STUDY OF ORGANIC AND INORGANIC NUTRIENTS ON PRODUCTIVITY AND NUTRIENT UPTAKE OF RICE

MARTINCO,M., S.MANIMARAN, D.KALYANASUNDRAM, R.KRISHNAMOORTHY AND C.RAVIKUMAR

Department of Agronomy, Faculty of Agriculture, Annamalai University, Tamil Nadu, India.

ABSTRACT

Field experiment was conducted to study the effect of organic and inorganic nutrients on yield and nutrient uptake of rice. The experiment consists of twelve treatments with three replications *viz.*, T_1-100 % recommended dose of NPK kg ha^{-1} (120:38:38), T_2 -T_1+ soil application of Beema green granules 25 Kg ha^{-1} at 20 DAT, T_3 -75 % recommended dose of NPK kg ha^{-1} (90:38:38) + soil application of Beema green granules 25 Kg ha^{-1} at 20 DAT, T_4 -T1 + foliar spray of panchagavya 3 % at 30 and 45 DAT, T_5 -T_1 + soil application of Beema green granules 25 Kg ha^{-1} 20 DAT + foliar spray of panchagavya 3 % at 30 and 45 DAT, T_6 -75 % recommended dose 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, T_7 -T_1 + foliar spray of Nitrobenzene 750ml ha^{-1} at 20 DAT, T_8 -T_1 + soil application of Beema green granules 25 Kg ha^{-1} at 20 DAT + foliar spray of Nitrobenzene 750ml ha^{-1} at 30 DAT, T_9 -75 % recommended dose 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, T_{10} -T_1 + foliar spray of panchagavya 3 % at 30 DAT+ foliar spray of Nitrobenzene 750ml ha^{-1} at 45 DAT, T_{11} -T_1 + 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, T_{12} -75 % recommended dose 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 grain yield, straw yield, N, P and K uptake was significantly 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 (T_{11}). It recorded the higher grain yield, straw yield, N, P and K uptake.

Keywords: Rice, Beema green granules, Panchagavya, Nitrobenzene, NPK, Uptake

INTRODUCTION

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 India it is grown in an area of 44.10 million hectares and the production of 159 million tonnes with the productivity of 3.58 t ha^{-1} (FAO, 2013). In Tamil Nadu, it 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} (TNAU, 2013). However, the yield is still lower, when compared to the average productivity of rice producing countries such as Japan (8.25 t ha^{-1}), China (6.70 t ha^{-1}), Egypt (7.50 t ha^{-1}) and Israel (5.50 t ha^{-1}) (USDA, 2012).

To fulfill the increased rice demand with shrinking resources, it is necessary to increase yield per unit area with sustainable nutrient management practices which would increase the rice production sustainability without harming the precious environment. Continuous use of inorganic fertilizers leads to deterioration of soil chemical, physical properties and biological activity in soil. Nutrients supplied exclusively through chemical sources, though enhance yield initially lead to unsustainable productivity over the years. Now a days the sources of organic matter are scare, 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. Panchagavya had positive influence on beneficial microorganisms present in the soil and influence the crop growth and yield. Panchagavya is used in crop as seed or seedling dipping, foliar spray, soil application through irrigation water etc. Nitrobenzene is a combination of nitrogen and plant growth regulators that act as plant energizer, flowering stimulant and yield booster (Aziz and Miah, 2009).

MATERIALS AND METHODS

The field experiment was conducted at the Experimental Farm, Department of Agronomy, Annamalai University, Tamil Nadu, to study the effect of organic and inorganic nutrients on grain yield, straw yield, N.P and K uptake of rice. The soil is clay loam with low in available nitrogen, medium in available phosphorus and high in available potassium. The short duration rice variety (110 days) was chosen for this experiment.

Randomized Block Design (RBD) adopted with three replication with twelve treatments *viz*., T_1-100 % recommended dose of NPK kg ha^{-1} (120:38:38), T_2 -T_1+ soil application of Beema green granules 25 Kg ha^{-1} at 20 DAT, T_3 -75 % recommended dose of NPK kg ha^{-1} (90:38:38) + soil application of Beema green granules 25 Kg ha^{-1} at 20 DAT, T_4 -T1 + foliar spray of panchagavya 3 % at 30 and 45 DAT, T_5 -T_1 + soil application of Beema green granules 25 Kg ha^{-1} 20 DAT + foliar spray of panchagavya 3 % at 30 and 45 DAT, T_6 -75 % recommended dose 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, T_7 -T_1 + foliar spray of Nitrobenzene 750ml ha^{-1} at 20 DAT, T_8 -T_1 + soil application of Beema green granules 25 Kg ha^{-1} at 20 DAT + foliar spray of Nitrobenzene 750ml ha^{-1} at 30 DAT, T_9 -75 % recommended dose 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, T_{10} -T_1 + foliar spray of panchagavya 3 % at 30 DAT+ foliar spray of Nitrobenzene 750ml ha^{-1} at 45 DAT, T_{11} -T_1 + 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, T_{12} -75 % recommended dose 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 (Beema green granules) contains humic acid, fulvic acid, amino acid and micronutrients. Beema green granules @ 25 kg ha^{-1} was applied at 20 DAT evenly over treatment plots. The panchagavya was applied through foliar @ 3 % at 30 and 45 DAT as per treatment. Nitrobenzene plant growth promoter was used as foliar spray @ 750 ml ha^{-1}. The solution was sprayed using hand sprayer at 20, 30 and 45 DAT as per the treatment schedule.

RESULTS AND DISCUSSION

Grain yield (Table 1**)**

Among the various treatments, T_{11} - 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 grain yield of 5.79 t ha^{-1}. It was on par with the treatment T_{12} - 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 grain yield was observed under T_3 – 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 3.42 t ha^{-1}. The positive effect of major nutrients viz., N, P, K influenced the yield components ultimately leading to increased yield (Kavimani and Krishnarajan 1991).

Straw yield (Table 1)

Among the different treatments, the straw yield at harvest was recorded under T_{11} - 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 7.24 t ha^{-1}. The T_{11} treatment on par with T_{12} - 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 straw yield was recorded under T_3 – 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 6.23 t ha^{-1}. The increased straw yield of rice due to combined application of organic and inorganic sources of plant nutrient was attributed to the positive plant characters which resulted in highest straw yield. The results are similar to with the finding of Yadav *et al.* (2005).

Nutrient uptake (Table 1)

The data recorded on uptake of N, P and K by crop at harvest. Among the treatments tried, the highest N, P and K uptake was recorded under T_{11} - (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}),which recorded N, P and K uptake of 132.35, 37.22 and134.62 kg ha^{-1} respectively. It on par with the treatment T_{12} - (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 N, P and K uptake was recorded in T_3-(75 % recommended dose of NPK kg ha^{-1} (90:38:38) + soil application of Beema green granules 25 kg ha^{-1}). The maximum N, P and K uptake was associated with the more availability of required nutrients to the crops. The combined application of organic and inorganic fertilizers resulted in to reduction of K fixation, solubilisation and release of K due to interaction of organic matter with clay, besides the direct potassium addition to the potassium pool of the soil. Similar reports were given by Roy *et al.* (2013).

CONCLUSION

The 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 (T_{11}) increased the grain yield, straw yield, N, P and K uptake in rice.

REFERENCES

Aziz, M.A. and M.A.M. Miah 2009. Effect on the growth and yield of wetland rice.***J.Agric. Rural Dev.*** 7:9-13.

FAO, 2013. Rice world, yield and production.Food and Agricultural Organization. http://faostat3.fao.org/download/Q/QC/E

Kavimani, R.andJ. Krishnarajan. 1991. Effect of method, level and time of phosphorus application on yield and yield components of IR 20 rice. ***Madras Agric. J., 78***(9-12):533-536.

Roy, R., K. Singh, S. Singh and A. Singh. 2013. Integrated nutrient management in rice (*Oryza sativa*). ***Ind. J. Agron.,*****58** (2): 203-207.

TNAU, 2013.Rice area, Productivity and production Tamil Nadu Agricultural University, Coimbatore.

USDA. 2012. Rice area, Yield and Production. United States Department of Agriculture, Foreign Agriculture service.

Yadav, M.P., Mohd Aslam and S.P. Kushwaha. 2005. Effect of integrated nutrient management in rice (*Oryza sativa* L.) -wheat (*Triticum aestivum*) cropping system in central plains zone of uttar pradesh. ***Ind. J. Agron.***,50 :89-93

Table 1. Effect of organic and inorganic nutrients on grain yield, straw yield and nutrient uptake of rice

Treatment	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Nutrient uptake (kg ha^{-1})		
			N	P	K
T_1-100% recommended dose (120:38:38 NPK kg ha^{-1})	3.71	6.38	111.01	21.12	113.16
T_2-100 % recommended dose (120:38:38 NPK kg ha^{-1}) + Beema green granules(Beema green granules) 25 kg ha^{-1}	4.00	6.54	113.21	22.85	115.40
T_3-75 % recommended dose (90:38:38 NPK kg ha^{-1}) + Beema green granules 25 kg ha^{-1}	3.42	6.23	108.79	19.50	110.98
T_4-100% recommended dose (120:38:38 NPK kg ha^{-1}) + Panchagavya 3%	4.23	6.61	115.42	24.51	117.64
T_5-100 % recommended dose (120:38:38 NPK kg ha^{-1}) + Beema green granules 25 kg ha^{-1} + Panchagavya 3%	4.94	6.56	126.14	32.61	128.30
T_6-75 % recommended dose (90:38:38 NPK kg ha^{-1}) + Beema green granules 25 kg ha^{-1} + Panchagavya 3%	4.33	6.30	119.74	27.78	121.89
T_7-100 % recommended dose (120:38:38 NPK kg ha^{-1}) + Nitrobenzene 750ml ha^{-1}	4.62	6.95	117.58	26.15	119.87
T_8-100 % recommended dose (120:38:38 NPK kg ha^{-1}) + Beema green granules 25 kg ha^{-1}+Nitrobenzene 750ml ha^{-1}	4.84	5.74	124.01	31.01	126.09
T_9-75 % recommended dose (90:38:38 NPK kg ha^{-1}) + Beema green granules 25 kg ha^{-1} + Nitrobenzene 750ml ha^{-1}	4.34	6.10	121.88	29.40	123.90
T_{10}-100 % recommended dose (120:38:38 NPK kg ha^{-1}) + Panchagavya 3% + Nitrobenzene 750ml ha^{-1}	5.23	6.80	128.26	34.20	130.50
T_{11}-100 % recommended dose (120:38:38 NPK kg ha^{-1}) + Beema green granules 25 kg ha^{-1} + Panchagavya 3% + Nitrobenzene 750ml ha^{-1}	5.79	7.24	132.35	37.22	134.62
T_{12}-75 % recommended dose (90:38:38 NPK kg ha^{-1}) + Beema green granules 25 kg ha^{-1} + Panchagavya 3% + Nitrobenzene 750ml ha^{-1}	5.75	7.21	132.06	37.04	133.90
SE_d	0.14	0.07	1.02	0.76	1.06
CD (P = 0.05)	0.28	0.15	2.07	1.53	2.15