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EFFECT OF SITE SPECIFIC NUTRIENT MANAGEMENT ON YIELD CHARACTERISTICS AND ECONOMICS OF TRANSPLANTED RICE IN THE CAUVERY DELTAIC ZONE

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Abstract

Field experiments were conducted at Annamalai University Experimental Farm, Annamalainagar, Tamil Nadu to study the effect of Site Specific Nutrient Management for transplanted Rice Cv. ADT 36 and ADT 43. There are fifteen treatments viz., T_1 – 150: 15: 50 kg NPK ha^{-1}, T_2 – 150: 30: 50 kg NPK ha^{-1}, T_3 – 150: 45: 50 kg NPK ha^{-1}, T_4 – 150: 60: 50 kg NPK ha^{-1}, T_5 – 150: 15: 75 kg NPK ha^{-1}, T_6 – 150: 30: 75 kg NPK ha^{-1}, T_7 – 150:45:75 kg NPK ha^{-1}, T_8 – 150: 60: 75 kg NPK ha^{-1}, T_9 – 150: 15:100 kg NPK ha^{-1}, T_{10} – 150:30:100 kg NPK ha^{-1}, T_{11} – 150:45:100 kg NPK ha^{-1}, T_{12} – 150:60:100 kg NPK ha^{-1}, T_{13} – LCC:15:80 kg NPK ha^{-1}, T_{14} – 150:50:50 kg NPK ha^{-1}, T_{15} – control. The treatments were replicated thrice in randomized block design. The study revealed that in both the seasons, yield components like number of tillers hill^{-1}, number of panicles hill^{-1} and number of grains panicle^{-1} were increased by the application of increased level of P & K. Application of treatment $T_{8,}$ recorded the highest grain yield of 5280 and 5390 kg ha^{-1} with ADT 36 and ADT 43. It was followed by the treatment, T_{12} – 150:60:100 kg NPK ha^{-1}. Considering the economics, application of 150: 60: 75 kg NPK ha^{-1} (T_8) recorded the highest return rupee^{-1} invested.

Key words: Site Specific Nutrient Management, levels of P and K, LCC, yield components.

Introduction

Rice (*Oryza sativa*) is the most important staple food crop of the world, grown widely in the tropical and sub-tropical regions of the world. The productivity of rice is lacking behind due to imbalanced, inappropriate or excessive use of nutrients in agricultural systems which acts as a major cause for low crop yields. The use of blanket nutrient management recommendations in India led to low nutrient use efficiency, lowered profits and increased environmental problems (Pampolino *et al.*, 2012). For reducing the wastage of fertilizers, to increase yield per unit of fertilizers applied and to increase farmer's income, new technologies are needed which would consider adjustment in fertilizer amounts and timing of application to the location and season specific needs of rice. In India, crop nutrient recommendations are based upon crop response data calculated for a large geographic areas while the spatial variability in indigenous nutrient supplying capacity of soils were not considered (Nimdar *et al.*, 2013). Estimation of field specific fertilizer requirements needs site specific knowledge of crop nutrient requirement, indigenous nutrient supply of soil and recovery efficiency of applied fertilizer in particular crop. SSNM, is a field specific management of nutrients like N, P and K to increase the efficiency of supplemental nutrients regarding the plant's demand for nutrients. By that way, higher yield can be achieved by fertilizer application regarding the location and season specific needs of the crop. LCC, leaf colour chart is an indicator of leaf N status based N management which contributes towards increased Nitrogen use efficiency (Alam *et al.*, 2006), while it is not for basal fertilizers and other nutrients like P and K (Buresh *et al.*, 2010).

In view of the above, the study was made in two different rice varieties applying with varying levels of nutrients.

Materials and Methods

The experiment was carried out at Faculty of Agriculture, Annamalai Nagar during the 'Navarai' season of 2017 and 2018. The experiments was laid out in Randomized block design with three replications. There are fifteen treatments. T_1 – 150:50:50 kg NPK ha$_{-1}$, T_2 –

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150: 30: 50 kg NPK ha^{-1}, T_3 – 150: 45: 50 kg NPK ha^{-1}, T_4 – 150: 60: 50 kg NPK ha^{-1}, T_5 – 150: 15: 75 kg NPK ha^{-1}, T_6 – 150: 30: 75 kg NPK ha^{-1}, T_7 – 150:45:75 kg NPK ha^{-1}, T_8 – 150: 60: 75 kg NPK ha^{-1}, T_9 – 150: 50:100 kg NPK ha^{-1}, T_{10} – 150:30:100 kg NPK ha^{-1}, T_{11} – 150:45:100 kg NPK ha^{-1}, T_{12} – 150:60:100 kg NPK ha^{-1}, T_{13} – LCC:15:80 kg NPK ha^{-1}, T_{14} – 150:50:50 kg NPK ha^{-1}, T_{15} – control. Fertilizers were applied plot wise as per the treatment schedule. Urea, Superphosphate and Murate of potash were the fertilizer used to supply the required quantity of N, P and K respectively. The entire dose of P_2O_5 was applied as basal along with half of the N and K_2O in two equal splits at maximum tillering and PPI stage. Observations on tiller number.

Panicle length, number of grain per panicle, 1000 grain weight and grain yield were recorded at harvest. BCR was also workout to make a clear conclusion.

Results and Discussion

The effect of various fertilizer levels on the yield parameters of rice is presented in the Table 1. There was a significant increase in productive tillers hill^{-1}, number of grain panicle^{-1} with each successive increment of fertilizer P and K.

The highest number of panicles hill^{-1} (8.03 and 8.09) was recorded under the treatment T_8 (150:60:75 kg NPK ha^{-1}). This treatment was found to be significantly superior over the other treatments. The higher dose of P and K probably gave better nourishment to rice crop resulted in highest panicle number. The results of the present study are in collaborative with the findings of Sapotaka *et al.,* 2014 and Kumar *et al.,* 2018. The maximum filled grains per panicle and thousand grain weight, highest panicles m^{-2}, was obtained in Treatment $T_{8,}$ which was followed by the treatment T_{12}.

More number of filled grains panicle^{-1} (74.26 and 81.54) was recorded with a fertilizer dose of 150:60:75 kg NPK ha^{-1}. Phosphorous application at higher level initiated early tillering and took less time for completion of flowering and thus available nutrients were directed to the production of not only a greater number of grain panicle^{-1} and higher number of filled grain panicle^{-1}. Similar observations were made by Peng *et al.,* 2010.

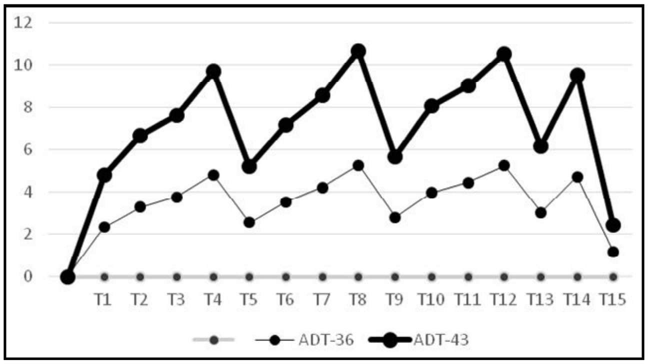
Number of filled grain per panicle, effective tillers, total grain per panicle and test weights were significantly influenced by the different nutrient management. Result shows that the yield was found highly significant in different nutrient management practices.

There was a spectacular and significant increase in grain and straw yields due to all the treatments over control. The higher grain and straw yield were recorded under application of 150:50:75 kg NPK ha^{-1} (T_8). The positive effect of major nutrients *viz.,* N (Promoter of growth), P (better rooting and more nutrient uptake), K (better grain formation and increased filling percentage) influenced the yield components ultimately leading to increased yields.

The grain yield recorded significantly higher values (5.28 and 5.39 t ha^{-1}) under T_8. Further, it was observed

Table 1: Effect of Site Specific Nutrient Management on yield characteristics and economics of Transplanted Rice.

Treatments	Panicles hill^{-1}		No. of filled grains panicle^{-1}		Grain yield (t ha^{-1})		Straw yield (t ha^{-1})		BCR	
	ADT-36	ADT-43	ADT-36	ADT-43	ADT-36	ADT-43	ADT-36	ADT-43	ADT-36	ADT-43
T_1-150:15:50 kg NPK ha^{-1}	4.33	4.35	53.36	58.38	2.33	2.47	3.46	3.55	1.09	1.13
T_2-150:30:50 kg NPK ha^{-1}	5.59	5.62	60.03	65.76	3.30	3.39	4.74	4.77	1.50	1.54
T_3-150:45:50 kg NPK ha^{-1}	6.10	6.24	63.36	69.38	3.76	3.86	5.35	5.40	1.67	1.71
T_4-150:60:50 kg NPK ha^{-1}	7.43	7.66	70.86	77.92	4.81	4.90	6.65	6.74	2.08	2.12
T_5-150:15:75 kg NPK ha^{-1}	4.57	4.66	55.01	60.27	2.56	2.66	3.75	3.85	1.18	1.22
T_6-150:30:75 kg NPK ha^{-1}	5.85	5.94	61.67	67.60	3.54	3.63	5.06	5.08	1.59	1.61
T_7-150:45:75 kg NPK ha^{-1}	6.67	6.87	66.68	73.04	4.22	4.34	5.95	6.04	1.85	1.90
T_8-150:60:75 kg NPK ha^{-1}	8.03	8.29	74.26	81.54	5.28	5.39	7.25	7.36	2.26	2.30
T_9-150:15:100kg NPK ha^{-1}	4.88	4.99	56.64	62.10	2.81	2.88	4.11	4.16	1.28	1.31
T_{10}-150:30:100 kg NPK ha^{-1}	6.53	6.57	63.01	71.25	3.97	4.12	5.64	5.73	1.76	1.82
T_{11}-150:45:100 kg NPK ha^{-1}	6.97	7.21	68.43	74.93	4.46	4.58	6.27	6.34	1.93	1.98
T_{12}-150:60:100 kg NPK ha^{-1}	7.72	7.98	72.57	79.75	5.25	5.31	6.96	7.06	2.13	2.17
T_{13}-LCC:15:80kg NPK ha^{-1}	5.28	5.31	58.34	63.88	3.04	3.14	4.42	4.47	1.43	1.47
T_{14}-150:50:50 kg NPK ha^{-1}	7.25	7.54	70.19	76.79	4.72	4.81	6.62	6.65	2.08	2.12
T_{15} – Control	3.03	3.98	40.72	54.35	1.15	1.29	2.13	2.29	0.67	0.74
SEd	0.11	0.14	0.80	0.76	0.09	0.11	0.13	0.14	-	-
CD (p = 0.05)	0.23	0.27	1.61	1.74	0.19	0.21	0.27	0.29	-	-



Graph 1: Yield of rice varieties ADT 36 and ADT 43 in SSNM practice.

that grain yield under LCC (3.04 and 3.14 t ha^{-1}) was significantly higher when compared with similar levels of Phosphorous and potassium in treatment T_5 (2.56 and 2.66 t ha^{-1}) which indicates that with proper timing and less quantity of N application along with increased P and K as compared to RDF could result in increased yields. Similar results were stated by Pankaj, 2019.

The concept of "feed the crop as needed" has been shown to increase the economic viability of rice farming for farmers (Peng *et al.*, 2010).

Conclusion

The results clearly indicated the advantage of application of higher level of P (60 kg ha^{-1}) and K (75 kg ha^{-1}) along with 150 kg N ha^{-1} in registering highest yield parameters. Considering the economics, application of 150: 60: 75 kg NPK ha^{-1} (T_8) recorded the highest return rupee^{-1} invested and found be agronomically efficient in achieving highest yield parameters and yield of rice in the Cauvery deltaic zone in a sustainable way.

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