



INFLUENCE OF INTEGRATED PLANT NUTRIENT SUPPLY SYSTEM ON ECONOMIC SUITABILITY AND VIABILITY IN LOWLAND RICE OF CAUVERY DELTA ZONE

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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 T₈ (50% N as vermicompost + 50% N as inorganic) was characterized by many benefactors with the maximum values of growth and yield in rice crop. In Phase I experiment, 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 T₈ (50% N as vermicompost + 50% N as inorganic) was characterized by many benefactors with the maximum values of gross return, net return and return per rupee invested leading to more suitability and economic viability for adoption in the tail end area of Cauvery deltaic zone.

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.

T₁-Absolute control

T₂-100% of Recommended dose of nitrogen (RDN)

T₃-100% N as green manure

T₄-75% N as green manure + 25% of N as inorganic

T₅-50% N as green manure + 50% of N as inorganic

T₆-100% N as vermicompost

T₇-75% N as vermicompost + 25% N as inorganic

T₈-50% N as vermicompost + 50% N as inorganic

T₉-100% N as pressmud compost

T₁₀-75% N as pressmud compost + 25% N as inorganic

T₁₁-50% N as pressmud compost + 50% N as inorganic

T₁₂-100% N as FYM

T₁₃-75% N as FYM + 25% N as inorganic

T₁₄-50% N as FYM + 50% N as inorganic

T₁₅-100% N as composted poultry manure

T₁₆-75% N as composted poultry manure + 25% N as inorganic

T₁₇-50% N as composted poultry manure + 50% N as inorganic

RESULTS AND DISCUSSION

The results of the experiment revealed that the 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

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

Treatments	Plant height at Harvest	DMP at Harvest(kg/Ha)	No. of productive tillers/m ²	Filled grains (per cent)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index
T ₁	79.20	3912.93	150.07	45.02	1106.25	2779.97	28.42
T ₂	101.70	10650.57	315.85	74.81	5090.58	7035.70	41.28
T ₃	94.12	10773.54	289.50	71.04	4612.72	6712.39	40.73
T ₄	95.77	10925.34	291.67	71.40	4793.94	6970.33	40.75
T ₅	108.56	12500.85	346.50	78.23	5625.80	7469.63	42.96
T ₆	98.17	11318.16	300.00	73.00	4832.15	6916.33	41.13
T ₇	99.30	11428.78	306.60	73.22	4915.36	6907.59	41.26
T ₈	110.98	12889.27	356.83	79.82	5993.78	7822.81	43.38
T ₉	86.10	9710.30	245.70	67.06	4095.20	6357.07	39.18
T ₁₀	87.84	9888.37	251.78	67.46	4272.77	6571.82	39.40
T ₁₁	105.24	11934.03	325.37	76.58	5372.28	7319.14	42.33
T ₁₂	82.15	9269.79	276.13	65.07	3917.78	6229.28	38.60
T ₁₃	83.70	9324.68	281.20	65.47	4009.22	6326.48	38.79
T ₁₄	104.13	11814.98	341.26	76.40	5292.66	7264.06	42.15
T ₁₅	90.23	10273.87	260.31	69.05	4338.69	6518.89	39.36
T ₁₆	91.73	10385.90	266.17	69.45	4555.05	6764.65	40.24
T ₁₇	107.65	12322.65	332.10	78.17	5599.93	7502.38	42.74
S.Ed	1.19	191.81	4.80	0.79	83.42	113.35	NS
CD (P = 0.05)	2.38	383.62	2.51	1.58	166.84	226.70	NS

Table-2 : Effect of organics and inorganic N on economics of rice cultivation.

Treatments	Cost of cultivation (Rs./ha)	Gross income (Rs./ha)	Net Income (Rs./ha)	Return per rupee invested
T ₁	9683.36	10239.99	556.62	1.05
T ₂	19866.37	42385.99	22519.62	2.13
T ₃	22363.36	40257.66	17894.60	1.80
T ₄	20458.39	41836.36	19948.22	1.90
T ₅	17825.74	48741.22	31415.48	2.73
T ₆	23308.36	42115.37	18807.01	1.80
T ₇	22985.37	42811.68	19826.31	1.86
T ₈	18329.74	51781.65	33451.91	2.82
T ₉	27063.86	35940.14	8876.77	1.32
T ₁₀	25301.52	37468.07	12166.25	1.48
T ₁₁	21225.74	46637.81	25412.07	2.19
T ₁₂	30313.36	34456.88	4143.52	1.13
T ₁₃	27739.32	35237.00	7497.68	1.27
T ₁₄	22850.74	45973.31	23122.57	2.01
T ₁₅	24063.36	37968.97	13905.61	1.57
T ₁₆	22864.32	39822.73	16958.41	1.74
T ₁₇	18350.84	48550.63	30199.79	2.64

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 photosynthetic 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 Kuppaswamy, 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 T₅ (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 T₁ (absolute control).

With regard to return per rupee invested, 50% N as vermicompost + 50% N as inorganic (T₈) registered the highest value (2.82) followed by T₅ (2.73). The least return per rupee invested was with T₁ (1.05). Increased profitability in vermicompost treatment plots (T₈) 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 Kuppaswamy (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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