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Drymatter and Yield of Rice as Influenced by Organics and Inorganics of Nitrogen

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ABSTRACT

A field experiment was conducted at Agricultural College Farm, Bapatla, during *kharif* 2015-16 to find out the response of transplanted rice to nitrogen management through combined use of different organic sources and inorganic levels. Organic manures *viz*., poultry manure, FYM and neemcake were used in this experiment. The experimental results indicated that highest drymatter accumulation (kg ha^{-1}) at maturity of rice was recorded with 50 per cent N applied as inorganic and remaining 50 per cent through poultry manure @ 125 per cent RDN and it was statistically at par with 125 per cent and 100 per cent N through only chemical fertilizers. The grain and straw yield of rice also followed the similar trend. Harvest index was not significantly influenced by the different nitrogen management treatments.

Key words: *Inorganic levels, Organic manures, Transplanted rice.*

Rice (*Oryza sativa* L.) is the prime source of food for nearly half of the world's population and it is one of the most important food crop, that plays a key role for food security. In India it is cultivated in an area of 43.86 M ha with a production of 105.80 million tonnes and productivity of 2.7 t ha^{-1}. Among the various factors known to augment the crop production, fertilizer aided with suitable agronomic practices play a pivotal role to boost up the crop yield. Nitrogen, an essential primary nutrient promotes the growth and development and also influences the availability of other nutrients. It deserves a special status among the major nutrients and is the "mineral of life" for rice. Indiscriminate use of high analysis chemical fertilizers increase the crop yield in the initial years, but it is leading to development of several problems like decline in soil organic matter, increase in salinity, soil pollution and reduction of soil productivity (Chakraborthi and Singh, 2004). To compensate this, there is a need to develop integrated nutrient management (INM) system. Hence, the present experiment was conducted to know the effect of nitrogen management through combined use of organics and inorganics in rice.

MATERIAL AND METHODS:

A field experiment was conducted at Agricultural College Farm, Bapatla during *kharif* 2015-16 on clay soils, which was slightly alkaline in reaction, medium in organic carbon and nitrogen, high in available phosphorous and potassium. The experiment consisted of twelve treatments viz., 75 per cent recommended dose of nitrogen i.e. 90 kg ha^{-1} (T_1), 100 per cent recommended dose of nitrogen i.e. 120 kg ha^{-1} (T_2), 125 per cent recommended dose of nitrogen i.e. 150 kg ha^{-1} (T_3), 50 per cent N of T_1 through inorganic fertilizer + 50 per cent N of T_1 through FYM (T_4), 50 per cent N of T_1 through inorganic fertilizer + 50 per cent N of T_1 through poultry manure (T_5), 50 per cent N of T_1 through inorganic fertilizer + 50 per cent N of T_1 through neemcake (T_6), 50 per cent N of T_2 through inorganic fertilizer + 50 per cent N of T_2 through FYM (T_7), 50 per cent N of T_2 through inorganic fertilizer + 50 per cent N of T_2 through poultry manure (T_8), 50 per cent N of T_2 through inorganic fertilizer + 50 per cent N of T_2 through neemcake (T_9), 50 per cent N of T_3 through inorganic fertilizer + 50 per cent N of T_3 through FYM (T_{10}), 50 per cent N of T_3 through inorganic fertilizer + 50 per

cent N of T_3 through poultry manure (T_{11}), 50 per cent N of T_3 through inorganic fertilizer + 50 per cent N of T_3 through neemcake (T_{12}). The experiment was laid out in a Randomized block design and replicated thrice. Well decomposed farmyard manure with 0.5 per cent nitrogen, poultry manure with 1.5 per cent and neem cake with 1.8 per cent nitrogen were used as organic sources and they were applied as per the treatment combinations ten days before transplanting. The inorganic nitrogen was applied through urea as per treatments while recommended dose of phosphorous (60 kg P_2O_5 ha^{-1}) and potassium (40 kg K_2O ha^{-1}) were applied through single super phosphate and muriate of potash, respectively uniformly to all the treatments. Entire quantity of phosphorus and potassium and one third of the N were applied as basal at the time of transplanting. Remaining N was applied in two equal splits, one at active tillering stage and the other at panicle initiation stage. Thirty two days old seedlings were transplanted in experimental plots keeping two seedlings per hill by adopting a spacing of 20 cm x 15 cm on 14-09-2015. Recommended agronomic practices and plant protection measures were followed.

RESULTS AND DISCUSSION

Dry matter accumulation (kg ha^{-1})

The drymatter accumulation at maturity was significantly influenced by the organics and inorganics of nitrogen. Significantly the highest (13763 kg ha^{-1}) drymatter accumulation was recorded (Table 1) with the application of 125 per cent recommended dose of nitrogen (T_3) over the T_1 (75 per cent RDN) in the inorganic treatments tested and it was statistically comparable with T_2 (100 per cent RDN). In the organic and inorganic treatment combinations, maximum (13895 kg ha^{-1}) drymatter accumulation was recorded with the application of 50 per cent N of T_3 through inorganic fertilizer + 50 per cent N of T_3 through poultry manure (T_{11}). However, among all treatments tested, T_{11}, T_3 and T_2 were on par among themselves and showed significantly superior to rest of the treatments. Significantly higher drymatter accumulation in 125 per cent fertilizer treatment (T_3) might be due to greater solubility and accelerated release of nitrogen and also by providing an opportunity for rice to utilize higher quantum of nutrients. Apart from that, nitrogen might have involved in various physiological activities like increased photosynthetic activity and better light interception which in turn resulted in higher drymatter accumulation. In the poultry manure treated plot higher drymatter accumulation might be due to the involvement of certain growth promoting substances which might have accelerated the number of tillers. Continuous slow release of nutrients from both inorganics and organic sources which also supplied nutrients directly to the plant after decomposition and mineralization than other organic or chemical source of nitrogen. This might have enabled the extension of leaf area, thereby providing an opportune time for plants to increase the photosynthetic rate which in turn, could have led to higher accumulation of drymatter. The results are supported by the findings of Suvarnalatha and Sankararao (2001), Solunke *et al.* (2006) and Santoshkumar *et al.* (2014).

Yield (kg ha^{-1})

The grain and straw yield of rice (Table 1) was significantly influenced by the nitrogen management through combined application of organics and inorganics. Among all the treatments tested, application of 50 per cent N of T_3 through inorganic fertilizer + 50 per cent N of T_3 through poultry manure (T_{11}) was found to be significantly highest. This might be due to higher nitrogen content in poultry manure which is readily available as compared to other organic manures. Due to quick decomposition, the nutrients present in the poultry manure were readily available to the crop, which might have resulted in increased yield attributes and yield. Generally, the poultry manure is acidic in nature, where the experimental plot was slightly alkaline in condition which would have helped in increasing the availability of nutrients. The supply of the required nutrients through organic and inorganic sources facilitated balanced nutrition of the crop, which might have resulted in enhanced grain yield (Jayabal *et al.,* 1999). Perhaps higher concentration of macro and micronutrients in the poultry manure and steady nutrient release compared to other organic manures such as FYM and neemcake could make it to perform well (Ananda *et al.* 2006). Similar findings were also

Table 1. Drymatter accumulation (kg ha^{-1}) at maturity, grain yield (kg ha^{-1}), straw yield (kg ha^{-1}) and harvest index (%) of rice as influenced by combined use of organics and inorganics in transplanted rice.

Treatments	Drymatter accumulation at maturity	Grain yield	Straw yield	Harvest index
T - 75% RDN (90 kg N ha^{-1})	8289	3313	4168	44.3
T^{1} - 100 % RDN (120 kg N ha^{-1})	13431	5530	6855	45.0
T^{2} - 125% RDN (150 kg N ha^{-1})	13763	5604	6901	44.8
T^{3} - 50% N of T through inorganic fertilizer + 50% N of T^{4} through FYM ^{1}	7374	2641	3187	45.3
T^{1} - 50% N of T through inorganic fertilizer + 50% N of T^{5} through poultry manure^{1}	7483	2752	3664	42.9
T^{1} - 50% N of T through inorganic fertilizer + 50% N of T^{6} through neemcake^{1}	7472	2835	3600	44.3
T^{1} - 50% N of T through inorganic fertilizer + 50% N of T^{7} through FYM ^{2}	8122	3180	4032	44.0
T^{2} - 50% N of T through inorganic fertilizer + 50% N of T^{8} through poultry manure^{2}	9780	4126	5042	45.0
T^{2} - 50% N of T through inorganic fertilizer + 50% N of T^{9} through neemcake^{2}	9846	4024	5021	44.6
T^{2} - 50% N of T through inorganic fertilizer + 50% N of T^{10} through FYM^{2}	9996	4196	5176	44.8
T^{3} - 50% N of T through inorganic fertilizer + 50% N of T^{11} through poultry manure^{3}	13895	5680	6997	44.9
T^{3} - 50% N of T through inorganic fertilizer + 50% N of T^{12} through neemcake^{3}	11942	4870	6013	44.7
SEm±	503.3	224.9	281.5	1.94
CD (0.05)	1476	660	826	NS
CV (%)	8.6	10.0	9.6	7.5

reported by Meena *et al.* (2010), Sisodia and Kewat (2009) and Siddaram *et al*. (2011). However, the results of T_{11} treatment proved statistically on par with those treatments which received 125 per cent and 100 per cent RDN and exhibited the superiority over all the other treatments tested. The lowest grain and straw yields were recorded with 75 per cent recommended nitrogen through inorganics and different organic sources viz., FYM (T_4), poultry manure (T_5) and neemcake(T_6). Harvest index was not significantly influenced by the combined use of organics and inorganics in transplanted rice (Table 1).

From the study, it can be concluded that enhanced grain yields in transplanted rice can be obtained with 50 per cent nitrogen through inorganic fertilizer and remaining 50 per cent through organic manure i.e. poultry manure @ 125 per cent RDN.

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