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EFFECT OF IPNSS FOR SUSTAINABILITY IN LOWLAND RICE OF CAUVERY DELTA ZONE

Stalin P., S.R. Vinod Kumar, M. Saravanaperumal, A. Balasubramanian and P. Anandan
Department of Agronomy, Faculty of Agriculture,Annamalai University, Annamalainagar-608 002, India
E-mail : *stalinagorediffmail.com*

ABSTRACT

Field investigations were conducted to evaluate a sustainable, eco-friendly and economically viable integrated plant nutrient supply system for rice. The study was conducted as preliminary study to find out the effect of graded levels of inorganic nitrogen in combination with different organics *viz.*, green manure, vermicompost, pressmud compost, FYM and composted poultry manure on rice. In the above study, the growth and yield components of rice were markedly influenced by the application of different organic manures in conjunction with inorganic N. Among the various organic manures tested, the treatment T_8 (50% N as vermicompost + 50% N as inorganic) was characterized by many benefactors with the maximum values of growth and yield in rice crop.

Rice is one of the most predominant and staple food crop that is being extensively cultivated and consumed all over the world and by more than two billion people in Asia. Rice is grown under diverse soil and agro-climatic conditions. World demand for rice by the year 2025 is estimated to be about 765 million tonnes as compared to present production of 556 million tonnes (Doberman *et al* ., 2003).In order to meet the production demand, average rice yields must be raised from 5.3 t ha^{-1} (1998) to 6.1 t ha^{-1} (2010) to 6.7 t ha^{-1} (2020). To achieve this targeted yield, about 30 per cent of all farmers must achieve yields of more than 8 t ha^{-1} and 15 per cent more than 9 t ha^{-1} in at least one crop per year. Rice often surprises us with phenomenal adjustments to its environments, perhaps that is the reason why it has become one of the worlds prime food crop. The prospect for rice production during the last two to three years is bright with the present production level of 86 million tonnes (Siddiq, 2000). India would be required to add annually not less than 2.3 million tonnes of rice to feed the anticipated increase in population by 2.2 per cent per annum. The burgeoning population of our country may stabilize around 1.4 and 1.6 billions by 2025 and 2050, requiring annually 380 and 450 million tonnes of food grains respectively (Siddiq, 2000). To make India self sufficient in food grain production by the year 2010, the yield level of rice has to be increased by 25 - 30 per cent from the present level of 2.2 t ha^{-1}.

Application of optimum dose of N to rice is gaining importance since N is such a star nutrient which is indispensable in crop production. The low recovery (30-40%) of applied N in lowland rice and higher unit cost price necessitate the use of alternative to inorganic N fertilizer to maintain the productivity. Considering the very low efficiency of applied N fertilizer and the possibility of only a partial substitution to rice, it has become a necessity to integrate the use of bioorganic and inorganic sources of N for higher N use efficiency, increased yield and sustained soil fertility (Kannaiyan *et al.*, 1990) besides achieving ecologically sound and economically viable sustainable agriculture (Swaminathan, 1987).

MATERIALS AND METHODS

A comprehensive field study was conducted on rice cropping system in the tail end area of cauvery deltaic zone of Tamil Nadu to study the graded levels of inorganic nitrogen (N) in combination with organic manures and to find out the suitability and sustainability of integrated plant nutrient supply system on rice-pulse cropping system. The study was aimed to find out the response of rice to graded levels of inorganic nitrogen in combination with different organic manures *viz.,* green manure, vermicompost, pressmud compost, FYM, composted poultry manure on rice var Co. 43, The experiments were laid out in randomized block design and replicated thrice.

T_1-Absolute control

T_2-100% of Recommended dose of nitrogen (RDN)

T_3-100% N as green manure

T_4-75% N as green manure + 25% of N as inorganic

T_5-50% N as green manure + 50% of N as inorganic

T_6-100% N as vermicompost

Table-1 : Effect of organics and inorganic N on growth attributes of rice.

Treatments	Plant height at Havest	LAI at Harvest	DMP at Harvest(kg/ Ha)
T_1	79.20	3.11	3912.93
T_2	101.70	4.81	10650.57
T_3	94.12	4.31	10773.54
T_4	95.77	4.40	10925.34
T_5	108.56	5.22	12500.85
T_6	98.17	4.59	11318.16
T_7	99.30	4.64	11428.78
T_8	110.98	5.40	12889.27
T_9	86.10	3.79	9710.30
T_{10}	87.84	3.85	9888.37
T_{11}	105.24	5.01	11934.03
T_{12}	82.15	3.56	9269.79
T_{13}	83.70	3.62	9324.68
T_{14}	104.13	4.98	11814.98
T_{15}	90.23	4.01	10273.87
T_{16}	91.73	4.12	10385.90
T_{17}	107.65	5.18	12322.65
S.Ed	1.19	0.07	191.81
CD (P = 0.05)	2.38	0.15	383.62

Table-2 : Effect of organics and inorganic N on yield attributes of rice.

Treatments	No. of productive tillers/hill	No. of productive tillers/m^2	Panicle length (cm)	Filled grains (per cent)	1000 grain weight (g)
T_1	3.02	150.07	8.65	45.02	19.86
T_2	6.30	315.85	16.18	74.81	20.10
T_3	5.79	289.50	13.95	71.04	20.05
T_4	5.82	291.67	14.47	71.40	20.05
T_5	6.93	346.50	18.38	78.23	20.18
T_6	6.00	300.00	15.04	73.00	20.07
T_7	6.12	306.60	15.61	73.22	20.08
T_8	7.12	356.83	18.95	79.82	20.20
T_9	4.90	245.70	11.86	67.06	20.01
T_{10}	5.02	251.78	12.28	67.46	20.01
T_{11}	6.50	325.37	17.28	76.58	20.17
T_{12}	5.51	276.13	10.06	65.07	20.00
T_{13}	5.62	281.20	10.13	65.47	20.00
T_{14}	6.82	341.26	16.75	76.40	20.15
T_{15}	5.21	260.31	12.85	69.05	20.03
T_{16}	5.32	266.17	13.38	69.45	20.03
T_{17}	6.64	332.10	17.85	78.17	20.17
S.Ed	0.008	4.80	0.28	0.79	0.21
CD (P = 0.05)	0.16	2.51	0.56	1.58	NS

T_7-75% N as vermicompost + 25% N as inorganic

T_8-50% N as vermicompost + 50% N as inorganic

T_9-100% N as pressmud compost

T_{10}-75% N as pressmud compost + 25% N as inorganic

T_{11}-50% N as pressmud compost + 50% N as inorganic

T_{12}-100% N as FYM

T_{13}-75% N as FYM + 25% N as inorganic

T_{14}-50% N as FYM + 50% N as inorganic

T_{15}-100% N as composted poultry manure

T_{16}-75% N as composted poultry manure + 25% N as inorganic

T_{17}-50% N as composted poultry manure + 50% N as inorganic

RESULTS AND DISCUSSION

The results of the experiment revealed that the

Table-3 : Effect of organics and inorganic N on yield of rice.

Treatments	Grain yield	Straw yield	Harvest index
T_1	1106.25	2779.97	28.42
T_2	5090.58	7035.70	41.28
T_3	4612.72	6712.39	40.73
T_4	4793.94	6970.33	40.75
T_5	5625.80	7469.63	42.96
T_6	4832.15	6916.33	41.13
T_7	4915.36	6907.59	41.26
T_8	5993.78	7822.81	43.38
T_9	4095.20	6357.07	39.18
T_{10}	4272.77	6571.82	39.40
T_{11}	5372.28	7319.14	42.33
T_{12}	3917.78	6229.28	38.60
T_{13}	4009.22	6326.48	38.79
T_{14}	5292.66	7264.06	42.15
T_{15}	4338.69	6518.89	39.36
T_{16}	4555.05	6764.65	40.24
T_{17}	5599.93	7502.38	42.74
S.Ed	83.42	113.35	NS
CD (P = 0.05)	166.84	226.70	NS

application of 50 per cent recommended nitrogen as inorganic + 50 per cent through Vermicompost favourably influenced the growth and yield parameters viz., Number of productive tillers, number of productive tillers, panicle length, filled grain, test weight, grain yield and straw yield ultimately. Among the various treatments imposed the treatment application of 50 per cent recommended nitrogen as inorganic + 50 per cent through Vermicompost registered the maximum values of growth and yield attributes and higher grain and straw yield. The least values were recorded under the control treatment.

The results of the experiment revealed that organic manures with inorganic fertilizer distinctly influenced the yield attributes of rice than control. Application of 50 per cent recommended nitrogen as inorganic + 50 per cent through Vermicompost exhibited an accelerated effect on yield growth and yield attributes which is mainly due to Vermicompost which contains nutrients that are readily taken up by the plants in form of nitrates, exchangeable phosphorous and soluble potassium, calcium and magnesium (Atiyewh *et al*., 2000). Besides, there is a significant quantity of vitamins and natural phyto-regulators in a balanced form (Madan, 1993).

The growth and yield parameters viz., Number of productive tillers, number of productive tillers, panicle length, filled grain, test weight, grain yield and straw yield ultimately Among the various treatments imposed the treatment application of 50 per cent recommended nitrogen as inorganic + 50 per cent through Vermicompost reflected in increased grain and straw yield. The aforesaid increased yield attributes and simultaneous enhanced yield due to inorganic N along with Vermicompost might be due to higher uptake and increased photosynthesic efficiency. The constant release of N from organic N might have satisfied the demand of rice at every phenophase of the crop as opined by Babu Mathew (2001).

The application of inorganic N along with Vermicompost in rice significantly influenced the growth and yield attributes of rice and in addition the aforesaid treatment offered favourable neutro-physiological conditions that enhanced the soil fertility (Sudhakar and Kuppuswamy, 2007). Among the different treatments imposed on rice, it was inferred that application of 50% N as vermicompost and 50% N as inorganic N registered the highest net return of Rs. 33451.91. The treatment T_5 (application of 50% N as green manure + 50% N as inorganic N) was next in order which registered a net return of Rs. 31415.48.

The lowest net income of Rs. 556.62 was observed in T_1 (absolute control).

With regard to return per rupee invested, 50% N as vermicompost + 50% N as inorganic (T_8) registered the highest value (2.82) followed by T_5 (2.73). The least return per rupee invested was with T_1 (1.05). Increased profitability in vermicompost treatment plots (T_8) could be attributed to the highest economical yield as a result of favorable neutro-physiological conditions offered by it. This present finding is in concomitance with the findings of Jeyabal and Kuppuswamy (2001) who reported highest net return ha^{-1} and return per rupee invested with vermicompost applied plots in rice based cropping system

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