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STUDIES ON GRADED DOSE OF NPK WITH DIFFERENT GRANULAR ORGANIC MANURES ON GROWTH ATTRIBUTES OF LOWLAND RICE

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Abstract

Field investigation was conducted at Annamalai University Experimental Farm to study the impact of integration of graded dose of NPK and different granular organic manures on growth and yield of low land rice (*Oryza sativa* L.) The experiment was laid out in a Randomized Block Design (RBD) with nine treatments. All the treatments significantly influenced the growth components of lowland rice. Results of the experiment revealed that 75 per cent NPK +Azophos @ 2 kg ha^{-1} + pressmud based organic manure granules @ 125 kg ha^{-1} + distillery ash granules @ 125 kg ha^{-1} recorded highest growth attributes *viz.,* plant height, LAI and DMP as compared to other treatments. The application of 50 per cent NPK +Azophos 2 kg ha^{-1} resulted in the lowest values of these growth components of lowland rice.

Key words : NPK, Organic Manures, Lowland Rice

Introduction

Rice is cultivated in about 160 million hectares globally with a produce of 685 million tonnes (DRR, 2011). India is one of the leading rice producing countries of the world along with China, Thailand, Vietnam, USA and Pakistan. It has the world's largest area under rice with 43.95 million hectare with an annual production of 106.54 million tonnes and an average yield of 2424 kg ha^{-1} (GOI, 2014). Rice crop alone contributes to about 40 to 43 per cent of the total food grain production and that is why the crop plays a vital role in national food and livelihood security mission. India is the second largest producer and consumer of rice in the world and is also the hub of food security of the global population. Rice export contributes nearly 25 per cent of total agriculture export from the country. Rice is a staple food of majority of Indians and its demand in future is bound to increase with growing population, which is projected to be 1.301 and 1.378 billion by 2020 and 2030 respectively (DRR, 2011).

The continuous use of inorganic fertilizers over the years in paddy field without application of organic amendments resulted in the change of soil structure as well as decreasing the soil fertility (Sannathimmappa *et al.,* 2015). The adoption of modern farming practices and integrated nutrient management are essential to produce crops in line with the observed global standards of quantity and quality. Owing to high growth and yield attributes, wetland rice removes a substantial amount of major and minor nutrients from the soil, and deficiency of either nutrient reduces its growth and yield. But with the present day high yielding cultivars, which have higher nutrient requirements, the use of inorganic fertilizers has increased considerably leading to decline in the use of organic materials. Continuous use of inorganic fertilizer have not only brought about loss of soil fauna and flora but also resulted in loss of secondary and micro nutrient in rice and wheat fields (Kharub and Chander, 2008). As rice is grown under submerged anaerobic conditions, integrated management of nutrients offers a wide scope for harnessing the efficiency of different nutrients and their combinations.

Integrated nutrient management aims at the efficient and judicious use of all the sources of plant nutrients in an integrated manner, to attain sustainable crop production with minimum deleterious effect of chemical fertilizers on soil health and least disturbance to the plant soil environment (Baradhan *et al*., 2006). Indiscriminate use of high levels of N, P and K often leads to nutritional imbalance particularly micronutrients which ultimately cause deterioration of physicochemical properties of soil and steadily decrease in crop yield (Mohanty *et al.,* 2013). Organic manures are reported to enhance the fertilizer efficiency and reduce the requirement of inorganic fertilizers. Integrated use of chemical fertilizers along with organic manure and biofertilizers has therefore, become need of the hour for improvement and maintenance of soil fertility leading to sustainable crop production. Addition of granular organic manures provides better availability of nutrient to the crop plants maintaining soil fertility and grain quality. After granulation compared with powdered organic manures, granules are compact and dry. Thus, they

are easily handled and applied to crop and it results in slow release of nutrients resulting in increased nutrient efficient (Suresh Kumar and Baradhan, 2018). Biofertilizers are products containing living cells of different types of microorganisms, which have an ability to convert nutritionally important elements from unavailable to available form through biological processes. INM can thus be considered an effective means of ensuring food security and improving environmental quality by minimizing nutrient losses, improving plant uptake and nutrient use efficiency which enhance the growth and yield attributes (Ghosh 2015).

Materials and Methods

The Field Experiment was conducted in Experimental Farm, Annamalai University, Annamalainagar. The Experimental Farm is geographically situated at 11°24´ North latitude and 79°44´ East longitude and at an altitude of +5.79 m above mean sea level, during the *Navarai* season of 2017 to study the graded dose of NPK with different granular organic manures at growth attributes of lowland rice. The experiment was laid out in Randomized Block Design with three replications. The treatments comprised of T_1- Recommended Dose of Fertilizer (RDF) 120:40:40 kg NPK ha^{-1}, T_2-75 per cent NPK +Azophos @ 2 kg ha^{-1}, T_3-75 per cent NPK +Azophos @ 2 kg ha^{-1} + pressmud based organic manure granules @ 125 kg ha^{-1}, T_4-75 per cent NPK +Azophos @ 2 kg ha^{-1} + distillery ash granules @ 125 kg ha^{-1}, T_5-75 per cent NPK +Azophos @ 2 kg ha^{-1}+ pressmud based organic manure granules @ 125 kg ha^{-1} + distillery ash granules @ 125 kg ha^{-1}, T_6-50 per cent NPK + Azophos 2 kg ha^{-1}, T_7-50 per cent NPK +Azophos 2 kg ha^{-1} + pressmud based organic manure granules @ 125 kg ha^{-1}, T_8-50 per cent NPK +Azophos 2 kg ha^{-1} + distillery ash granules @ 125 kg ha^{-1}, T_9-50 per cent NPK +Azophos 2 kg ha^{-1}+ pressmud based organic manure granules @ 125 kg ha^{-1}+ distillery ash granules @ 125 kg ha^{-1}. Rice seedlings were raised in dry nursery beds. The fertilizers were applied to the experimental field as per the recommended schedule of 120:40:40 kg N, P_2O_5 and K_2O ha^{-1}. 75 per cent and 50 per cent NPK was done as per the treatment schedule. Azophos @ 2 kg ha^{-1} and pressmud based organic manure granules @ 125 kg ha^{-1} and distillery ash granules @ 125 kg ha^{-1} was applied basally to the respective treatment plots as per the treatment schedule.

Results and Discussion

Nutrient management showed significant effect on increasing plant height, LAI and DMP of rice. The results of the present investigation involving nitrogen applied through inorganic fertilizer and Azophos and organic manure granules (pressmud and distillery ash granules) showed marked impact on growth characters of rice. From the perusal of experimental results, it is evident that the values of rice growth at varied stages of crop growth were significantly higher with application of 75 per cent NPK +Azophos 2 kg ha^{-1} + press mud based organic manure granules @ 125 kg ha^{-1} + distillery ash granules @ 125 kg ha^{-1} (T_5). Among the treatments 75% NPK along with Azophos 2 kg ha^{-1} and pressmud based organic manure granules @ 125 kg ha^{-1} + distillery ash granules @ 125 kg ha^{-1} (T_5) significantly registered the highest plant height of 82.9 and 101.2 cm respectively at flowering and harvest stage of crop growth. Likewise this treatment recorded highest LAI (6.25) at flowering and dry matter production (12,728 kg ha^{-1}) at harvest. Application of 50 % NPK along with Azophos @ 2 kg ha^{-1} (T_6) recorded the least plant height of 64.9 and 80.5 cm at respective stages of crop growth, LAI (4.8) at flowering and dry matter production (9673 kg ha^{-1}) at harvest.

From the perusal of experimental results, it is evident that the values of rice growth components *viz.,* plant height, leaf area index and dry matter production at varied stages of crop growth were significantly higher with application of 75% NPK +Azophos 2 kg ha^{-1} + press mud based organic manure granules @ 125 kg ha^{-1} + distillery ash granules @ 125 kg ha^{-1} (T_5). It is due to increased absorption of nutrients and their assimilation. This may be also attributed to the constant and uniform supply of N throughout the growth period of rice. This was also in conformity with the findings of (Virdia and Mehta, 2010) who noticed higher rice yield with the integrated application of nitrogen and organic manures. Urea supplies N in the initial stages of crop growth and press mud based organic manure granules + distillery ash granules releases N slowly and steadily thus at no stage of crop suffered for want of nitrogen. This is the reason why this treatments receiving 75% NPK through inorganics and azophos 2 kg ha^{-1} + press mud based organic manure granules @ 125 kg ha^{-1} + distillery ash granules recorded highest growth components than RDF through inorganics alone. The excellent vegetative growth and development resulted in maximum plant height. This is in agreement with the findings of Yadav *et al.* (2013). Pandey *et al.* (2007) also observed that the plant height and dry matter production were increased due to the application of pressmud which may be attributed to the better supply of nutrients through pressmud which contains 43.20 per cent organic carbon, 3.08 per cent total nitrogen and 0.62 per cent phosphorus.

Measurement of leaf area is a basic tool of growth analysis and it is directly related with both biological and economical yield. Sarker *et al.* (2004) reported the increased LAI with organic manure application in

combination of inorganic N fertilizers. In case of any plant, leaves are important organs which have an active role in photosynthesis. To achieve high yield, maximization of leaf area is an important factor. In the present investigation we found that organic manures and in combination with chemical fertilizers significantly increased the leaf area. Similar findings are reported by Mirza *et al*. (2010) and Siddaram *et al*. (2010). Plant growth promoting microorganisms such as Azophos can reduce the uses of urea –N by growth promotion through the production of auxins, cytokines, gibberellins and ethylene which also led to higher plant height, leaf area index and dry matter production of rice. The results are in conformity of Dobbelaere *et al*. (2003).

The total dry matter production of crop during the growth period is important for the determination of the economic yield. In this study, dry matter accumulation was associated positively and significantly with plant height. This is attributed by enhanced plant N uptake thereby promoting vigorous vegetative growth of the rice crop plants. Moreover, industrial waste such as distillery ash which contains high amount of macro and micro nutrients enhanced the nutritional status of soil when applied to the soil in combination with inorganic fertilizer nutrient in the forms that are readily taken up by the plant which led to higher plant height and leaf area index of rice. Thereby opportunity for the plants to increase the photosynthetic rate which in turn resulted in higher accumulation of dry matter. Thus integration of compost and chemicals offer more balanced nutrients to the plants especially macro and micro nutrient which positively influence the plant biomass system. Similar results were reported by Dada *et al*. (2014) and Kavitha and Subramanian (2007).

Application of 50% NPK +Azophos 2 kg ha^{-1} (T_6) resulted in the least values in all these growth parameters *viz.,* plant height, LAI and DMP which is due to the absence of beneficial effect of pressmud based organic manure, distillery ash and 25 per cent lesser dose of NPK. The organic manure contains nutrients in forms that are readily taken up by the plants and presence of good amount of organic carbon, nitrogen and phosphorus which are not available for this treatment. The results are in conformity with the findings of Tripathi and Kumar (2005) and Virdia and Mehta (2010).

Conclusion

On the basis of the result of the field experiment, it may be inferred that application of 75 per cent NPK +Azophos 2 kg ha^{-1}+ pressmud based organic manure granules @ 125 kg ha^{-1}+ distillery ash granules @ 125 kg ha^{-1} holds promise as an eco-friendly and economically suitable nutrient management system with emphasis to achieve the sustained production together with maintenance of soil fertility over a long period of low land rice production in Cauvery delta region.

Table 1: Effect of graded dose of NPK with different granular organic manures at growth attributes of lowland rice

Treatments	Plant height (cm)		LAI	DMP (kg ha^{-1})	
	At Flowering	At Harvest		At flowering	At harvest
T_1 - RDF (120:38:38 NPK kg ha^{-1})	70.1	85.5	5.31	5320	10,290
T_2 - 75% RDF + Azophos @ 2 kg ha^{-1}	68.3	83.4	5.16	5029	9905
T_3 - 75% RDF + Azophos @ 2 kg ha^{-1} + Pressmud based organic manure granules @ 125 kg ha^{-1}	77.9	95.3	5.9	6505	11,890
T_4 - 75% RDF + Azophos @ 2 kg ha^{-1} + Distillery ash granules @ 125 kg ha^{-1}	76.1	93	5.82	5898	11,489
T_5 - 75% RDF + Azophos @ 2 kg ha^{-1} + Pressmud based organic manure granules @ 125 kg ha^{-1} + Distillery ash granules @ 125 kg ha^{-1}	82.9	101.2	6.25	7092	12,728
T_6 - 50% RDF + Azophos @ 2 kg ha^{-1}	64.9	80.5	4.8	4699	9473
T_7 - 50% RDF + Azophos @ 2 kg ha^{-1} + Pressmud based organic manure granules @ 125 kg ha^{-1}	73.9	88.2	5.65	5898	10,694
T_8 - 50% RDF + Azophos @ 2 kg ha^{-1} + Distillery ash granules @ 125 kg ha^{-1}	72.2	90.6	5.56	5601	10,290
T_9 - 50% RDF + Azophos @ 2 kg ha^{-1}+ Pressmud based organic manure granules @ 125 kg ha^{-1} + Distillery ash granules @ 125 kg ha^{-1}	80.5	98.3	6.07	6800	12,280
S Ed	0.8	0.97	0.062	127.39	170.1
CD (p=0.05)	1.69	2.05	0.13	270.06	360.6

Reference

Baradhan, G.; Kuppuswamy, G.; Ganapathy, M. and Suresh, S.M. (2006). Influence of organic and inorganic sources of nitrogen on yield components and yield of sunflower. Plant Archives. 6(2): 855-856.

Dada, O.A.; Adeniyi, O.T.; Adediran, J.A.; Nwilene, F.E. (2014). Growth, Nutrient Uptake Efficiency and Yield of Upland Rice as Influenced by Two Compost Types in Tropical Rainforest-Derived Savannah Transition Zone. Agricultural Sciences, 5: 383-393.

Dobbelaere, S.; Vanderleyden, J. and Okon, Y. (2003). Plant growth promoting effects of diazotrophs in the rhizosphere. Crit. Rev. Plant Sci., 22 : 107 – 149.

DRR, (2011). Vision 2030. ICAR, Rajendra Nagar, Hyderabad.

Ghosh, D.C. (2015). Integrated nutrient management in potato for increasing nutrient use efficiency and sustainable productivity. In: Rakshit, A, Singh, HB, Sen, A, editors. Nutrient use efficiency: from basics to advances. SpringerIndia; 343- 355.

Government of India (2014). Agricultural Statistics at a Glance, Ministry of Agriculture and Cooperation. Directorate of Economics and Statistics. Oxford University Press, New Delhi, 72-74.

Kavitha, R. and Subramanian, P. (2007). Effect of enriched municipal solid waste compost application on growth, plant nutrient uptake and yield of rice. Journal of Agronomy ; 6(4): 586-592.

Kharub, A.S. and Chander, S. (2008). Effect of organic farming on yield quality and Soil fertility status under basmati rice (*Oryza sativa*) - wheat (*Triticum aestivum*) cropping system. Indian J. Agri. Sci., 77 (8) : 512- 515

Mirza-Hasanuzzaman, K.U.; Ahamed, N.M.; Rahmatullah, N.; Akhterand, K.N. and Rahman, M.L. (2010). Plant growth characters and productivity of wetland rice (*Oryza sativa* L.) as affected by application of different manures, Emir. J. Food Agric., 22(1):46-58

Mohanty, M.; Nanda, S.S. and Barik, A.K. (2013). Effect of integrated nutrient management on growth, yield, nutrient uptake and economics of wet season rice (*Oryza sativa*) in Odisha. Indian Journal of Agricultural Science, 83(6): 599-604.

Pandey, N.; Verma, A.K.; Anurag and Tripathi, R.S. (2007). Integrated nutrient management in transplanted hybrid rice (*Oryza sativa*). Indian Journal of Agronomy, 52(1): 40-42.

Sannathimmappa, H.G.; Gurumurthy, B.R.; Jayadeva, H.M.; Rajanna, D. and Shivanna, M.B. (2015). Effect of Paddy Straw Based Integrated Nutrient Management Practices for Sustainable Production of Rice. IOSR Journal of Agriculture and Veterinary Science, 8: 74-77.

Sarker, M.A.R.; Pramanik, M.Y.A.; Faruk, G.M. and Ali, M.Y. (2004). Effect of green manures and levels of nitrogen on some growth attributes of transplant rice. Pak. J. Biol. Sci; 7: 739-742.

Siddaram, K.; Murali, M.K.; Basavaraja, N.; Krishna, M. and Manjunatha, B.N. (2010). Effect of nitrogen levels through organic sources on yield attributes, yield and economics of irrigated aerobic rice. Mysore J. Agric. Sci., 44(3) : 485 – 489.

Suresh, K.S.M. and Baradhan, G. (2018). Effect of different sources of organic manure granules on the growth of hybrid maize (*Zea mays*). Plant Archives, 18(2) : 1401-1404.

Tripathi, S.K. and Kumar, A. (2005). Changes in organic-C, available N, P, K, S, Zn and grain yield due to long-term fertilizer use in rice-wheat system. Pantnagar J. Res., 3(1):1-3.

Virdia, H.M. and Mehta, H.D. (2010). Integrated nutrient management in transplanted rice (*Oryza sativa* L.). Int. J. Agric. Sci., 6(1): 295-299.

Yadav, S.K.; Subhash, B.; Singh, Y.; Yadav, M.K.; Yadav, G.S.; Pal, S.; Singh, R. and Singh, K. (2013). Effect of organic nutrient sources on yield, nutrient uptake and soil biological properties of rice *(Oryza sativa)* based cropping system. Indian J. Agron., 58 (3) : 271 – 276.