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Performance of rice under integrated nutrient management in southern region of Tamil Nadu

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Abstract

Field experiments were conducted at Agricultural Research Station, Thirupathisaram during *rabi* season of 2011-12 to study the effect of integrated nutrient management (INM) on rice under rice-rice-pulse cropping system. The treatments structure comprised *viz.*, T₁- Control (No manures/fertilizers), T₂- Organic manuring (*Sesbania aculeata* @ 6.25 t ha⁻¹), T₃- Inorganic Fertilization (NPK @ 150:50:50 kg ha⁻¹ for medium duration rice) and T₄-Integrated Nutrient Management (*Sesbania aculeata* @ 6.25 t ha⁻¹ + NPK @ 150:50:50 kg ha⁻¹). Biometrics such as plant height, number of tillers hill⁻¹, number of panicles m⁻², number of grains panicle⁻¹, panicle length, grain yield and straw yield were recorded. Integrated Nutrient management significantly influenced the growth and yield. The results revealed that treatment receiving application of *Sesbania aculeata* @ 6.25 t ha⁻¹ + 150:50:50 kg NPK ha⁻¹ for medium duration rice TPS 3 recorded relatively higher growth, yield and economics than other treatments.

Keywords: Rice, *Sesbania aculeata*, NPK, integrated nutrient management, yield

Introduction

In India rice is cultivated in an area of 44.1 million hectares with a production of 103.4 million tons (USDA, 2012), which plays a key role in food security. The country has to produce about 130 million tons of rice by 2025 to meet the food requirement of the growing population (Hugar *et al.*, 2009) [2]. Every year, huge amount of chemical fertilizers are applied to achieve maximum production in rice to meet the food requirement of our country. Due to the indiscriminate and injudicious use of chemical fertilizers, pesticides and aberrant weather conditions, the production and productivity of rice in India is facing a sustainability problem. Use of chemical fertilizers without addition of organic manures has created problems such as environmental pollution, health hazards, interruption of natural ecology, destruction of biological communities that support crop production, the depletion of soil organic carbon and mineral nutrients (Sheeja Raj *et al.*, 2013) [4].

Continuous application of fertilizers at high doses may, have adverse effects on crop yield besides affecting soil physical, chemical and biological properties. It was therefore considered important to initiate long term manurial experiment with a commonly practiced cropping sequence of the region, i.e., rice-rice- pulse cropping system. The use of organic manures in combination with chemical fertilizers proved its significant long term consistent beneficial effect on soil properties and productivity. Thus keeping in view the above consideration present investigation was undertaken to study the effect of integrated nutrient management on rice under rice-rice-pulse cropping system.

Materials and Methods

The field experiments were conducted during *rabi* 2011-12 at Agricultural Research Station, Thirupathisaram, Kanyakumari District. The experiment was laid out four treatments. According to plot size of each treatment, observation was made by dividing the whole plot area into 4-6 sub plots based on the number of rows, with forming binds. Each subplot was treated as replication. Based on variance the standard error for each treatment was worked out and compared. The treatments details of the experiment are furnished below.

T ₁ - Control	No manures/fertilizers
T ₂ - Organic manuring	<i>Sesbania aculeata</i> @ 6.25 t ha ⁻¹
T ₃ - Inorganic Fertilization	NPK @ 150:50:50 kg ha ⁻¹ for medium duration rice
T ₄ -Integrated Nutrient Management	<i>Sesbania aculeata</i> @ 6.25 t ha ⁻¹ + NPK @ 150:50:50 kg ha ⁻¹

The variety TPS 3 was used for test crop in *rabi* (Oct-Mar) season of 2011-12, respectively. *Sesbania aculeata* @ 6.25 t ha⁻¹ was applied as a source of organic manure at the time of final

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ploughing. The recommended dose of NPK @ 150:50:50 kg ha⁻¹ for medium duration rice TPS 3 was applied as inorganic sources. Observations on growth characters, yield characters, grain yield and straw yield were recorded and economics was worked out.

Results and Discussion

Effect on crop growth

Data on growth attributes of rice viz., plant height and number of tillers hill⁻¹ of short duration rice medium duration rice TPS 3 were significantly influenced by the treatments. Plant height varied from 90 to 103 cm and the number of tillers varied from 18 to 30 (Table 1). The maximum plant height (103 cm) and number of tillers hill⁻¹ (30) were recorded under integrated nutrient management followed by inorganic fertilizer and organic manure. This might be owing to efficient utilization of nutrients which helped in better and vigorous vegetative growth under integrated nutrient management treatment than inorganic and organic treatments (Yadhuvanshi, 2002). The least plant height (90cm) and number of tillers hill⁻¹ (18) was noticed under control. Similar results were also reported by Aswan *et al.* (2000).

Effect on yield attributes

The effect of organic and inorganic nutrients on yield attributes viz., number of panicles m⁻², number of grains panicle⁻¹ and panicle length were significantly influenced by the treatments (Table 1). The highest number of panicles m⁻² (255), number of grains panicle⁻¹ (268) and panicle length (27cm) were recorded under INM than inorganic and organic nutrients treatments. This was due to favourable influence of combined effect of *Sesbania aculeata* and recommended dose of N, P and K resulting in enhancing the maximum yield attributes produced on account of better availability and uptake of nutrients. This results are in accordance with the findings of the Tabasam *et al.* (2002) [5]. The minimum number of panicles m⁻² (177), number of grains panicle⁻¹ (165) and panicle length (14cm) were recorded in control during both *kharif* and *rabi* seasons.

Table 1: Effect of integrated nutrient management on growth and yield characters of Rice TPS 3

Treatment	Plant height (cm)	No. of Tillers hill ⁻¹	No. of panicles m ⁻²	No. of grains Panicle ⁻¹	Panicle length (cm)
T1-Control	90	18	177	165	14
T2-Organic manure	95	21	194	194	19
T3-Inorganic manure	98	25	227	235	24
T4-INM	103	30	255	268	27
S.Ed	1	1.2	7	12	1
CD (P= 0.05)	2	2.4	14	25	2.2

Yield and economics

Grain and straw yield of rice were significantly influenced by the application of organic manures and inorganic fertilizers (Table 2). Higher grain yield (6225 kg ha⁻¹) and straw yield (6850 kg ha⁻¹) were recorded with the combined application of *Sesbania aculeata* @ 6.25 t ha⁻¹ + NPK @ 150:50:50 kg ha⁻¹ for medium duration rice TPS 3 during *rabi* seasons. This was due to the production of more number of panicles m⁻², grains panicle⁻¹ and panicles weight. The increased efficiency of NPK fertilizers with green manuring may be due to chemical and enzymatic process, various growth and yield

components of rice were positively affected, which contributed towards increase in grain and straw yield of rice Tabasam *et al.* (2002) [5]. Inorganic and organic manure alone applied plots did not result in better grain and straw yield when compared to INM practice. The least grain yield (5200 kg ha⁻¹) and straw yield (5300 kg ha⁻¹) were recorded under no manured/no fertilizer applied plots. The grain and straw yield in control was found to be low, which might be due to insufficient nutrient supply to the plants due to non-addition of fertilizers and manures (Elayarajan *et al.*, 2013) [1]. Integrated nutrient management proved to be the most profitable treatment in terms of highest net income (Rs. 21917 ha⁻¹) and benefit cost ratio (1.70). This might be owing to the production of highest grain yield, the gross and net returns were found maximum under INM practice. Higher gross returns were due to higher grain yield, consequently better return for rupee invested on cost of cultivation. The lower returns were fetched from no manure/no fertilizer applied a plot which was the result of lowest grain yield under this treatment.

It was concluded that combined application of *Sesbania aculeata* @ 6.25 t ha⁻¹ + NPK @ 150:50:50 kg ha⁻¹ for medium duration rice TPS 3 during *rabi* season can be recommended as the best integrated nutrient management practice for higher yield and economics in southern region.

Table 2: Effect of integrated nutrient management on yield and economics of Rice TPS 3

Treatment	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	Net return (Rs.ha ⁻¹)	BC ratio
T1-Control	5200	5300	12334	1.42
T2-Organic manure	5725	5860	14687	1.47
T3-Inorganic manure	6250	6390	18406	1.58
T4-INM	6625	6850	21917	1.70
S.Ed	154	194	-	-
CD (P= 0.05)	310	390	-	-

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