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Performance of paddy as influenced by distillery waste and inorganic fertilizers

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Abstract

A field experiment was conducted at College of Agriculture, Rajendranagar, Professor Jayashankar Telangana State Agricultural University in season *Kharif*, 2015-16 to study the effect of distillery waste and inorganic fertilizer on growth and yield attributes of rice. Application of 100 % RDF gave a positive increase in growth and yield attributes. All treatments had a significant affect compared with control at all parameters studied. The higher growth and yield parameters were obtained by 100% RDF followed by 50% NPK + Godavari Kash @ 4 bags/ha. The effect of different treatments on growth and yield parameter showed that application of 100% RDF through inorganic source and application of distillery waste along with chemical fertilizers showed better results than sole application of distillery waste.

Keywords: Distillery waste, inorganic fertilizer, RDF, growth and yield parameters.

Introduction

Rice (*Oryza sativa* L.) is the world leading cereal crop for human utilization with cultivated area 154 M ha with an annual production of around 426 Mt and average productivity of 3.9 t ha⁻¹. Rice contributes to nearly 15 per cent of India's annual gross domestic product (GDP) and provides 43 per cent of the calorie/protein requirement for more than 70 per cent Indians (Tzudir and Ghosh, 2014) ^[9]. The total area of rice in India is 44.1 million hectares, with a production and productivity of 105.3 million tonnes and 2.38 t ha⁻¹ respectively (Department of Agriculture and Cooperation, 2014) ^[2]. In recent years due to increased cost of fertilizers, detrimental effect on the soil health have been noticed. The reduction in the use of chemical fertilizers and supplementing the same through organic manure have become necessary to sustain productivity, profitability and to maintain soil health. The enrichment of organic manures with micronutrients not only enhances the rate of decomposition but also improves the nutrient status (Singh *et al.* 1999). Micronutrients enriched organic manures improve their availability in soil by preventing fixation and precipitation, thereby enhancing the use efficiency of applied micronutrients and thus saving the cost on fertilizer. In addition to inorganics, supply of organic waste from MSW compost is a good source of plant nutrients for crops (Supriya, 2014) ^[8]. Hence, the present study was taken up to evaluate the response of distillery waste on growth and yield attributes of rice.

Materials and method

This field study was carried out during *kharif* season of 2015-16 at College Farm, College of Agriculture, Rajendranagar, PJTSAU. The soil of the experimental plot was sandy loam soil, slightly alkaline in reaction (pH 7.76), low in organic carbon and nitrogen and medium in P₂O₅ and K₂O. The trial was conducted in randomized block design with three replications on paddy var. MTU-1010. The experiment consisted of eight treatments *i.e* T₁ : Control , T₂ : 100% NPK- Recommended dose of fertilizers, T₃: Godavari Kash @ 2 bags/ ha, T₄: Godavari Kash @ 3 bags/ ha, T₅: Godavari Kash @ 4 bags/ ha, T₆: 50% NPK + Godavari Kash @ 2 bags/ ha, T₇: 50% NPK + Godavari Kash @ 3 bags/ ha and T₈: 50% NPK + Godavari Kash @ 4 bags/ ha. A seed rate of 50 kg ha⁻¹ was first soaked in water for 24 hours and kept for 48 hours in a moist gunny bag for sprouting. The sprouted seeds were broadcasted uniformly in a well prepared seed bed. Twenty seven days old seedlings were transplanted at 20 cm x 10 cm spacing in levelled plots. Recommended dose of fertilizers @ 120:60:60 was applied as per treatments at transplanting, tillering and panicle initiation. Potassium in the form of distillery waste *viz* Godavari Kash was applied to respective treatments @ 5 days before transplanting and also top dressed at tillering and panicle initiation. The distillery waste used in the study was analysed before application and nutrient status is presented in table 1. The data on the observations made were analyzed statistically by applying the technique of analysis of

variance for randomized block design and significance was tested by F-test (Snedecor and Cochran, 1967) [7]. Critical difference for examining treatment means for their significance was calculated at 5 per cent level of probability.

Table 1: Chemical components in the distillery waste

Moisture content (%)	13.70
Colour	Grey
C/N ratio	7.10
Nitrogen (%)	0.05
Phosphorus (%)	0.18
Potassium (%)	14.60
Calcium (%)	2.40
Magnesium (%)	2.60
Sulphur (mg/kg)	3.20
Copper (mg/kg)	56.50
Zinc(mg/kg)	35.80
Nickel (mg/kg)	19.4
Lead (mg/kg)	<1.00
Mercury (mg.kg)	<1.00
Cadmium (mg.kg)	2.30
Chromium (mg.kg)	36.6

Results and discussion

Growth parameters

From the results obtained, it was seen that the plant height, LAI and no. of tillers hill⁻¹ increased with advancement of crop growth stages and it was highest at harvest. T₂ exerted marked influence on plant height at tillering and harvest stage with values of 58.33 and 104.67 cm. This was closely followed by 50% NPK + Godavari kash 4 bags ha⁻¹ and 50% NPK + Godavari kash 3 bags ha⁻¹. The increase in plant height with increasing NPK could have resulted due to sufficient supply of nutrient which encourages plant growth. Availability of sufficient quantity of nutrients at the growth phases of plant recorded the maximum tiller production. In the integrated treatment basal and split application of distillery waste at tillering and panicle initiation had resulted in the addition of nutrients to the available soil pool, thereby facilitating higher nutrient uptake. Thus integration of distillery waste and chemicals offer more balanced nutrients to the plants especially macro and micro nutrient which positively influence the plant biomass system. The results are in conformity with Viridia and Mehta (2010) [10] and Baradhan and Suresh kumar (2013) [11].

Table 2: Growth parameters of paddy as influenced by distillery waste and inorganic fertilizers

Treatments	Plant height (cm)		LAI		No. of tillers/hill	
	Tillering	Harvest	Tillering	Harvest	Tillering	Harvest
T ₁ : Control	20.0	47.25	1.42	1.05	4.50	2.39
T ₂ : 100% NPK	58.33	104.67	3.38	2.72	12.77	8.60
T ₃ : Godavari kash @ 2 bags/ ha	22.17	51.00	2.07	1.42	5.25	2.87
T ₄ : Godavari kash @ 3 bags/ ha	27.23	60.33	2.20	1.59	6.23	3.20
T ₅ : Godavari kash @ 4 bags/ ha	31.86	68.67	2.56	1.78	7.57	3.96
T ₆ : 50% NPK + Godavari kash @ 2 bags/ ha	42.20	78.17	2.73	2.12	10.43	4.90
T ₇ : 50% NPK + Godavari kash @ 3 bags/ ha	46.72	88.45	2.89	2.34	11.17	5.67
T ₈ : 50% NPK + Godavari kash @ 4 bags/ ha	52.97	96.69	3.07	2.47	11.63	6.23
SE m ±	1.48	2.4	0.07	0.21	0.25	0.20
CD (P=0.05)	4.34	7.0	0.20	NS	0.73	0.58

Data pertaining to yield parameters are given in table 3 which indicated that highest no. of panicle hill⁻¹, no. of filled grains panicle⁻¹, test weight and grain yield was recorded with 100% NPK followed by 50% NPK + Godavari kash @ 4 bags ha⁻¹ and 50% NPK + Godavari kash @ 3 bags ha⁻¹. This might be due to N induced enhancement through inorganic fertilizers in photosynthetic activity and resulted in the translocation of photosynthesis and amino acids from leaves to the grain. Chemical fertilizers offer nutrients which are easily soluble in soil solution and instantly available to the plants enhancing the production and transportation of photosynthates from

source to sink and there by resulting in increased yield parameters. Better and continuous supply of macro and micro nutrients by distillery waste and chemical fertilizers might have helped for more enzymatic activity and physiological process of plant, resulting in better translocation of photosynthates and dry matter to the sink. This might have helped in increasing the number of panicles, filled grains/panicle and test weight. However, test weight was not significantly differed within the treatments. This work is in accordance with findings of Mishra (1991) [5] and Mondal *et al.* 1994 [6].

Table 3: Yield parameters and yield of paddy as influenced by distillery waste and inorganic fertilizers

Treatments	No. of Panicle /hill	No. of filled grains /panicle	Test weight(g)	Grain yield (kg ha ⁻¹)
T ₁ : Control	2.00	40.67	19.01	2.09
T ₂ : 100% NPK	7.45	116.00	20.75	6.83
T ₃ : Godavari kash @ 2 bags/ ha	2.36	46.40	18.14	2.65
T ₄ : Godavari kash @ 3 bags/ ha	2.67	52.33	18.98	3.13
T ₅ : Godavari kash @ 4 bags/ ha	3.25	63.67	19.81	3.78
T ₆ : 50% NPK + Godavari kash @ 2 bags/ ha	4.04	75.67	19.93	3.89
T ₇ : 50% NPK + Godavari kash @ 3 bags/ ha	5.75	95.00	20.40	4.54
T ₈ : 50% NPK + Godavari kash @ 4 bags/ ha	6.46	103.33	20.58	5.13
SE m ±	0.16	2.77	0.26	0.16
CD (P=0.05)	0.45	7.93	NS	0.45

Conclusions

The results obtained revealed that 100% RDF and 50% NPK + Godavari kash 4 bags ha⁻¹ had valuable effect on growth and yield of rice. Hence Godavari Kash @ 4 bags along with 50% recommended dose of N P K may be advocated for obtaining higher rice yields which helps in reducing 50 % recommended dose of N and P in particular muriate of potash and also expenditure incurred on chemical fertilizers.

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