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RESEARCH ARTICLE

INFLUENCE OF ORGANIC AND INORGANIC SOURCES OF NUTRIENTS ON GROWTH OF RICE

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ABSTRACT

Field experiments were conducted during February to May, 2014 to study the influence of organic and inorganic sources of nutrients on growth parameters of rice (ADT 36). The experiment consists of twelve treatments with three replications viz., T1-100 % Recommended Dose (RD) of NPK kg ha⁻¹ (120:38:38), T2 -T1+ soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT, T3 -75 % RD of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT, T4 -T1 + foliar spray of panchagavya 3 % at 30 and 45 DAT, T5 -T1 + soil application of Beema green granules 25 Kg ha⁻¹ 20 DAT + foliar spray of panchagavya 3 % at 30 and 45 DAT, T6 -75 % RD of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 Kg ha⁻¹ 20 DAT + foliar spray of panchagavya 3 % at 30 and 45 DAT, T7 -T1 + foliar spray of Nitrobenzene 750ml ha⁻¹ at 20 DAT, T8 -T1 + soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT + foliar spray of Nitrobenzene 750ml ha⁻¹ at 30 DAT, T9 -75 % RD of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT + foliar spray of Nitrobenzene 750ml ha⁻¹ at 30 DAT, T10 -T1 + foliar spray of panchagavya 3 % at 30 DAT+ foliar spray of Nitrobenzene 750ml ha⁻¹ at 45 DAT, T11 -T1 + soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT + foliar spray of panchagavya 3 % at 30 DAT+ foliar spray of Nitrobenzene 750ml ha⁻¹ at 45 DAT, T12 -75 % RD of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT + foliar spray panchagavya 3 % at 30 DAT + foliar spray of Nitrobenzene 750ml ha⁻¹ at 45 DAT. The growth parameters of rice viz., plant height, number of tillers per hill, LAI and DMP was favourably influenced by 100 % recommended dose of NPK kg ha⁻¹ (120:38:38) + soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT + foliar spray of panchagavya 3 % at 30 DAT+ foliar spray of Nitrobenzene 750ml ha⁻¹ at 45 DAT (T11). It recorded the higher plant height at harvest, number of tillers per hill at tillering stage, LAI at flowering and DMP at harvest.

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INTRODUCTION

Rice (*Oryza sativa*) is one of the most staple food crops that is being extensively cultivated in India. Rice is grown in 114 countries across the world with an area of 164 million hectares and production of 741.4 million tonnes with the productivity of 4.4 t ha⁻¹. In Tamil Nadu, rice is grown in an area of 2.2 million hectares resulting in production of 8.65 million tonnes with the productivity of 3.93 t ha⁻¹. However, the yield is still lower, when compared to the average productivity of rice producing countries such as Japan, China, Egypt and Israel. Continuous use of inorganic fertilizers leads to deterioration of soil chemical, physical properties and biological activity in soil (Mahajan *et al.*, 2008). Now a days the sources of organic matter are scarce, due to shortage and non-availability of labour to rear animals.

Humic acid, a decomposed product of organic matter, influences plant growth by modifying the physiology of plant and by improving the physical, chemical and biological properties of soil and ultimately crop yield (Schnitzer, 2000). Humic substances improve yield and quality of a variety of plants, including grains (Ulukan, 2008). Panchagavya, an organic source of nutrition, is an indigenous material which is used widely for agricultural and horticultural crops. Panchagavya had positive influence on beneficial microorganisms present in the soil and influence the crop growth and yield (Natarajan, 2002). Panchagavya is now gaining attention as an efficient organic growth promotor (Naik and Sreenivasa, 2009). Nitrobenzene is a combination of nitrogen and plant growth regulators that act as plant energizer, flowering stimulant and yield booster. Nitrobenzene produces best results in combination with plant growth regulators, which have capacity to increase flowering in plant and also prevent flower shedding (Mithila Deb *et al.*, 2012). Keeping in view of sustainable agronomic practices to increase the yield of rice, the field investigation was taken up.

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Table 1. Influence of organic and inorganic sources of nutrients on growth parameters of rice

Treatment	Plant height at harvest	No.of tillers hill ⁻¹ at tillering	LAI at flowering	DMP at harvest (kg ha ⁻¹)
T ₁ –100% RDF(120:38:38 NPK kg ha ⁻¹)	64.80	5.39	4.69	7705
T ₂ – 100 % RDF (120:38:38 NPK kg ha ⁻¹) + Beema green granules 25 kg ha ⁻¹	68.29	5.20	4.86	7886
T ₃ – 75 % RDF(90:38:38 NPK kg ha ⁻¹) +Beema green granules 25 kg ha ⁻¹	60.42	5.02	4.29	6670
T ₄ –100% RDF (120:38:38 NPK kg ha ⁻¹) + Panchagavya 3%	71.68	5.57	5.02	8845
T ₅ – 100 % RDF (120:38:38 NPK kg ha ⁻¹) + Beema green granules 25 kg ha ⁻¹ + Panchagavya 3%	88.78	6.57	5.68	9817
T ₆ – 75 %RDF(90:38:38 NPK kg ha ⁻¹) + Beema green granules 25 kg ha ⁻¹ + Panchagavya 3%	78.56	5.94	5.29	9340
T ₇ –100 % RDF(120:38:38 NPK kg ha ⁻¹) + Nitrobenzene 750ml ha ⁻¹	75.11	5.76	5.14	8948
T ₈ – 100 % RDF (120:38:38 NPK kg ha ⁻¹) + Beema green granules 25 kg ha ⁻¹ + Nitrobenzene 750ml ha ⁻¹	85.39	6.37	5.56	9648
T ₉ – 75 %RDF(90:38:38 NPK kg ha ⁻¹) +Beema green granules 25 kg ha ⁻¹ + Nitrobenzene 750ml ha ⁻¹	81.98	6.16	5.43	9381
T ₁₀ –100 % RDF (120:38:38 NPK kg ha ⁻¹) + Panchagavya 3% + Nitrobenzene 750ml ha ⁻¹	92.21	6.76	6.26	11176
T ₁₁ – 100 % RDF (120:38:38 NPK kg ha ⁻¹) + Beema green granules 25 kg ha ⁻¹ + Panchagavya 3% + Nitrobenzene 750ml ha ⁻¹	98.95	7.00	6.48	12034
T ₁₂ –75 % RDF (90:38:38 NPK kg ha ⁻¹) + Beema green granules 25 kg ha ⁻¹ + Panchagavya 3% + Nitrobenzene 750ml ha ⁻¹	97.62	6.95	6.45	11990
SE _d	1.56	0.07	0.05	84
CD (P = 0.05)	3.38	0.17	0.11	180

MATERIALS AND METHODS

The field experiment was conducted at the Experimental Farm, Department of Agronomy, Annamalai University, Tamil Nadu, during the period of February to May, 2014, to study the influence of organic and inorganic sources of nutrients on growth parameters of rice. The cropping period the mean maximum temperature ranges between 29.2°C and 37.3°C, while the minimum temperature ranges from 20.9°C to 26.6°C. The RH ranges from 76 to 96 percent. The soil was clay loam in texture with low in available nitrogen, medium in available phosphorus and high in available potassium. A short duration rice variety ADT 36 was chosen with a duration of 110 days. The experiment was laid out in Randomized Block Design (RBD) with three replication with twelve treatments viz., T₁-100 % Recommended Dose (RD) of NPK kg ha⁻¹ (120:38:38), T₂-T₁+ soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT, T₃ -75 % RD of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT, T₄ -T₁ + foliar spray of panchagavya 3 % at 30 and 45 DAT, T₅ -T₁ + soil application of Beema green granules 25 Kg ha⁻¹ 20 DAT + foliar spray of panchagavya 3 % at 30 and 45 DAT, T₆ -75 % RD of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 Kg ha⁻¹ 20 DAT + foliar spray of panchagavya 3 % at 30 and 45 DAT, T₇ -T₁ + foliar spray of Nitrobenzene 750ml ha⁻¹ at 20 DAT, T₈ -T₁ + soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT + foliar spray of Nitrobenzene 750ml ha⁻¹ at 30 DAT, T₉ -75 % RD of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT + foliar spray of Nitrobenzene 750ml ha⁻¹ at 30 DAT, T₁₀ -T₁ + foliar spray of panchagavya 3 % at 30 DAT+ foliar spray of Nitrobenzene 750ml ha⁻¹ at 45 DAT, T₁₁ -T₁ + soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT + foliar spray of panchagavya 3 % at 30 DAT+ foliar spray of Nitrobenzene 750ml ha⁻¹ at 45 DAT, T₁₂ -75 % RD of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 Kg ha⁻¹ at 20 DAT + foliar spray panchagavya 3 % at 30 DAT + foliar spray of Nitrobenzene 750ml ha⁻¹ at 45 DAT. Beema green granules is an organic humic granules and it contain humic acid, fulvic acid, amino acid and micronutrients. Beema green granules @ 25 kg ha⁻¹ was applied at 20 DAS evenly over respective plots.

The panchagavya was applied through foliar @ 3 % at different growth stages of rice. Nitrobenzene plant growth promoter was used as foliar spray @ 750 ml ha⁻¹. The solution was uniformly sprayed using hand sprayer (knap sack) at 30 and 45 DAT as per the treatment schedule. The 26 days old paddy seedlings were transplanted in lines @ 2 seedlings hill⁻¹ in a depth of 2-3cm. A spacing of 12.5× 10 cm was adopted.

RESULTS AND DISCUSSION

Plant height at harvest: The plant height observed at harvest is presented in Table 1. Among the different treatments, the highest plant height at harvest was observed under T₁₁ - 100% recommended dose of NPK kg ha⁻¹ (120:38:38) + soil application of Beema green granules 25 kg ha⁻¹ + foliar spray of Panchagavya 3% + foliar spray of Nitrobenzene 750 ml ha⁻¹. This treatment was found to be superior and recorded the plant height of 98.95 cm at harvest. It was on par with the treatment T₁₂ - 75% recommended dose of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 kg ha⁻¹ + foliar spray of Panchagavya 3% + foliar spray of Nitrobenzene 750 ml ha⁻¹. The least plant height (60.42 cm) was recorded in T₃ – 75 % recommended dose of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25kg ha⁻¹. The enhancement in growth with increase in nutrient availability was owing to rapid conversion of synthesized photosynthates into protein to form more protoplasm, this increased the number and size of the cell which might have increased the plant height. Similar finding was reported by Sridevi (2011).

Number of tillers hill⁻¹: Among the treatments tried, highest values on number of tillers hill⁻¹ (Table.1) was observed under T₁₁ - 100% recommended dose of NPK kg ha⁻¹ (120:38:38) + soil application of Beema green granules 25 kg ha⁻¹ + foliar spray of Panchagavya 3 % + foliar spray of Nitrobenzene 750 ml ha⁻¹ with a value of 7.00. It was on par with the treatment T₁₂ - 75% recommended dose of NPK kg ha⁻¹(90:38:38) + soil application of Beema green granules 25 kg ha⁻¹ + foliar spray of Panchagavya 3% + foliar spray of Nitrobenzene 750ml ha⁻¹. The least number of tillers were recorded in T₃ – 75% recommended dose of NPK kg ha⁻¹ (90:38:38) + soil

application of Beema green granules 25 kg ha⁻¹ of 5.02. The increase in number of tillers hill⁻¹ may be due to cumulative effect of fertilizer under increasing trend of nutrients. Similar result was reported by Nageswari and Balasubramanian (2004).

Leaf area index (LAI): The leaf area index at flowering are presented in Table 1. Among the various treatments, T₁₁ - 100 % Recommended dose of NPK kg ha⁻¹ (120:38:38) + soil application of Beema green granules 25 kg ha⁻¹ + foliar spray of Panchagavya 3% + foliar spray of Nitrobenzene 750 ml ha⁻¹ recorded a highest LAI of 6.48. It was on par with the treatment T₁₂ - 75 % recommended dose of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 kg ha⁻¹ + foliar spray of Panchagavya 3% + foliar spray of Nitrobenzene 750 ml ha⁻¹. The lowest LAI was observed under T₃ - 75 % Recommended dose of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 kg ha⁻¹ with a value of 4.29. Adequate supply of the essential nutrients i.e. N, P and K might have exerted a positive influence on the tillers and leaves leading to higher leaf area index. The results are in conformity with the findings of Manivannan (2003).

Dry matter production: Among the different treatments, the highest dry matter production (Table 1) at harvest was recorded under T₁₁ - 100 % recommended dose of NPK kg ha⁻¹ (120:38:38) + soil application of Beema green granules 25 Kg ha⁻¹ + foliar spray of Panchagavya 3% + foliar spray of Nitrobenzene 750 ml ha⁻¹ with a value of 12034 kg ha⁻¹. The T₁₁ treatment on par with T₁₂ - 75 % Recommended dose of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 kg ha⁻¹ + foliar spray of Panchagavya 3% + foliar spray of Nitrobenzene 750 ml ha⁻¹. The lowest dry matter production was recorded under T₃ - 75 % Recommended dose of NPK kg ha⁻¹ (90:38:38) + soil application of Beema green granules 25 kg ha⁻¹ which recorded a value of 6670 kg ha⁻¹.

Increased dry matter accumulation observed under higher NPK level due higher portion of green leaves with increased chlorophyll content enabling the plants to have increase the photosynthetic efficiency and resulted in vigorous crop growth coupled with more tillers. The above finding was in conformity with the result of Yadana *et al.* (2009).

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