Studies on Integrated Nutrient Management Approach for Sustaining the Yield in Rice- Blackgram Cropping Sequence

Stalin, P, P. Anandan, K. Suseendran, A. Balasubramanian, S.R.Vinod kumar and R.Gobi
Department of Agronomy,
Faculty of Agriculture, Annamalai University. Annamalai Nagar-608 002, Tamil Nadu, India

***Abstract*:** Field experiment were conducted to study 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. CO 43 and its possible residual effect on rice fallow blackgram crop *viz*., blackgram var. ADT 3 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 of 75% RDFN + 25% N through vermicompost + Azophos favourably influenced the yield parameters of rice – Blackgram 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. 100804.6 and Rs. 68507.6 which ultimately resulted in registering the highest net rupee invested as 3.12

Key words : **Rice, INM, Organics, Bio-Fertilizer, Inorganic fertilizer**

INTRODUCTION

Rice (*Oryza sativa*) is one of the most prominent food crop that is being extensively cultivated in India. Rice is grown in 114 countries across the world with an area of 159.22 million hectares with the production of 465.81 million tonnes and productivity of 4.36 t ha^{-1}. To feed the exploring population, projection of India's rice production target for 2025 AD is 140 million tonnes, which can be achieved only by increasing the rice production by over 2.0 million tonnes per year in the coming decade. In contrast, recent slow down or plateauing of yield in irrigated rice was noticed as a result of eroding soil health and decline in productivity level. Use of inorganic fertilizers for increasing food grain production is inevitable in the present circumstances where food security and livelihood issues of the people have sustained national priority. Continuous use of inorganic fertilizers leads to deterioration of soil chemical, physical properties and biological activity in soil health. The Green revolution had gradually turned into a 'greedy revolution' as evident from the indiscriminate use of inorganic inputs to attain higher productivity. Highly intensified irrigated rice cropping runs the risk of disturbing the established equilibrium among the established equilibrium among system components and function.

The recommendation of nitrogen use thus needs attention. Despite growth in nitrogen use, research over the past 20-30 years had showed that nitrogen use efficiency (NUE) of different N fertilizers is generally low or decrease. Poor utilization of nitrogenous fertilizer by rice is thought to be largely due to different losses of nitrogen. It is widely that for sustainable agriculture, a balanced fertilizer with efficient use of other inputs is the key to achieve higher crop production. Efficient integrated nutrient management in a cropping sequence as a whole is the use of different organic sources.

MATERIALS AND METHODS

Field experiments were conducted in the Experimental farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai nagar with rice CO 43. The treatments comprised of an absolute control with no application of organics and inorganics (T_0).

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

Table 1. Growth attributes and yield of rice

Treatments	Tillers hill^{-1}	Panicles hill^{-1}	Filled grains panicle^{-1}	Grain yield (t ha $^{-1}$)	Straw yield (t ha^{-1})
T_0	21.35	5.38	79.01	3.18	5.74
T_1	31.84	7.69	94.14	5.79	8.62
T_2	27.20	7.06	89.05	4.98	7.73
T_3	28.32	7.13	90.38	5.15	7.89
T_4	29.52	7.38	91.82	5.39	8.17
T_5	23.67	6.45	84.72	4.27	6.98
T_6	24.77	6.55	86.02	4.42	7.13
T_7	25.99	6.82	87.57	4.69	7.44
T_8	30.65	7.50	93.17	5.52	8.36
T_9	33.02	7.87	95.59	6.05	8.87
T_{10}	34.18	8.03	97.02	6.28	9.12
T_{11}	22.61	5.74	80.51	3.51	6.20
T_{12}	23.72	5.81	81.79	3.65	6.32
T_{13}	22.47	6.14	83.27	3.96	6.66
S.Ed	0.56	0.06	0.67	0.08	0.12
CD (p=0.05)	1.15	0.14	1.39	0.19	0.23

Table 2. Effect of INM practices on nutrient uptake (kg ha^{-1}) by rice crop

Treatments	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})
T_0	108.19	24.96	103.96
T_1	135.36	32.71	139.25
T_2	125.56	30.05	126.61
T_3	127.56	30.62	129.69
T_4	130.46	31.37	132.93
T_5	118.03	27.90	116.98
T_6	120.36	28.45	120.04
T_7	122.97	29.26	123.32
T_8	132.87	31.98	136.04
T_9	137.84	33.42	142.44
T_{10}	140.32	34.11	145.63
T_{11}	110.84	25.78	107.33
T_{12}	113.11	26.30	110.37
T_{13}	115.41	27.10	113.68
S.Ed	1.45	0.31	159
CD (p=0.05)	2.94	0.65	3.15

Table 3. Economic analysis of various treatments on rice CO43

Treatments	Cost of cultivation (Rs. ha^{-1})	Gross income (Rs. ha^{-1})	Net Income (Rs. ha^{-1})	Return per rupee invested
T_0	24751	41340	16589	1.67
T_1	28139	75270	47131	2.67
T_2	27198	64740	37542	2.38
T_3	27445	66950	39701	2.43
T_4	27603	70070	42467	2.53
T_5	26225	55510	29285	2.11
T_6	26538	57460	30922	2.16
T_7	26887	60970	34083	2.26
T_8	27952	71760	43808	2.56
T_9	28351	78650	50299	2.77
T_{10}	28741	81640	52893	2.84
T_{11}	24989	45630	20641	1.82

T_{12}	25689	47480	21791	1.84
T_{13}	25981	51480	25499	1.98

RESULT AND DISCUSSIONS

The results of the experiments revealed that the application of 75% RDFN + 25% N through vermicompost + Azophos favourably influenced the yield parameters number of filled grains panicle^{-1}, grain and straw yield. The above treatment also projected an increased yield over the control.

The treatment which received 100% N as inorganic (T_1) was lower than the application of N in the ratio of (75 : 25). The growth enhancement in T_1 could be ascribed to the higher urea hydrolysis which released more NH_4-N into soil solution for crop utilization which in turn, reflected in growth improvement as opined by Siddeswaran (1992). Higher DMP was recorded. The addition or fixation of atmospheric N *Azospirillum* and solubilization of phosphorus by phosphobacteria and the enhanced growth by micro nutrients like zinc, borax, Mg, Mn and Fe of plant growth hormones. This favorable effect increased plant biometrics which ultimately led to higher DMP. This might be due to higher availability of both native and applied nutrients and better source – sink relationship, which contributed to better dry matter accumulation. These results are in accordance with the findings of Gopal et al. (2003). Similar findings in rice was reported by Kale and Bano (1986). The increase in growth and yield components of crops due to application of vermicompost is mainly because of microbial stimulation effect and N supplied through gradual mineralizaion in a steady manner throughout the crop growth as reported by Roy and Singh (2006). The increase in growth, yield attributes and grain yield might also be complemented by inorganic N applied and the fixation of atmospheric nitrogen and synthesis, excretion of growth promoting substances such as IAA, auxin and solubilization of phosphorus by P solubilizing bacteria. Similar findings were reported by Shankariah and Kalyanamurthy (2005).Enhanced N, P and K uptake in this treatment could be attributed to increased dehydrogenase activity and higher nutrients supplied by vermicompost along with inorganic NPK. This in turn increased their availability in the form of NH_4-N, NO_3-N, orthophosphates and potassium and their uptake by crop. Similar findings was reported by Aranocon et al. (2006). Increased uptake of nutrients by rice in this treatment could also be attributed to the effect of organic matter present in vermicompost and its influence in increasing the native microbial population and consequent mobility and availability of NPK nutrients. The present result is in agreement with the findings of Babu Mathew (2001).

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