Studies on Integrated Nutrient Management for sustaining the yield in transplanted rice Crop Cv Co 43

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Abstract

Field studies were conducted to find out the effect of graded levels of inorganic nitrogen in conjunction with different organics viz., coirpith, vermicompost, pressmud and biofertilizer *viz*., azophos on base crop rice cv. CO43 at the experimental farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai nagar, Tamil Nadu. The treatments were tested in randomized block design and replicated thrice. The effect of application 75 % RDFN + 25 % N through vermicompost + Azophos favourably influenced the growth and yield parameters of rice culminating in the highest yield per hectare, which was higher than that of the control. The economic analysis of various treatments imposed revealed that application of 75 % RDFN + 25 % N through vermicompost + Azophos recorded the highest gross and net return of Rs.81640.00 and Rs.52893.00 which ultimately resulted in registering the highest net rupee invested as 2.84

Introduction

Rice is one of the most predominant and staple food crop that are being extensively cultivated and consumed all over the world by more than two billion people in Asia. India has the largest acreage under rice of 44 million hectares with a production of about 141million tonnes. However, the national productivity of rice is 3.21t ha^{-1}. The burgeoning population of our country may stabilize around 1.4 and 1.6 billion by 2025 and 2050, requiring annually 380 and 450 million tonnes of food grains, respectively (Siddiq, 2000). To meet the future food requirements, India has to increase its rice productivity by three per cent per annum. Nitrogen is the kingpin for any fertilizer management programme in rice cultivation and is the universal key element for realizing the yield potential of high yielding rice varieties in Indian soils. Though use of inorganic fertilizers are beneficial in increasing the crop yields, exclusive use of them causes imbalance of micronutrients and also has the deleterious effect on soil micro flora. Besides, the high cost of fertilizers deters the farmers from using them in recommended doses. Therefore, there is a felt necessity to evaluate suitable agronomic strategies with emphasis on eco friendliness to accomplish the twin objectives of achieving the sustained production and to maintain the soil fertility over a longer period. Therefore, it is envisaged that for sustainable agricultural production in the country, integrated plant nutrient supply system (IPNSS) appears to be more promising. Such system would also reduce the cost of farming in addition to maintaining the soil productivity, improving the eco-system and ultimately resulting in improved soil-plant-health in a sustainable agricultural eco-system.

MATERIALS AND METHODS

The experimental site is situated at 11°24' N latitude and 74°44' E longitude at an altitude of + 5.79 m above mean sea level in the southern part of India. The soil is deep clay, low in available N, medium in available P_2O_5 and high in available K_2O. This experiment comprised of fourteen treatments viz., T_0 – Absolute control

T_1 – 100 % RDFN

T_2 – 75 % RDFN + 25 % N through coirpith compost

T_3 – 75 % RDFN + 25 % N through enriched pressmud compost

T_4 – 75 % RDFN + 25 % N through vermicompost

T_5 – 50 % N through RDFN + 50% N through coirpith compost

T_6 – 50 % N through RDFN + 50 % N through enriched pressmud compost

T_7 – 50 % N through RDFN + 50 % N through vermicompost

T_8 – 75 % RDFN + 25 % N through coirpith compost + Azophos

T_9 – 75 % RDFN + 25 % N through enriched pressmud compost + Azophos

T_{10} – 75 % RDFN + 25 % N through vermicompost + Azophos

T_{11} – 50 % N through RDFN +50 % N through coirpith compost + Azophos

T_{12}– 50 % N through RDFN + 50 % N through enriched pressmud compost + Azophos

T_{13} – 50 % N through RDFN + 50 % N through vermicompost + Azophos

The experiment was laid out in randomized block design with three replications and statistically analyzed to find out the best performing treatments.

RESULTS AND DISCUSSION

Growth attributes

Among the treatments tested, treatment T_{10} (75% RDFN + 25% N through vermicompost +azophos) recorded the maximum values for plant height, number of tillers at maximum tillering stage, LAI @ 60 DAT and DMP @ harvest stage (Table 1). The beneficial effect of N applied through inorganic fertilizer and vermicompost to supply N in the proportion of (75:25) on the growth attributes viz., plant height, number of tillers $hill^{-1}$, LAI and DMP of rice was observed to be significant when compared to other treatments. Similar results were found in the research findings of Kuldeep Singh et al. (2015) in cereal crop of sweet sorghum with the observations of maximum growth and development parameters. The increase in the growth parameters was also due to the Azospirillum which produces phytohormones to enhance plant growth that also formed for the uptake of nutrients through higher availability, which in turn reflected on the growth attributes. Application of

phosphobacteria also favoured by producing organic acids which favoured for the mobilization of phosphorus in the soil, and all these cumilately led to increase in the growth parameters of rice (Saravanan, 2015).

Table 1. Effect of growth attributes of rice as influenced by IPNSS

Treatments	Plant ht @ flowering (cm)	LAI @ flowering	Tillers /hill @ maxi. tillering stage	DMP @ harvest (t/ha)
T_0	61.04	3.58	20.35	7.63
T_1	76.66	5.69	31.84	13.21
T_2	71.13	4.39	27.20	11.25
T_3	72.38	5.29	28.32	11.67
T_4	73.83	5.42	29.52	12.21
T_5	66.79	4.08	23.67	9.67
T_6	68.08	4.16	24.77	10.08
T_7	69.62	4.29	25.99	10.67
T_8	75.11	5.53	30.65	12.65
T_9	78.09	5.84	33.02	13.81
T_{10}	**79.48**	**5.98**	**34.18**	**14.32**
T_{11}	62.66	3.72	32.61	8.16
T_{12}	63.93	3.82	23.7	8.55
T_{13}	65.33	3.95	22.47	9.14
S.Ed	0.67	0.07	0.56	0.26
C.D (p=0.05)	1.32	0.12	1.15	0.48

Yield attributes

The yield potential of rice is determined by the yield attributes and the values of the yield attributes were in accordance with that of growth parameters. Among the treatments, combined application of 75 % recommended dose of N + recommended dose of P and K + 25 % N on equivalent basis of vermicompost + azophos (T_{10}) resulted in significantly superior effect on all the yield attributes *viz*., number of panicles hill^{-1} and number of filled grains, except the test weight (Table 2), since the weight of individual grain is mainly influenced by the genetic makeup of the plant as compared to other environmental factor. These results are in accordance with the findings of Kuldeep Singh et al., (2015). The better performance of integrated application might also be due to the counteraction of the effect of inorganic fertilizer by the vermicompost and the steady and liberal supply of adequate nutrients during the later stages of crop growth, thus helping in fixing more photosynthates and translocation of them from source to sink and thereby enhanced the number of filled grains panicle^{-1}. This is in line with the findings of Stalin and Vaiyapuri (2009); Suseendran (2011).

Table 2. Effect of yield attributes of rice as influenced by IPNSS

Treatments	Tillers hill^{-1}	Panicles hill^{-1}	Filled grains panicle^{-1}
T_0	21.35	5.38	79.01
T_1	31.84	7.69	94.14
T_2	27.20	7.06	89.05
T_3	28.32	7.13	90.38
T_4	29.52	7.38	91.82
T_5	23.67	6.45	84.72
T_6	24.77	6.55	86.02
T_7	25.99	6.82	87.57
T_8	30.65	7.50	93.17
T_9	33.02	7.87	95.59
T_{10}	34.18	8.03	97.02
T_{11}	22.61	5.74	80.51
T_{12}	23.72	5.81	81.79
T_{13}	22.47	6.14	83.27
S.Ed	0.56	0.06	0.67
CD (p=0.05)	1.15	0.14	1.39

Among the various treatments imposed in the study, substantial increase in yield attributes viz., number of productive tillers m^{-2} and filled grains panicle^{-1} was evidenced in the treatment (T_{11}) that received the recommended dose of N through inorganic and vermicompost (75: 25) which in turn reflected on enhanced grain and straw yield. This treatment registered higher values of 4.87t ha^{-1} and 6.65 t ha^{-1} of grain and straw yield than all other treatments (Table 3). The constant release of N supplemented by vermicompost in conjunction with inorganic N might have satisfied the demand of rice crop at every phenophase as opined by Babu Mathew (2001). The application of biofertilizers viz., Azospirillum produce phytohormones that induce root growth, improved nutrient and water absorption by plants, that augmented increase in production of shoot dry biomass that ultimately favoured for higher growth parameters, yield attributes and yield of rice. The above findings are in collaborative with the earlier report of Sunil and ShankaraLingappa (2014).

Table 3. Grain and Straw yield (t ha^{-1}) of Rice as influenced by IPNSS

Treatments	Grain Yield (t ha $^{-1}$)	Straw Yield (t ha^{-1})
T_0	3.18	5.74
T_1	5.79	8.62
T_2	4.98	7.73
T_3	5.15	7.89
T_4	5.39	8.17
T_5	4.27	6.98
T_6	4.42	7.13
T_7	4.69	7.44
T_8	5.52	8.36
T_9	6.05	8.87
T_{10}	6.28	9.12
T_{11}	3.51	6.20
T_{12}	3.65	6.32
T_{13}	3.96	6.66
S.Ed	0.08	0.12
C.D (p= 0.05)	0.19	0.23

CONCLUSION

The conjoint application of inorganic N and vermicompost in the ratio of 75: 25 of recommended dose of nitrogen along with biofertilizers for rice was found to be a suitable and sustainable integrated plant nutrient supply system for rice. It also registered maximum values for most of the parameters like growth, yield and yield components of rice, as a whole without affecting the soil fertility and thereby maintaining the soil health and sustainability of rice production for the tail end of Cauvery deltaic region.

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