

EFFECT OF NPK WITH GRANULAR AND FOLIAR APPLICATION OF ORGANIC SUBSTANCES ON RICE

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Abstract

With a view to enhance the yield of rice by low cost agronomic practices, a field experiment was conducted at Annamalai University experimental farm during sornavari season with short duration rice variety ADT-45. The experiment was conducted in Randomised block design, consist of 12 treatments involving foliar application of organic substances along with different levels of recommended NPK in three replications. The result revealed that, treatment T₉- 100 % NPK + FYM @ 12.5 t/ha + Isabion foliar spray application @ 1250ml/ha on 20 and 50 DAT ranked first in terms of plant height (111.06 cm), number of tillers/hill (16), DMP (10.67 t/ha), grain yield (5.88 t/ha) and NPK uptake (121.05, 27.77, 113.78 kg/ha).

Key words: NPK, Humic acid, foliar spray, grain yield

Introduction

In India, the productivity of rice is 2.4 t/ha, which is lower, compared to the average productivity of rice producing countries. India ranked 97 out of 118 in global hunger risk. India has to produce two to four times more food in 2050 to meet the demand. In Tamil Nadu, during 2014-15 rice was grown in an area of 1.83 million hectares with a production of 5.84 million tonnes and the productivity is 3.19 t/ha. In Cuddalore district the productivity is 4.13 t/ha. Amino acids are well-known bio-stimulant which has positive effects on plant growth and yield. Humic acid application increased the levels of chlorophyll in leaves, consequently enhanced the photosynthetic activity and resulted in higher uptake of nutrients (Senthilkumar, 2001). Granular slow release fertilizers using low biodegradable, non-toxic, eco-friendly and low-cost agro-waste materials which have increased efficacy of nutrient very significantly in rice, wheat and Indian mustard (Sharma and Singh, 2011).

Materials and method

The experiment was carried out in field number GL A8 in the garden land of the Experimental Farm, Department of Agronomy, Annamalai University, Annamalai Nagar. The Experimental Farm is situated at 11° 24' North latitude and 79° 44' East longitude at an altitude of 5.79 m above mean sea level. The soil of the experimental field is clayey loam in texture with low in available nitrogen, medium in available phosphorous and high in available potassium. The rice crop was raised during Sornavari season (March to July 2016) with short duration rice variety ADT 45. The field experiment was laid out in Randomized Block Design (RBD) with twelve treatments and three replications. The treatments were, T₁- 100 % NPK + FYM @ 12.5 t/ha, T₂- 100 % NPK + eM power granule @ 12.5kg/ha on 7 and 35 DAT, T₃- 75 % NPK + eM power granule @ 12.5kg/ha on 7 and 35 DAT, T₄-50 % NPK + eM power granule @ 12.5kg/ha on 7 and 35 DAT, T₅-100 % NPK + FYM @ 12.5 t/ha + Humic plus P foliar spray @ 625g/ha on 20 and 50 DAT, T₆- 100 % NPK + eM power granule @ 12.5kg/ha on 7 and 35 DAT + Humic plus P foliar spray @ 625g/ha on 20 and 50 DAT, T₇- 75 % NPK + eM power granule @ 12.5kg/ha on 7 and 35 DAT + Humic plus P foliar spray @ 625g/ha on 20 and 50 DAT, T₈- 50 % NPK + eM power granule @ 12.5kg/ha on 7 and 35 DAT + Humic plus P foliar spray @ 625g/ha on 20 and 50 DAT, T₉- 100 % NPK + FYM @ 12.5 t/ha + Isabion foliar spray @ 1250ml/ha on 20 and 50 DAT, T₁₀- 100 % NPK + eM power

granule @ 12.5kg/ha on 7 and 35 DAT + Isabion foliar spray @1250ml/ha on 20 and 50 DAT , T₁₁- 75 % NPK + eM power granule @ 12.5kg/ha on 7 and 35 DAT + Isabion foliar spray @ 1250ml/ha on 20 and 50 DAT, T₁₂- 50 % NPK + eM power granule @ 12.5kg/ha on 7 and 35 DAT + Isabion foliar spray @1250ml/ha on 20 and 50 DAT. While the eM power granule was applied @ 12.5 kg/ha in two equal splits on 7 and 35 DAT, the growth promoters namely Humic plus P (Humic acid) and Isabion (Organic fraction of amino acids and Peptide mixture) were applied on 20 and 50 DAT. The rate of application was 625 g/ha and 1250 ml/ha respectively. The growth promoters were sprayed through knapsack sprayer by using water at the rate of 500 l/ha. A fertilizer schedule of 120 kg N, 38 kg P₂O₅ and 38 kg K₂O per ha was followed for 100 per cent NPK recommended plots. For 75 and 50 per cent of NPK applications, the respective quantities of NPK were calculated and applied to respective plots as per treatment schedule. While the entire dose of P₂O₅, half dose of N and K₂O were applied basally. Remaining N and K₂O were applied in two equal splits at maximum tillering and panicle initiation stages. At harvest, the plant samples were collected plot wise , dried, powdered and analysed for NPK content by standard procedures and multiplied with respective DMP and thus total NPK uptake was computed.

Results and Discussion

All the treatments influenced the various parameters mentioned in Table - 1 significantly. At harvest , the tallest plant (111.06 cm) was recorded in T₉- 100 % NPK + FYM @ 12.5 t/ha + Isabion foliar spray application @1250ml/ha on 20 and 50 DAT. The next in order was was T₅-100 % NPK + FYM @ 12.5 t/ha + Humic plus P foliar spray application @ 625g/ha on 20 and 50 DAT . The least plant height (91.72 cm) was noticed in T₄-50 % NPK + eM power (Humic acid and Fulvic acid) @ 12.5kg/ha application on 7 and 35 DAT.

At 60 DAT, the highest dry matter production of 10667 kg/ha was noticed in T₉- 100 % NPK + FYM @ 12.5 t/ha + Isabion foliar spray application @1250ml/ha on 20 and 50 DAT. The slow release of macro, micro nutrients and plant growth regulating substances from the FYM as well as the readily available macro nutrients from the inorganic fertilizers in optimum quantities at various stages of crop growth nourished the plant very well , as it was evident from the increased plant height, DMP and number of tillers/hill. This was followed by T₅-100 % NPK + FYM @ 12.5 t/ha + Humic plus P foliar spray application @ 625g/ha on 20 and 50 DAT. Both these treatments were comparable. The least dry matter production (4303 kg/ha) was noticed in T₄-50 % NPK + eM power (Humic acid and Fulvic acid) application @ 12.5kg/ha on 7 and 35 DAT.

At harvest, the treatment T₉- 100 % NPK + FYM @ 12.5 t/ha + Isabion foliar spray application @1250ml/ha on 20 and 50 DAT outstripped all other treatments and ranked first in terms of number of tillers/hill (16). This might be due to the positive influence of organic and inorganic sources. Further, isabion or humic plus spray might stimulated the root and shoot growth which resulted in enhanced nutrient uptake . The second best was T₅-100 % NPK + FYM @ 12.5 t/ha + Humic plus P foliar spray @ 625g/ha on 20 and 50 DAT. The least number of tillers/hill was noticed in T₄-50 % NPK + eM power (Humic acid and Fulvic acid) application @ 12.5kg/ha on 7 and 35 DAT.

Among the treatments, the highest grain yield of 5.88 t/ha was recorded in T₉- 100 % NPK + FYM @ 12.5 t/ha + Isabion foliar spray application @1250 ml/ha on 20 and 50 DAT. The combined positive effect of FYM, inorganic fertilizers and foliar spray supplement positively influenced the growth parameters like plant height, LAI, number of tillers/hill and yield by increasing the synthesis of chlorophyll pigments, enhanced the root length, volume, increased and effective uptake of nutrients, improved photosynthetic rate and effective translocation of photosynthates contributed for higher grain yield recorded in these treatment combination. This result was earlier reported by Ashik Jamil Mahmud *et al.* (2016). Among the treatment combination consisting of 100 per cent NPK plus FYM along with either Isabion @ 1250 ml/ha or Humic plus P @ 625g/ha on 20 and 50 DAT, the Isabion combination treatment was found to be better in influencing growth and yield parameters. The increase in grain yield was recorded up to 450 and 180 kg/ha respectively when compared to conventional method of 100 per cent NPK and FYM applications. Soil application of eM power @ 12.5 kg/ha along with 75 or 50 per cent NPK application reduced the grain yield

to the tune of 290 and 1530 Kg/ha compared to T₂- 100 % NPK + eM power (Humic acid and Fulvic acid) @ 12.5kg/ha on 7 and 35 DAT. But this reduction in grain yield was improved by foliar application of Humic plus P @ 625 g/ha on 20 and 50 DAT to the tune of 370 and 210 Kg/ha respectively and by Isabion foliar spray @ 1250 ml/ha on 20 and 50 DAT to the tune of 520 and 370 Kg/ha respectively.

Nutrient Uptake

All the treatments significantly influenced the Nitrogen , Phosphorus and potassium uptake. The treatment T₉- 100 % NPK + FYM @ 12.5 t/ha + Isabion foliar spray application @1250 ml/ha on 20 and 50 DAT resulted in the highest N uptake. This was followed by T₅-100 % NPK + FYM @ 12.5 t/ha + Humic plus P foliar spray application @ 625g/ha on 20 and 50 DAT and both of them were comparable. The least N uptake was noticed in T₄-50 % NPK + eM power (Humic acid and Fulvic acid) application @ 12.5kg/ha on 7 and 35 DAT (80.51 kg/ha). Similar results were obtained earlier by Osman et al., (2013). The Phosphorus uptake noticed due to various treatments was ranged from 16.67 to 27.77 kg/ha. The treatment T₉- 100 % NPK + FYM @ 12.5 t/ha + Isabion foliar spray application @1250 ml/ha on 20 and 50 DAT resulted in the highest Phosphorus uptake. This was followed by T₅-100 % NPK + FYM @ 12.5 t/ha + Humic plus P foliar spray application @ 625g/ha on 20 and 50 DAT and both of them were comparable. The least Phosphorus uptake was noticed in T₄-50 % NPK + eM power (Humic acid and Fulvic acid) application @ 12.5kg/ha on 7 and 35 DAT. The treatment T₉- 100 % NPK + FYM @ 12.5 t/ha + Isabion foliar spray application @1250 ml/ha on 20 and 50 DAT resulted in the highest Potassium uptake. This was followed by T₅-100 % NPK + FYM @ 12.5 t/ha + Humic plus P foliar spray application @ 625g/ha on 20 and 50 DAT and both of them were comparable. The least Potassium uptake was noticed in T₄-50 % NPK + eM power (Humic acid and Fulvic acid) application @ 12.5kg/ha on 7 and 35 DAT (69.73 kg/ha).

References

- 1).Ashik Jamil Mahmud, Shamsuddoha, A.T.M. and Nazmul Haque, Md. 2016. Effect of Organic and Inorganic Fertilizer on the Growth and Yield of Rice (*Oryza sativa* L.). *Nature and Science* **14**(2): 45-54.
- 2).Osman, E.A.M., El-Masry, A.A. and Khatab, K.A. 2013. Effect of nitrogen fertilizer sources and foliar spray of humic and/or fulvic acids on yield and quality of rice plants. *Adv. Appl. Sci. Res.* **4**(4): 174-183.
- 3).Sharma, V.K. and Singh, R.P. 2011. Organic matrix based slow release fertilizer enhances plant growth, nitrate assimilation and grain yield of Indian mustard (*Brassica juncea* L. Cv. Pusa Bold). *Journal of Environmental Biology* **32**: 619-624.
- 4).Senthilkumar, S. 2001. Physiological effects of humic acid on growth and yield of rice. *M.Sc. (Ag.) thesis*, TNAU, Coimbatore.

Table - 1 Effect of various treatments on the growth, yield and NPK uptake of Rice

Treatments	Plant height at Harvest (cm)	Number of tillers/hill at harvest	DMP (60 DAT) Kg/ha	Grain Yield t/ha	Nutrient Uptake kg/ha		
					N	P	K
T ₁ - 100 % NPK + FYM	107.87	14.00	8667	5.43	114.02	25.80	105.62
T ₂ - 100 % NPK + eM power @ 12.5kg/ha on 7 and 35 DAT (Humic acid and Fulvic acid)	104.17	11.33	7114	4.78	104.52	22.55	93.87
T ₃ - 75 % NPK + eM power @ 12.5kg/ha on 7 and 35 DAT (Humic acid and Fulvic acid)	101.03	10.00	5234	4.49	95.22	19.67	83.56
T ₄ - 50 % NPK + eM power @ 12.5kg/ha on 7 and 35 DAT (Humic acid and Fulvic acid)	91.72	8.33	4303	3.25	80.51	16.67	69.73
T ₅ - 100 % NPK + FYM + Humic plus P @ 625g/ha on 20 and 50 DAT (foliar spray)	108.87	14.33	10556	5.61	118.92	26.85	109.34
T ₆ - 100 % NPK + eM power @ 12.5kg/ha on 7 and 35 DAT (Humic acid and Fulvic acid)+ Humic plus P @ 625g/ha on 20 and 50 DAT (foliar spray)	104.98	11.67	7224	5.18	107.23	23.64	97.27
T ₇ - 75 % NPK + eM power @ 12.5kg/ha on 7 and 35 DAT (Humic acid and Fulvic acid)+ Humic plus P @ 625g/ha on 20 and 50 DAT (foliar spray)	102.44	10.00	6778	4.86	98.59	20.69	87.11
T ₈ - 50 % NPK + Organic granules (Humic acid and Fulvic acid) + Humic plus P @ 625g/ha on 20 and 50 DAT (foliar spray)	96.69	9.00	4451	3.46	86.21	17.69	76.01
T ₉ - 100 % NPK + FYM + Isabion @1250ml/ha on 20 and 50 DAT (foliar spray)	111.06	16.00	10667	5.88	121.05	27.77	113.78
T ₁₀ - 100 % NPK + eM power @ 12.5kg/ha on 7 and 35 DAT (Humic acid and Fulvic acid)+ Isabion @1250ml/ha on 20 and 50 DAT (foliar spray)	105.70	13.33	8446	5.24	110.94	24.69	100.89
T ₁₁ - 75 % NPK + eM power @ 12.5kg/ha on 7 and 35 DAT (Humic acid and Fulvic acid) Isabion @1250ml/ha on 20 and 50 DAT (foliar spray)	103.61	11.00	7021	5.01	101.78	21.88	90.12
T ₁₂ - 50 % NPK + eM power @ 12.5kg/ha on 7 and 35 DAT (Humic acid and Fulvic acid)+ Isabion @1250ml/ha on 20 and 50 DAT (foliar spray)	100.49	9.67	4632	3.62	89.99	18.62	79.94
SE _a	1.68	0.974	218.17	0.301	1.93	0.37	1.81
CD (P=0.05)	3.49	2.019	451.83	0.623	3.78	0.79	3.72