50% of RDN + 50% through FYM	156.7	22.9	38.5	54.4	29.2
T_6-50% of RDN + 50% through Neem cake	150.0	16.0	41.1	47.3	13.6
T_7-50% of RDN + 50% through Poultry Manure	161.1	24.3	38.1	49.8	22.5
T_8-25% of RDN + 37.5% FYM and 37.5% Neem cake	163.3	24.7	37.5	57.5	32.5
T_9-25% of RDN + 37.5% FYM and 37.5% Poultry manure	201.9	25.6	51.0	66.7	49.2
T_{10}-25% of RDN + 37.5% Neem cake and 37.5% Poultry manure	179.2	16.9	45.3	62.8	47.8

^{1}) were recorded with recommended dose of nutrient (120:60:40 kg N:P:K ha^{-1}) along with 10 tonnes of FYM ha^{-1}. However, it was at par with 50 % of RDN through inorganic + 50 % through poultry manure (50.97 q ha^{-1}), 50% of RDN through inorganic + 50% through Neem cake (48.86 q ha^{-1}), 75% of RDN through inorganic + 25% through poultry manure (46.46 q ha^{-1}) and 75% of RDN through inorganic + 25% through neem cake (44.95 q ha^{-1}). Similar findings were also reported by Mandal *et al.* (1994) that dry matter production, yield components and yield of rice improved significantly when the crop was applied with 75 per cent recommended NPK along with 10 tonnes of FYM ha^{-1} as compared to 100 per cent recommended NPK alone. Nitrogen resulted in increased amount of interception of phosynthetically active radiation and greater photosynthesis by crop. As a corollary to these, there will be increase in growth and yield components and both grain yield and straw yield (Gill and Singh, 1985; Dhurandher and Tripathi, 1999) or because of higher leaf area and leaf area duration which are responsible for higher photosynthetic activity that promoted dry matter production resulting in higher grain and straw yield (Dhyani and Mishra, 1994). Because of more leaf area and more light interception, dry matter production was increased significantly resulting into significant increase in straw yield. These results confirm the findings of Sharu and Meerabai (2001) who reported that application of equal ratio of chemical fertilizer and organic manure increased the nutrient levels. As the nitrogen supply increased, the extra protein content might have induced the plant leaves to grow larger and made more surface area for photosynthesis.

Microbial population:

Application of 25% of RDN through inorganic + 37.5% through FYM and 37.5% poultry manure recorded higher microbial population (201.9X10^6 CFU g^{-1}, 25.6 X 10^4 CFU g^{-1}, 51 X10^4 CFU g^{-1}, 66.7X 10^5 CFU g^{-1} and 49.2X10^5 CFU g^{-1}, of total bacteria, fungi, actinomycetes, nitrogen fixers and P-solubilizers, respectively (Table 4). Continuous use of organic manures preferably with poultry manure, neem cake, FYM, vermicompost can improve microbial activity in soil and these improving the fertility in short run and have not indicated yield advantage (Sudha and Chandani 2003). The increased microbial biomass was mainly attributed to high microbial activity (Zaman *et al*., 1998).

Conclusion:

On the basis of above findings, it may be concluded that application of 100% recommended doses of nutrients (RDN) through inorganic in combination with 10 tonnes of FYM ha^{-1} recorded maximum yield attributes and grain yield, more number of microbial population was found higher in treatment receiving 25% of RDN through inorganic +37.5% through FYM and 37.5% through poultry manure.

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