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Research Article

Effect of rice (*Oryza sativa* L.) to Integrated Nutrient Management on growth attributes, dry matter production and nutrient status under system of rice intensification

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Abstract : The experiment was laid out in Randomized Complete Block Design (RCBD) with ten treatments replicated thrice. The treatments consisted of 100 per cent, 75 per cent, 50 per cent and 25 per cent recommended doses of nutrients (RDN) through chemical fertilizers and 25 per cent, 37.5 per cent and 50 per cent RDN through organic sources like farm yard manure, poultry manure and neem cake. Application of recommended dose of nutrients (120:60:40kg N:P:K ha^{-1}) along with 10 tonnes of FYM ha^{-1} recorded significantly higher plant height, more number of tillers/ hill and maximum dry weight.

Key Words : Organic, Inorganic, INM, SRI

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INTRODUCTION

Rice is one of the most important cereal crops in India. The country has to produce about 130 mt of rice by 2025 to feed the ever growing population. Meeting the targeted demands of rice is a challenging task. Decreasing in the soil fertility and increasing in water scarcity is becoming threat for rice cultivation. Hence, the technology which maintains the soil health and water scarcity and as well as economically beneficial needs to be developed. The role of organic fertilizer in plant nutrition is now attracting the attention of agriculturists and soil scientists throughout the world. Chemical fertilizers, no doubt have the positive impact on crop growth and yield, but had negative impact on soil organic matter, soil structure, and microbial population. Application of organic materials along with inorganic fertilizers into soil results an increase in productivity of the system and also sustain the soil health for longer period. Rice being a crop having water requirement, there is a need to search for alternative method to reduce water requirement of rice without reduction in yield. In recent years, system of rice intensification (SRI) is an emerging water saving technology, with many fold increase in crop yield. This method was developed in Madagascar in early 1980s, where it has been shown that yields can be enhanced by suitably modifying certain management practices such as controlled supply of water, planting younger seedlings and providing wider spacing. Keeping above factors in mind, present investigation was conducted to study the response of rice to integrated nutrient management under system of rice

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intensification.

EXPERIMENTAL METHODS

Field experiment was conducted during *Kharif* season of 2010 at central research farm, SHIATS, Allahabad. The soil of the experimental site was sandy loam with pH (7.7) and medium in organic carbon (0.4%). The initial status of available N, P_2O_5 and K_2O of the experimental site was 220.0, 18.8 and 250.0 kg ha^{-1}, respectively. 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 per cent of RDN through inorganic + 25 per cent through FYM (T_2), 75 per cent of RDN through inorganic + 25 per cent through neem cake (T_3), 75 per cent of RDN through inorganic + 25 per cent through poultry manure (T_4), 50 per cent of RDN through inorganic + 50 per cent through FYM (T_5), 50 per cent of RDN through inorganic + 50 per cent through neem cake (T_6), 50 per cent of RDN through inorganic + 50 per cent through poultry manure (T_7), 25 per cent of RDN through inorganic + 37.5 per cent through FYM and 37.5 per cent through neem cake (T_8), 25 per cent of RDN through inorganic +37.5 per cent through FYM and 37.5 per cent through poultry manure (T_9), 25 per cent of RDN through inorganic + 37.5 per cent through neem cake and 37.5 per cent through poultry manure (T_{10}). Observations were recorded for various growth attributes.

EXPERIMENTAL RESULTS AND ANALYSIS

The results obtained from the present study have been presented under following heads :

Growth attributes:

The different growth indices like plant height, number of tillers and dry matter production of rice significantly influenced by various treatments (Table 1). Significantly higher plant height (88.2 cm) and more number of tillers per hill (38.7) was 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 per cent of RDN through inorganic + 50 per cent through poultry manure (87.6 cm and 38.1 $hill^{-1}$ of plant height and number of tillers, respectively), 50 per cent of RDN through inorganic + 50 per cent through neem cake (85.4 cm and 37.4 $hill^{-1}$ of plant height and number of tillers, respectively), 75 per cent of RDN through inorganic + 25 per cent through poultry manure (82.7 cm and 35.9 $hill^{-1}$ of plant height and number of tillers, respectively) and 75 per cent of RDN through inorganic + 25 per cent through neem cake (82.2 cm and 35.2 $hill^{-1}$ of plant height and number of tillers, respectively). Significant increase in plant height might be due to greater availability and steady release of nutrients from organic sources (FYM, poultry manure and neem cake), which perhaps enabled the recovery of plant height towards reproductive stage. Devaraju *et al.* (1998) opined that adequate supply of plant nutrients influenced the plant height. Nitrogen increases the chlorophyll content at all growth stages as it is a constituent and might have increased the photosynthesis and resulted in increased plant height (Gill and Singh, 1985). The development of leaf area is an important factor that could affect crop response to added nitrogen. Larger leaf area development aided in more interception of light leading to higher dry matter production (Vijayalakshmi and Nagarajan, 1994).

Dry matter production:

Application of recommended dose of fertilizers

Table 1 : Plant height, number of tillers and dry weight as influenced INM under SRI at 90 DAS

Treatments	Plant height (cm)	Number of tillers $hill^{-1}$	Dry weight
T_1-RDN + 10 tonne FYM.	88.2	38.7	53.9
T_2-75% RDN + 25% FYM	80.3	34.7	65.0
T_3-75% RDN + 25% neem cake	82.2	35.2	51.3
T_4-75% RDN + 25% poultry manure	82.7	35.9	52.0
T_5-50% RDN + 50% FYM	77.6	33.9	59.8
T_6-50% RDN + 50% neem cake	85.4	37.4	55.9
T_7-50% RDN + 50% poultry manure	87.6	38.1	61.0
T_8-25% RDN + 37.5% FYM and 37.5% neem cake	73.5	27.4	50.0
T_9-25% RDN + 37.5% FYM and 37.5% poultry manure	76.6	30.9	62.9
T_{10}-25% RDN + 37.5% neem cake and 37.5% poultry manure	79.7	34.7	64.4
S.E. ±	2.21	1.2	1.85
C.D. (P=0.05)	6.64	3.7	5.50

Table 2 : Nutrient status of soil after harvesting of rice crop as influenced by INM in SRI

Treatments	OC (%)	Nitrogen (kg ha^{-1})	P_2O_5 (kg ha^{-1})	K_2O (kg ha^{-1})
T_1- Recommended dose of nutrient (RDN) + 10 tonnes of FYM ha^{-1}	0.42	255.2	18.8	224.3
T_2-75% of RDN + 25% through FYM	0.42	260.7	22.2	225.5
T_3-75% of RDN + 25% through neem cake	0.44	255.3	20.5	236.7
T_4-75% of RDN + 25% through poultry manure	0.44	267.2	19.5	248.3
T_5-50% of RDN + 50% through FYM	0.45	269.2	22.8	256.3
T_6-50% of RDN + 50% through neem cake	0.42	259.5	19.8	255.4
T_7-50% of RDN + 50% through poultry manure	0.46	268.8	22.6	260.1
T_8-25% of RDN + 37.5% FYM and 37.5% neem cake	0.46	271.4	30.9	280.4
T_9-25% of RDN + 37.5% FYM and 37.5% poultry manure	0.46	272.4	31.1	280.1
T_{10}-25% of RDN + 37.5% neem cake and 37.5% poultry manure	0.47	261.3	32.4	276.3

(100:60:40 kg N:P:K ha^{-1}) along with 10 tonnes of FYM ha^{-1} recorded significantly higher total dry matter at 90 DAT (76.90 g hill^{-1}) (Table 1). However, it was at par with 50 per cent of RDN through inorganic + 50 per cent through poultry manure (74.51 g hill^{-1} at 90 DAT), 50 per cent of RDN through inorganic + 50 per cent through neem cake (73.29 g hill^{-1} at 90 DAT), 75 per cent of RDN through inorganic + 25 per cent through poultry manure (70.12 g hill^{-1} at 90 DAT) and 75 per cent of RDN through inorganic + 25 per cent through neem cake (69.41 g hill^{-1} at 90 DAT). The combined application of inorganic fertilizer and organic manure could have helped in balanced availability of nutrients at all stages. Further, this might have improved the soil aggregation, higher nutrient availability and enhanced soil microbial activity resulting in congenial soil condition. As a consequent improved uptake of nutrients has led to more vegetative growth of the plants and also dry matter. This has provided more photosynthetically active leaf area resulting in higher dry matter accumulation. Apart from that, nitrogen might have involved in various physiological activities like increased photosynthetic activity and better light interception which in turn resulted in higher dry matter accumulation. Basavarj (2007) also reported that higher growth indices recorded in paddy had a positive association with higher dry matter accumulation. Similar results were reported by Rajeswari (1990). As nitrogen enhanced tillers production and leaf area development, total dry matter production also increased with increased levels of nitrogen.

Nutrient status:

Nitrogen present in the soil after harvest of crop (Table 2) was higher in amount (272.7 kg ha^{-1}) with 25 per cent of nitrogen through inorganic + 37.5 per cent through FYM and 37.5 per cent poultry manure. Phosphorus present in the soil after harvest of crop was found to be higher (32.4 kg ha^{-1}) with 25 per cent of RDN + 37.5 per cent through neem cake and 37.5 per cent poultry manure. Potassium present in the soil after harvest of crop was found to be higher (280.4 kg ha^{-1}) in 25 per cent of nitrogen through inorganic +37.5 per cent through FYM and 37.5 per cent neem cake. Poultry manure appeared to contain higher concentration of macro and micronutrients that contributed for higher solubility and nutrient uptake. Similar views were expressed by Suresh and Ramasubba Reddy (2002).

Conclusion:

On the basis of above findings, it may be concluded that application of 100 per cent recommended doses of nutrients (RDN) through inorganic in combination with 10 tonnes of FYM ha^{-1} recorded maximum plant height, more number of tillers hill^{-1} and highest plant dry weight.

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