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Effect of integrated nutrient management practices on growth attributes of transplanted rice

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Abstract

An experiment was conducted at experimental research farm, Rampur, Doon PG college of Agriculture and Allied Sciences, Rampur, Selaqui, Dehradun "Effect of Integrated Nutrient Management Practices on Yield Attributes of Transplanted Rice (*Oryza Sativa* L.)" during kharif season of 2016. Twelve treatments viz., Control (T₀), FYM @ 12.5 t ha⁻¹ + 100% RDF, FYM @ 12.5 t ha⁻¹ + 75% RDF, GM @ 6.25 t ha⁻¹ + 100% RDF, GM @ 6.25 t ha⁻¹ + 75% RDF, FYM @ 12.5 t ha⁻¹ + Biofertilizer + 100% RDF, FYM @ 12.5 t ha⁻¹ + Biofertilizer + 75% RDF, FYM @ 12.5 t ha⁻¹ + Biofertilizer, GM @ 6.25 t ha⁻¹ + Biofertilizer + 100% RDF, GM @ 6.25 t ha⁻¹ + Biofertilizer + 75% RDF, GM @ 6.25 t ha⁻¹ + Biofertilizer, FYM @ 12.5 t ha⁻¹ + GM @ 6.25 t ha⁻¹ conducted in a randomized block design (RBD) with three replications. Rice variety "PS-5" was used as test crop. The soil of experimental plot was silt clay loam in texture, medium organic carbon and available nitrogen, high in available Phosphorus and rich in Potassium status. The results of the experiment indicated that maximum value of growth attributes viz., plant height, no of tillers and dry matter accumulation were conspicuously increased with the application of GM @ 6.25 t ha⁻¹ + Biofertilizer + 100% RDF (T₈) and was superior over rest of the treatments but at par with GM @ 6.25 t ha⁻¹ + Biofertilizer + 75% RDF (T₉) and FYM @ 12.5 t ha⁻¹ + Biofertilizer + 100% RDF (T₅). However the lowest growth attributes were recorded with the treatments Control (T₀), FYM @ 12.5 t ha⁻¹ (T₁₁). Based on the results, it can be concluded that higher grain yields and net profit from Transplanted Rice crop can be obtained with the application of GM @ 6.25 t ha⁻¹ + Biofertilizer + 100% RDF (T₈).

Keywords: rice, green manure, farm yard manure, recommended dose fertilizer, biofertilizer

Introduction

Rice is one of the most important food grains produced and consumed all over the world. As per 4th Advance Estimates for 2014 – 15, total production of rice in the country is estimated at 104.80 million tonnes which is lower by 1.85 million tonnes than the production of rice during 2013-14.

Nutritionally, rice contains 80% carbohydrates, 7-8% protein, 3% fat and 3% fiber. Medicinally, it is valued for curing ailments like diarrhea, vomiting, fever, hemorrhages, chest pain, dyspepsia, worm disorder and burns. Rice also has hemostatic and aphrodisiac properties (Uma Ahuja *et.al.* 2008) [8].

The use of inorganic fertilizer to sustain cropping was found to increase yield only for some few years but on long term, it has not been effective and leads to soil degradation. The full growth potential of 7 -14 days old seedlings would be exploited by addition of organic manures along with chemical fertilizers rather than the application of individual sources alone (Sri Ranjitha, P and Reddy, K.L. 2014) [7]. On the other hand, continuous application of organic fertilizer alone on rice field resulting in low yield and low N & K content at the mid tillering stage of rice plant. This implies that the need of integrated nutrient management for rice production. In other studies application of two thirds of recommended dose of nitrogen + some organic fertilizer, FYM resulted in higher dry matter production, better leaf area index (Zayed *et.al.*, 2013) [10]. Therefore the combined use of organic manures and inorganic fertilizers help in maintaining yield stability through correction of marginal deficiency of secondary and micro nutrients, enhancing efficiency of applied nutrients and providing favorable soil physical conditions (Jagjoth Singh Gill and Sohan Singh Walia, 2014) [2]. Integrating nutrient management (INM) aims for efficient and judicious use of all the major sources of plant nutrients in an integrated manner (Farouque and Takeya, 2007) [1]. The major.

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Components of INM are fertilizers, Farm yard Manure, Green manure, crop residues, recyclable wastes and the biofertilizer. Organic fertilizers not only act as the source of nutrients, but also provide micronutrients and modify soil physical behavior as well as increased the efficiency of applied nutrients. The supplementary and complementary use of organic manures improves the soil physical, chemical and biological properties and also improves the use efficiency of applied fertilizers as well as other inputs (kalyanasundaram, 2003) [3].

Materials and Methods

An experiment was conducted during *Kharif* season of 2016 in Doon (PG) college of Agriculture and Allied Science, Rampur, Selaqui, Dehradun (Uttarakhand) situated at 29°N latitude, 79.3°E longitude at an altitude of 243.84 m above the mean sea level in the *tarai* belt of Shivalik range of Himalayan foot hills. This experiment was conducted with twelve treatments Control (T₀), FYM @ 12.5 t ha⁻¹ + 100% RDF (T₁), FYM @ 12.5 t ha⁻¹ + 75% RDF (T₂), GM @ 6.25 t ha⁻¹ + 100% RDF (T₃), GM @ 6.25 t ha⁻¹ + 75% RDF (T₄), FYM @ 12.5 t ha⁻¹ + Biofertilizer + 100% RDF (T₅), FYM @ 12.5 t ha⁻¹ + Biofertilizer + 75% RDF (T₆), FYM @ 12.5 t ha⁻¹ + Biofertilizer (T₇), GM @ 12.5 t ha⁻¹ + Biofertilizer + 100% RDF (T₈), GM @ 12.5 t ha⁻¹ + Biofertilizer + 75% RDF (T₉), GM @ 12.5 t ha⁻¹ + Biofertilizer (T₁₀), FYM @ 12.5 t

ha⁻¹ + GM @ 6.25 t ha⁻¹ (T₁₁) laid out in Randomized Block Design (RBD) with three replications.

Results and Discussion

1. Plant height (cm)

The plant height was recorded at 30, 60, 90 DAT and harvest. The height was not effected significantly by different treatments at 30, 60, 90 DAT. At harvest stage various treatments influenced the plant height significantly. Application of T₈ in which GM @ 6.25 t ha⁻¹ + 100% RDF + biofertilizer @ 1 kg ha⁻¹ at 30 DAT (34.58 cm) recorded maximum plant height, being a par with FYM + biofertilizer + 100% RDF at 30 DAT was significantly superior to all treatments. The application of FYM + biofertilizer (T₇) resulted significantly reduction in plant height in comparison to the GM @ 6.25 t ha⁻¹ + 100% RDF + biofertilizer @ 1 kg ha⁻¹ (T₈) at 30, 60, 90 DAT (34.58, 62.24, 82.57, 94.58 cm) and at harvest. Minimum plant height is 66.86 cm was recorded with control plot. All the treatments are superior to control treatment (T₀). Application of 100% recommended dose of nitrogen in inorganic form along with organic manure resulted in highest height of plants (Koushal, S. *et. al.*, 2011) [4]. Significant response was observed with inorganic fertilizer alone and in combination with organic sources was due to increased availability of nutrients in adequate amount (Vinod kumar *et.al.*, 2014) [9].

Table 1: Plant height as influenced by integrated nutrient management practices of crop growth in transplanted rice

Treatments	Plant height (cm)			
	30 DAT	60 DAT	90 DAT	Harvest
T ₀	28.56	54.26	58.73	66.86
T ₁	33.10	61.58	70.61	86.64
T ₂	32.23	60.29	69.18	83.54
T ₃	33.27	61.09	74.27	87.54
T ₄	32.51	60.56	72.33	85.79
T ₅	34.12	62.24	80.12	93.81
T ₆	33.39	61.21	79.56	91.67
T ₇	30.12	57.24	61.64	68.92
T ₈	34.58	62.86	82.57	94.58
T ₉	33.67	61.57	80.70	92.67
T ₁₀	30.57	57.12	62.79	69.74
T ₁₁	30.89	57.85	60.25	68.23

2. No of tillers per plant (No of tillers⁻¹)

No of tillers was counted at different crop growth stages and it can be concluded the number of tillers increased up to 60 DAT and declined thereafter at 90 DAT and harvest. The possible reason might be the mortality of smaller and weaker tillers at later stages of growth. The treatment having GM +

100% RDF + biofertilizer produced maximum number of tillers at all stages because application of organic manures along with chemical fertilizers resulted in more number of tillers (Rayees, A *et.al.*, 2014) [5]. Minimum number of tillers were found in control treatment.

Table 2: Number of tillers as influenced by integrated nutrient management practices of crop growth in transplanted rice

Treatments	Number of tillers/hill			
	30 DAT	60 DAT	90 DAT	Harvest
T ₀	6.32	12.86	11.62	13.95
T ₁	8.16	24.19	16.89	15.21
T ₂	7.59	23.62	15.41	14.98
T ₃	8.81	24.67	17.03	15.48
T ₄	8.43	24.13	16.97	15.36
T ₅	9.09	25.64	18.54	18.12
T ₆	8.31	24.31	17.96	17.53
T ₇	6.41	13.91	14.73	14.12
T ₈	9.42	26.12	20.54	19.86
T ₉	9.16	24.21	19.98	17.69
T ₁₀	6.74	13.98	14.06	14.26
T ₁₁	6.98	14.95	14.77	15.01

3. Dry matter accumulation (g)

Rate of dry matter accumulation increased progressively with age of crop, maximum rate being recorded at 60, 90 DAT and harvest. Total dry matter accumulation is a function of total plant stand, plant height, number of tillers plant⁻¹ and therefore, effect of treatment on these parameters finally affects the dry matter accumulation by the crop. The highest dry matter accumulation was observed in GM + 100% RDF + biofertilizer in all observations up to harvest of crop. Another treatment FYM + 100% RDF + biofertilizer gives highest dry matter compared to other treatments. This was also evidenced by the studies of (Spurti mondal *et. al.*, 2015) [6]. Minimum amount of dry matter was observed in control treatment.

Table 3: Plant dry matter as influenced by integrated nutrient management practices of crop growth in transplanted rice

Treatments	Plant dry matter (g)			
	30 DAT	60 DAT	90 DAT	Harvest
T ₀	7.93	33.21	109.24	224.62
T ₁	9.86	64.38	133.61	256.16
T ₂	9.15	63.78	127.29	254.97
T ₃	10.78	65.26	144.58	254.97
T ₄	9.91	64.71	140.77	257.32
T ₅	11.29	67.24	157.25	278.11
T ₆	10.98	66.18	151.03	276.09
T ₇	8.14	34.78	112.34	227.13
T ₈	11.81	68.56	161.20	279.35
T ₉	11.09	66.98	159.32	277.91
T ₁₀	8.58	35.02	115.41	228.51
T ₁₁	8.69	37.58	121.37	230.48

Conclusion

The objective to study the effect of organic manures like Green manure, FYM and biofertilizer and chemical fertilizers on growth of rice and work out optimum combination of organic source and inorganic sources of nutrients plant height. Plant height, dry matter accumulation and number of tillers were affected significantly by different treatments. In general, application of require sources resulted in higher plant height, number of tiller and dry matter accumulation were found in treatment T₈ GM + 100% RDF + biofertilizer @ 1 kg ha⁻¹.

On the basis of the experimental findings, it may be concluded that the integration of GM + 100% RDF + biofertilizer @ 1kg/ha (T₈) resulted in higher productivity in terms of growth attributes.

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