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RESEARCH NOTE

Nutrient management practices for enhancing the productivity of aerobic rice during summer in hill zone of Karnataka

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A field experiment was conducted during summer-2015 at Agricultural Research Station (Paddy), Sirsi on sandy clay loam soil to study the effect of nutrient management practices in enhancing productivity of aerobic rice in hill zone of Karnataka. There were 11 treatment combinations having spray of two different water soluble fertilizers *viz.*, 19:19:19 and 13:0:45 (0.5%) ; soil application of micronutrients *viz.*, zinc as zinc sulphate (25 kg ha^{-1}) and boron as borax (2 kg ha^{-1}) along with recommended dose of fertilizer (RDF) (75:75:87.5 kg N, P_2O_5 and K_2O ha^{-1}) and RDF + Farm Yard Manure (FYM) (10 t ha^{-1}). Among the different treatments, treatment having foliar spray of 19:19:19 (0.5 % at 45, 60 and 75 DAS) along with RDF + FYM + $ZnSO_4$ + borax has recorded significantly higher grain and straw yield (3765 and 4420 kg ha^{1}, respectively) and also higher gross and net returns (₹ 65,321 and 33,436 ha^{-1}, respectively) and was found significantly superior over all other treatments except the treatments with foliar application of either 19:19:19 or 13:0:45.

Key words: Aerobic rice, Borax, Zinc sulphate

Rice (*Oryza sativa* L.) is the world's most important food crop. It is a staple food for more than half of the world's population. Aerobic rice is a recent method of rice cultivation, wherein, the rice is grown under non-puddled and non-flooded soil conditions with water content of 70 to 100 per cent of water-holding capacity throughout the cropping period. This method provides opportunities for saving irrigation water by 12 to 35 per cent and labour upto 60 per cent with similar or slightly lower yield of rice (Kumar and Ladha, 2011). Rice is a major crop in the hill zone of Karnataka grown mainly as rainfed crop during *kharif* season. The area under rice during summer season is very less and is restricted to areas near by small reservoirs, ponds and wells. Aerobic rice cultivation may help in increasing area under rice during summer in hill zone of Karnataka. The yield of rice crop mainly depends on nutrient management practices together with its interaction to environmental factors, soil condition and availability of water. Aerobic rice cultivation is a new concept and very few efforts were made to work out nutrient management practices for aerobic rice in hill zone of Karnataka during summer season. Keeping these points in view, an experiment was planned to work out nutrient management practices to enhance the productivity of aerobic rice during summer season in hill zone of Karnataka.

A field experiment was conducted during summer 2015 at Agricultural Research Station (Paddy), Sirsi to study the effect of different nutrient management practices in enhancing productivity of aerobic rice in hill zone of Karnataka. The experiment was laid out in Randomized Block Design with three replications. There were 11 treatment combinations having spray of two water soluble fertilizers *viz.*, 19:19:19 and 13:0:45 (0.5%) ; soil application of micronutrients *viz.*, zinc as zinc sulphate (25 kg ha^{-1}) and boron as borax (2 kg ha^{-1}) along with recommended dose of fertilizer (RDF) (75:75:87.5 kg N, P_2O_5 and K_2O ha^{-1}) and RDF + farm yard manure (FYM) (10 t ha^{-1}). The soil of the experimental site was sandy clay loam with pH 6.1. The available N, P_2O_5 and K_2O contents of the soil were 291.2, 27.5, 146.4 kg ha^{-1}, respectively and available zinc and boron were 1.98 and 0.58 ppm, respectively. Seeds of aerobic rice (var. MAS 946-1) were sown by using seed drill with row spacing of 30 cm and seed rate of 18 kg per hectare. At the time of sowing, complete dose of P_2O_5 and half the dose of N and K_2O were applied. Remaining 50% N and K_2O were applied in two equal splits at tillering and panicle initiation stages as top dressing in all treatments. Zinc and boron were applied at the time of sowing as per treatments. The water soluble fertilizers *viz.*, 19:19:19 and 13:0:45 were applied as foliar @ 0.5 per cent at 45, 60 and 75 days after sowing (DAS) with spray volume of 600 litres per ha as per the treatments. Statistical analysis was carried out based on mean values obtained. The level of significance used in 'F' and 'T' test was P = 0.05 (Gomez and Gomez, 1984).

The variation in grain and straw yield of aerobic rice was significant due to different nutrient management practices (Table 1). The grain and straw yield (2753 and 3346 kg ha^{-1}, respectively) recorded with RDF alone was significantly lower when compared to all other treatments. The grain and straw yield recorded with RDF + FYM was 3265 and 3951 kg ha^{-1}, respectively, which was found significantly superior over that of RDF alone (2753 and 3346 kg ha^{-1}, respectively). Similarly, the grain and straw yield of rice was found to increase significantly with application of $ZnSO_4$ (3377 and 4037 kg ha^{-1}, respectively) and borax (3321 and 4000 kg ha^{-1}, respectively) when applied along with RDF+FYM when compared to application of RDF alone. These results are in agreement with those of Abbas *et al.* (2013) who reported that application of Zn and B at the rate of 10 and 2 kg ha^{-1}, respectively, along with N and P found to increase the yield and 1000 grain weight of rice varieties *viz.*, IR-6, IR-8, DR-92, DR-83 and Shakkaar as compared to application of only N+P. The grain and straw yield of rice was found to increase further when these treatments were combined with foliar application of either 19:19:19 or 13:0:45. Among these different treatments, treatment having foliar spray of 19:19:19 (0.5 % at 45, 60 and 75 DAS) along with RDF + FYM + $ZnSO_4$ + borax has resulted in significantly higher grain and straw yield (3765 and 4420 kg ha^{1}, respectively) and was found significantly superior over all other treatments except the other treatments with foliar application of either 19:19:19 or 13:0:45.

Table 1. Yield and yield attributing parameters of aerobic rice as influenced by different nutrient management practices

Treatment	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1}) row length	Productive tillers m^{-1} panicle^{-1}	Number of filled grains panicle^{-1} (g)	Grain weight (g)	1000 grain weight
T_1 - RDF alone	2753	3346	113.2	51.0	2.05	22.91
T_2 - RDF + FYM (10 t ha^{-1})	3265	3951	122.7	56.8	2.14	23.61
T_3 - T_2 + $ZnSO_4$ @ 25 kg ha^{-1}	3377	4037	125.5	58.6	2.21	23.76
T_4 - T_2 + Borax @ 2 kg ha^{-1}	3321	4000	128.2	59.6	2.26	23.78
T_5 - T_2 + $ZnSO_4$(25 kg ha^{-1}) + Borax (2 kg ha^{-1})	3407	4056	131.7	62.5	2.29	24.14
T_6 - T_3 + 13:0:45 (0.5 % at 45, 60 and 75 DAS)	3636	4395	138.2	65.7	2.42	24.47
T_7 - T_4 + 13:0:45 (0.5 % at 45, 60 and 75 DAS)	3630	4352	140.3	66.2	2.45	23.94
T_8 - T_5 + 13:0:45 (0.5 % at 45, 60 and 75 DAS)	3716	4395	142.8	69.0	2.53	24.49
T_9 - T_3 + 19:19:19 (0.5 % at 45, 60 and 75 DAS)	3642	4377	142.3	65.2	2.51	24.03
T_{10} - T_4 + 19:19:19 (0.5 % at 45, 60 and 75 DAS)	3623	4321	141.5	66.5	2.52	24.28
T_{11} - T_5 + 19:19:19 (0.5 % at 45, 60 and 75 DAS)	3765	4420	143.7	69.3	2.56	24.93
S.Em ±	82	110	3.40	2.0	0.06	0.56
C.D. (p=0.05)	242	325	10.0	5.9	0.17	NS

These results are in close conformity with findings of Rani *et al.* (2014) who reported that rice variety BPT-5204 responded well to foliar application of 19:19:19 @ 2.5 kg ha^{-1} at tillering and panicle initiation stages when applied along with recommended NPK as compared to recommended NPK alone. The increase in grain and straw yield of aerobic rice in treatments having foliar spray might be due to better absorption of foliar applied nutrients by leaves directly which in turn increased the rate of photosynthesis. This might have resulted in higher accumulation of dry matter which in turn resulted in higher grain and straw yield. These results are in agreement with those of Viswanath Patil *et al.* (2016) who reported that application of 100% RDFwith 1% each foliar spray of 19:19:19 and 13:0:45 at maximum tillering and grain filling stages, respectively, found to increase the uptake of nitrogen, phosphorus and potassium by rice crop.

The extent of increase in grain yield in treatment combinations having 19:19:19 spray ranged from 32.3 to 36.8 per cent, whereas, with 13:0:45, it was from 32.1 to 35.0 per cent as compared to RDF alone. These results are in close conformity with findings of Manjappa *et al*. (2008) and Girijesh *et al.* (2016) who reported significant increase in grain yield of rice with foliar application of KNO_3 and K_2SO_4, respectively. The improved grain yield in these treatments might be due to improved yield components *viz.*, number of productive tillers per meter row length, number of filled grains per panicle, grain weight per panicle and test weight. Foliar application of 19:19:19 (0.5% at 45, 60 and 75 DAS) along with RDF + FYM + $ZnSO_4$ + borax has resulted in significantly higher in number of productive tillers per m row length (143.7), number of filled grains per panicle (69.3), grain weight per panicle (2.56 g) and test weight (24.93 g). Similar results indicating enhancement in yield components of rice *viz.*, panicles m^{-2}, grains panicle^{-1} and 1000 grain weight by foliar application of balanced amounts of fertilizers was reported by Jamshid Shaygany *et al*. (2012).

The price of inputs and farm produce change from time to time and place to place thus profitable nutrient management system in crop production also varies accordingly. In the present investigation, foliar application of 19:19:19 (0.5 %) along with RDF + FYM + $ZnSO_4$ + borax has recorded significantly higher gross (₹ 65,321 ha^{-1}) and net (₹ 33,436 ha^{-1}) returns and was found significantly superior to all other treatments except other treatments with foliar application of either 19:19:19 or 13:0:45. The gross (₹ 47,988 ha^{-1}) and net (₹ 24,558 ha^{-1}) returns recorded with RDF alone were significantly lower when compared to all treatments. Among the treatments having FYM or zinc or boron along with RDF, higher gross and net returns were recorded in RDF + FYM + zinc + boron (₹ 59,222 and 29,137 ha^{-1}, respectively). However, the differences were not significant among these treatment combinations. The increased gross and net returns in different treatments were mainly due to increased

Table 2. Economics of aerobic rice as influenced by different nutrient management Practices

Treatments	Gross returns (₹ ha^{-1})	Cost of cultivation (₹ ha^{-1})	Net returns (₹ ha^{-1})
T_1 - RDF alone	47988	23430	24558
T_2 - RDF + FYM (10 t ha^{-1})	56883	28430	28453
T_3 - T_2 + $ZnSO_4$ @ 25 kg ha^{1}	58722	29805	28917
T_4 - T_2 + Borax @ 2 kg ha^{-1}	57815	28710	29105
T_5 - T_2 + $ZnSO_4$(25 kg ha^{-1}) + Borax (2 kg ha^{-1})	59222	30085	29137
T_6 - T_3 + 13:0:45 (0.5% at 45, 60 and 75 DAS)	63327	31605	31722
T_7 - T_4 + 13:0:45 (0.5% at 45, 60 and 75 DAS)	63148	30510	32638
T_8 - T_5 + 13:0:45 (0.5% at 45, 60 and 75 DAS)	64531	31885	32646
T_9 - T_3 + 19:19:19 (0.5% at 45, 60 and 75 DAS)	63383	31605	31778
T_{10} - T_4 + 19:19:19 (0.5% at 45, 60 and 75 DAS)	62994	30510	32484
T_{11} - T_5 + 19:19:19 (0.5% at 45, 60 and 75 DAS)	65321	31885	33436
S.Em±	1259	-	1259
C.D. (p=0.05)	3714	-	3714

grain and straw yield in respective treatments. Similar results were also reported by Rani *et al*. (2014) who reported that maximum net returns were obtained when RDF was supplemented with spraying.

Hence, by considering the net returns realised, application of 19:19:19 or 13:0:45 foliar spray along with RDF + FYM + zinc + boron was found to be a better nutrient management option for rice under aerobic situation in hill zone of Karnataka.

References

Abbas, T.M., Zahida, R., Uddin, I., Sajjid, A., Akhlaq, K., Moheyuddin, J., Salahuddin, A.H., Mari and Panhwar, R.N., 2013, Effect of Zinc and Boron fertilizers application on some physicochemical attributes of five rice varieties grown in Agro-Ecosystem of Sindh, Pakistan. *American-Eurasian J. Agric. and Environ. Sci.*, 13 (4): 433-439.

Girijesh, G. K., Shivanand Patil and Ravi Kannanvar, 2016, Standardization of potassium management practices for paddy in command areas of Karnataka. Extended Summaries Vol. 2 : 4th International Agronomy Congress, Nov. 22–26, 2016, New Delhi, India, pp. 743-744.

Gomez, K. A. and Gomez, A., 1984, Statistical procedures for Agricultural Research (2/E). John Willey and Sons, New York, pp. 28-33.

Jamshid Shaygany, Noura Peivandy and Seyedhadi Ghasemi, 2012, Increased yield of direct seeded rice (*Oryza sativa* L.) by foliar fertilization through multi-component fertilizers. Archives of Agronomy and Soil Science, 58 (10): 1091-1098.

Kumar, V. and Ladha, J. K., 2011, Direct seeded rice. Recent developments and future research needs. *Adv. Agron.,* 111: 299-413.

Manjappa, K., Katraki, N., Kelaginamani, S. V. and Jowkin, V., 2008, Potash management in rainfed transplanted paddy in lowland rice soils. *Karnataka J. Agric. Sci.,* 21: 482-484.

Rani, B. S., Krishna, T. G. and Munirathnam, P., 2014, Studies on the effect of foliar fertilization in combination with conventional fertilizers on yield, economics and nutrient uptake of rice (*Oryza sativa* L.) under K. C. canal ayacut area of Andhra Pradesh, India. *Agric. Sci. Digest*, 34 (1): 15-20.

Viswanath Patil, Veeranna, H. K. and Dinesh Kumar, M., 2016, Integrated use of conventional and foliar fertilizers with effective microbial consortia on nutrient uptake and nutrient status of soil in paddy crop. Extended Summaries Vol. 2 : 4th International Agronomy Congress, Nov. 22–26, 2016, New Delhi, India, pp. 752-753.