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EFFECT OF INTEGRATED NUTRIENT MANAGEMENT PRACTICES ON PRODUCTIVITY AND PROFITABILITY OF TRANSPLANTED RICE

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Abstract

Field experiment was conducted at experimental farm, department of agronomy, faculty of agriculture, annamalai university, annamalainagar during samba season of 2014 to study the effect of integrated nutrient management practices on productivity and profitability of transplanted rice. The treatments consist of T_1-recommended dose of fertilizers, T_2- RDF + humic acid (soil application) @ 1.25kg/ha, T_3 – RDF + humic acid(foliar application)@ 1% concentration, T_4 – RDF + micro nutrient mixture no 10+humic acid(soil application),T_5 – RDF + micro-nutrient mixture No 10 + humic acid (foliar application), T_6 – RDF + micronutrient mixture No 11+humic acid (soil application), T_7 - RDF +micronutrient mixture No 11+ humic acid (foliar application), T_8-RDF + micronutrient mixture No 10+micronutreint mixture No 11+humic acid (foliar application), T_9 – RDF + micronutrient mixture No10+micronutreint mixture no 11+humic acid (soil application). The experiment was laid out in randomized block design with four replications. Among the various treatments imposed, RDF + micronutrient mixture No 10+micronutreint mixture No 11+humic acid (soil application) (T_9) significantly recorded the higher growth, yield components and yield of rice. This treatment also registered maximum NPK uptake and nutrient use efficiency. The higher net income and return per rupee invested (Rs.2.41) also higher in T_9. Hence it may be concluded that RDF + micronutrient mixture No10+ micronutrient mixture No 11+ humic acid (soil application) (T_9) hold promise as an appropriate technology for achieving productivity and profitability of transplanted rice.

Key words: INM, growth, yield, NPK uptake, economics, rice

Introduction

Rice *(Oryza sativa* L.) is one of the most important cereal crops of the world, grown in wide range of climatic regions, to nourish the mankind. More than 90% of the world's rice is grown and consumed in Asia. 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 (FAO, 2013). Current generalized recommendations with respect to NPK fertilizer alone are directing towards soil degradation, resulting in their declined efficiency which necessitates improvement through proper nutrition. The concept of balanced fertilization includes application of all essential nutrients for higher productivity and health of soil. Imbalance fertilization of plant nutrients resulted in the emergence of deficiencies of phosphorous, sulphur, zinc, iron, boron, manganese and copper in the soil and plant on large scale. Use of chemical fertilizer, humic acid and micronutrients has been found promising on arresting the trend in soil health and productivity through the correction of the deficiencies of secondary and micro nutrients, beneficial influence on physical and biological properties. Integrated nutrient management system can bring about equilibrium between degenerative and restorative activities in soil eco-system (Upadhyay *et al.,* 2011).

Humic acid is not a fertilizer, it acts as conditioner for the soil and bio-stimulant for plant growth. Humic acid enhance the plant growth and fertility of soil. Humic acid formed through the chemical and biological humification of plant and animal matter. The advantage of humic acid usage is long time effectiveness for crop growth. Selim *et al.* (2010) found that the addition of humic acid with NPK fertilizer through drip irrigation in cowpea resulted in higher available N, P, K. Earlier research reports on foliar application and soil application of humic acid, micro nutrient mixture improve the growth, yield and nutrient uptake by rice and have shown conflicting response to methods, sources and the levels. Considering the facts, field experiment was conducted to study the effect of the humic acid and micro nutrient mixture in nutrient uptake and nutrient use efficiency for transplanted rice.

Materials and Methods

Field experiment was concluded in the Experimental Farm, Department of Agronomy, Faculty of agriculture, Annamalai University, Annamalai Nagar during September-January 2014-2015 to study the effect

of integrated nutrient management practices on productivity and profitability of transplanted rice. The soil is clay loamy in texture with low available Nitrogen (190.02 kg/ha), medium in available P_2O_5 (15.5 kg/ha), high in available K_2O (315.2 kg/ha). The treatments consist of T_1-recommended dose of fertilizers, T_2-RDF + humic acid (soil application) @ 1.25kg/ha, T_3 – RDF + humic acid(foliar application)@ 1% concentration, T_4 – RDF + micro nutrient mixture no 10+humic acid(soil application),T_5 – RDF + micro-nutrient mixture No 10 + humic acid(foliar application),T_6 – RDF + micronutrient mixture No 11+humic acid(soil application),T_7 - RDF +micronutrient mixture No 11+ humic acid(foliar application),T_8-RDF + micronutrient mixture No 10+micronutreint mixture No 11+humic acid(foliar application), T_9 – RDF + micronutrient mixture No10+micronutreint mixture no 11+ humic acid (soil application). The experiment was laid out in randomized block design with four replications. The crop was transplanted on 10th October 2014 adopting the spacing of 12.5×10 cm. The organic manures and inorganic fertilizers were applied as basal as per the schedule. Need based plant protection measures were taken up based on economic threshold level of pest and diseases. The crop was harvested on 3rd January 2017 and yield was recorded. The cost of inputs, labour charges and prevailing market rates of farm produce were taken into consideration for working out gross and net returns per hectare. The benefit cost ratio was worked out for various treatments by dividing the gross returns by cost of cultivation.

Results and Discussion

Among the treatments, application of RDF + Micronutrient mixture 10+Micronutreint mixture no 11+Humic acid (soil application) (T_9) influence the growth characters (Table 1) like plant height, number of tillers m^{-2}, LAI, dry matter production on rice followed by application of RDF+Micronutrient mixture No10+Micronutreint mixture No 11+Humic acid (foliar application) (T_8). This was agreement with the founding's of Petit *et al*. (2004) who reported that humic acid improved the physical, chemical and biological properties of the soil and influenced the plant growth by influencing the growth of roots. The same treatments also recorded highest values for yield characters (Table 2) viz., number of panicles per hill, number of filled grains, grain yield and straw yield. Osman *et al*. (2013) reported that foliar application of humic acid and fulvic acid together led to significant increases of plant height, tillers no/m^2, thousand grains weight (g), grain, straw yield of rice and N, P, K content of grain and straw. Vanitha *et al*. (2014) reported that application of humic acid recorded maximum root length, higher chlorophyll content, LAI, more filled grains percentage and yield. The least values recorded for growth and yield attributes under the treatment T_1 (RDF). This might be due to the lack of availability of adequate amount of essential nutrients, which in turn affects proper development of growth and yield components result in low yield. The results are in line with the findings of Singh *et al*. (2005).

Table 1 : Effect of INM practices on growth attributes of rice

Treatments	Plant height at harvest	Leaf area index at maximum flowering stage	Number of tillers m^{-2} at maximum tillering stage
T_1	90.98	5.65	400.16
T_2	92.87	5.82	405.54
T_3	94.36	5.97	412.54
T_4	95.61	6.14	418.55
T_5	96.60	6.28	424.89
T_6	97.52	6.40	430.88
T_7	98.16	6.44	434.00
T_8	98.93	6.49	436.79
T_9	99.87	6.58	442.00
S.Ed	**46.2**	**0.05**	**2.58**
CD	**0.91**	**0.08**	**5.12**

Table 2 : Effect of INM practices on yield attributes and yields of rice

Treatments	Number of panicles m^{-2}	Number of filled grains per panicles	Test weight (g)	Grain yield(kg/ha)	Straw yield(kg/ha)
T_1	348.24	81.29	15.40	4485.67	5905
T_2	352.34	82.90	15.53	4615.63	6035
T_3	355.02	84.00	15.58	4725.48	6145
T_4	357.61	84.94	15.64	4825.50	6245
T_5	360.18	85.76	15.71	4918.26	6338
T_6	362.61	86.60	15.75	5009.31	6429
T_7	364.37	87.06	15.81	5048.27	6460
T_8	365.96	87.65	15.85	5088.31	6508
T_9	368.29	88.29	15.92	5176.65	6616
S.Ed	**1.16**	**0.32**	**0.35**	**44.02**	**46.82**
CD	**2.31**	**0.63**	**NS**	**87.24**	**90.47**

The same treatment recorded higher uptake of nutrients (NPK) (Table 3) and agronomic efficiency (Table 4) in rice, which was followed by application of RDF + Micronutrient mixture No 10+ Micronutreint mixture No 11+Humic acid (foliar application) (T_8).This was agreement with the founding's of Yaofu (2005) that humic acid increased the content of N, P, K and Fe in tobacco. Ayman *et al*. (2009) observed that humic acid as foliar application to improve the growth and mineral content in faba bean. Mengal and Kirby (2001) found that the uptake of Zn, Fe, Ca was maximum by plant roots. Hussain *et al.* (2005) also reported the same results and observe non-significant difference in total number of tillers per plant and number of fertile tillers per plant in response to applied micronutrients.

Table 3 : Effect of INM practices on plant nutrients uptake (NPK) (Kg ha^{-1}) of rice

Treatments	N	P	K
T_1	96.40	14.57	81.55
T_2	98.18	15.39	83.84
T_3	99.67	16.01	85.92
T_4	100.89	16.52	87.90
T_5	101.91	16.98	89.68
T_6	102.88	17.50	91.23
T_7	103.52	17.89	92.61
T_8	104.05	18.18	93.84
T_9	105.00	18.67	95.24
S. Ed	0.47	0.23	0.72
CD (P= 0.05)	0.93	0.45	1.43

Table 4 : Effect of INM practices on agronomic efficiency of rice

Treatments	Agronomic efficiency
T1	NS
T2	9.58
T3	14.16
T4	15.41
T5	17.33
T6	20.25
T7	21.00
T8	21.83
T9	23.33

Among the treatment, application of application of RDF + Micronutrient mixture No 10+Micronutreint mixture No 11+Humic acid (soil application) (T_9) gave the highest return rupees^{-1} (Table 5) invested of Rs.2.41 followed by application of RDF + Micronutrient mixture No10+Micronutreint mixture No 11+Humic acid (foliar application) (T_8) recorded the return rupees^{-1} invested of Rs.2.25 in the season. From the results, it is evident that through (T_9) gave the highest net return ha^{-1} and return per rupee invested. Based on the results of experiment carried out at the Experimental farm, Department of Agronomy, Annamalai University, Annamalai Nagar, It can be concluded that conjoint application of RDF + Micronutrient mixture No10+Micronutreint mixture No 11+Humic acid (soil application) (T_9) were found to be more effective method for increasing the productivity and profitability of transplanted rice.

Table 5 : Effect of INM practices on economics of rice

Treatment	Cost of cultivation (Rs.ha^{-1})	Gross income (Rs.ha^{-1})	Net income (Rs.ha^{-1})	Return rupee^{-1} harvested (Rs.ha^{-1})
T_1	29120	42760	13640	1.46
T_2	33970	52306	18336	1.53
T_3	34020	55960	21940	1.64
T_4	35305	62215	26910	1.76
T_5	36300	66619	30319	1.83
T_6	37570	71677	34107	1.90
T_7	37793	77860	40067	2.06
T_8	39074	87980	48906	2.25
T_9	39750	95850	56100	2.41

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