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Effect of Integrated Organic Sources of Nutrients on Rice (*Oryza sativa* L.) Productivity and Profitability

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Abstract

A field experiment was conducted during *kharif* season to study the effect of integrated organic sources of nutrients on rice productivity and profitability. The soil of experimental site was red sandy loam, with having soil organic carbon content of 0.63%. The field trial consisted of eight treatments laid out in randomized complete block design with three replications. The sources of organic manures used in the trial to supply the nutrients were farmyard manure, vermicompost and cow urine. The analysis of organic substrates indicated that the highest organic carbon content of 29.43% was noticed in sheep manure followed by pressmud (27.20%),vermicompost (21.75%), poultry manure (20.85%), pig manure (17.20%), FYM (16.43%) and the lowest was observed in crossbreed urine (0.79%). The experimental results indicated that the application of 15 tons of farmyard manure as basal dose and top dressing with 75 kg of nitrogen through cow urine on nitrogen equivalent basis recorded significantly the highest grain yield of 5,138 kg/ha followed by 10 tons of farmyard manure as basal dose and top dressing with 75 kg of nitrogen through vermi-compost (4736.13 kg/ha) and found superior over other treatments. The lowest grain yield was observed with the application of farmyard manure at 10 tons per hectare as basal dose and top dressing with 50 kg nitrogen through cow urine (4,305.56 kg/ha). The highest gross returns, net returns and benefit cost ratio were achieved from the crop receiving 15 ton farmyard manure as basal dose and top dressing 75 kg nitrogen through cattle urine (Rs 62,028, 39,907 and 2.21 respectively) which was higher than other treatments and the lowest cost of production was observed with the application of farmyard manure at 10 t/ha as basal dose and top dressing with 50kg N/ha through cattle urine. The soil organic carbon content increased significantly in the plots treated with organics (0.64—0.72%) over the initial soil organic carbon of 0.63%. Soil available nutrient status improved significantly with farmyard manure applied at 15 t/ha as basal dose and top dressed with 75 kg nitrogen per ha through cattle urine than the initial soil nutrient status.
Key words : Cow urine, Integrated organic sources, Soil organic carbon content, Productivity, Profitability.

Organic agriculture is a holistic way of farming with an important aim conservation of natural resources, fertile soil, clean water and rich biodiversity. In order to sustaining the soil health, avoids environmental pollution and substitution of chemical fertilizers using locally available organic sources plays vital role in present context. Integrated organic nutrient supply system helps to maintain or improve soil fertility for sustaining the desired level of crop production and productivity, through optimization of the benefits from all possible sources of plant nutrients in integrated manner. The integrated organic source of nutrient management approach has perhaps greater scope in rice than other cropping system. Rice is grown predominantly under submerged anaerobic soil conditions that offer wider scope for harvesting different organic nutrient sources. Besides, serving as a source of plant nutrients to crops the farm yard manure (FYM) and cattle urine helps to improve the physical and biological properties of soil thereby enhancing nutrient use efficiency. Integrated use of organic manures like cow urine, vermicompost, FYM green manures, crop residues and bio-fertilizers not only supply the nutrients but also helps in maintaining soil fertility on sustainable basis towards an eco-friendly environment. The necessary data on integrated use of different organic sources of nutrients on growth and yield of paddy was meager. Hence, the study was conducted with a view to find out the optimum combination of organic sources (both basal and top dressing) of nutrients and its residual effect on productivity of rice.

Table 1. Nutrient concentration (%) of organic manures (pooled data of 2 years)

	Organic manures	Physico-chemical properties pH	EC (dS/m)	OC (%)	Nutrient concentration (%) N	P	K
1	Farmyard Manure	8.70	0.48	16.43	0.53	0.30	0.35
2	Vermi compost	7.05	0.45	21.75	0.99	0.35	1.00
3	Sheep manure	9.01	1.12	29.43	1.01	0.66	0.88
4	Poultry manure	7.28	0.35	20.85	0.98	0.91	1.03
5	Pig manure*	8.29	0.32	17.20	0.62	0.34	0.46
6	Pressmud*	7.46	1.31	27.20	1.08	0.64	0.76
7	Cattle urine						
	(a) Hallikar cow	7.20	24.15	1.03	1.10	0.04	1.20
	(b) Cross breed	7.65	15.55	0.79	1.25	0.03	1.40
8	Bio digester liquid*	7.81	27.60	–	0.39	0.01	0.46
9	Jeevamrutha	4.45	11.59	–	0.30	0.007	0.31
10	Beejamrutha	7.10	6.95	–	0.22	0.003	0.07

Methods

The field experiment was conducted at Organic Farming Research Station (OFRS), Naganahalli, Mysore during 2008-09. The experimental field was sandy loam with pH 6.83. The soil organic carbon content was 0.63%, medium in available N (298 kg/ha), P_2O_5 (32 kg/ha) and K_2O (139 kg/ha). The experiment consisted of eight treatments were laid out in randomized complete block design with three replications. The treatments were as follows : T_1 : FYM at 10t/ha as basal dose + top dressing with 50 kg N/ha through cattle urine, T_2 : FYM at 10t/ha as basal dose+ top dressing with 75kg N/ha through cattle urine, T_3: FYM at 15 t/ha as basal dose + top dressing with 50 kg N/ha through cattle urine, T_4: FYM at 15 t/ha as basal dose + top dressing with 75kg N/ha through cattle urine, T_5 : FYM at 10 t/ha as basal dose + top dressing with 50 kg N/ha through vermi compost, T_6 : FYM at 10 t/ha as basal dose + top dressing with 75 kg N/ha through vermi compost, T_7 : FYM at 15 t/ha as basal dose + top dressing with 50 kg N/ha through vermi compost, T_8 : FYM at 15 t/ha as basal dose + top dressing with 75 kg N/ha through vermi compost.

The sources of organic nutrients were applied based on the treatments. Farm yard manure was applied on nitrogen equivalent basis three weeks before land preparation as basal dose and cattle urine and vermi compost was top dressed on N equivalent basis during crop growth period. Soil, plant and organic sources were analyzed by following the standard procedures.

Soil Analysis

Initial soil sample was analyzed for different parameters like soil pH, organic carbon and soil available nutrients to know the initial soil fertility status. Soil samples were collected after the harvest of paddy crop from all the treatments in each replication from 0—15 cm depth. Soil samples were analyzed by following standard procedures (1).

Plant Analysis

The plant samples were analyzed for total nitrogen by micro-kjeldahl method and total potassium by flame photometer, whereas the total phosphorus content was analyzed through vanadomolybdophosphoric yellow color method (1).

Organic Manure Analysis

After collecting the organic manure samples from various sources and they were oven dried at 65C, ground to pass through lmm sieve and used for analysis. Organic carbon content was determined by ignition method, the total nitrogen content was determined using micro-kjeldahl system by H_2SO_4digestion followed by distillation with 40% Naoh. Phosphorus content in di-acid digested manure samples was determined by colorimetric method using vanadomolybdophosphoric yellow complex using a UV-VIS spectrophotometer (2). Potash content in the di-acid digested manure was determined flame pho-

Table 2. Productivity (kg/ha) and economics of rice as influenced by integrated organic sources (average of two years).

Treatments	Productivity of paddy			Economics of Paddy		
	Grain yield (kg/ha)	Straw yield (kg/ha)	Cost of production Rs/ha	Gross returns Rs/ha	Net returns Rs/ha	B : C ratio
T_1 : FYM 10 t/ha as basal dose + top dressing with 50 kg N/ha through cattle urine	4306	4607	24275	51973	27698	2.14
T_2 : FYM 10 t/ha as basal dose + top dressing with 75 kg N/ha through cattle urine	4403	4711	25621	53144	27523	2.07
T_3 : FYM 15 t/ha as basal dose + top dressing with 50 kg N /ha through cattle urine	4542	4860	26775	54822	28047	2.05
T_4 : FYM 15 t/ha as basal dose + top dressing with 75 kg N/ha through cattle urine	5139	5499	28121	62028	33907	2.21
T_5 : FYM 10 t/ha as basal dose + top dressing with 50 kg N/ha through vermi compost	4639	4964	26551	55993	29442	2.11
T_6 : FYM 10 t/ha as basal dose + top dressing with 75 kg N/ha through vermi compost	4736	5068	29076	57164	28088	1.97
T_7 : FYM 15 t/ha as basal dose + top dressing with 50 kg N/ha through vermi compost	4667	4994	29051	56331	27280	1.94
T_8 : FYM 15 t/ha as basal dose + top dressing with 75 kg N/ha through vermi compost	4972	5320	31576	60012	28436	1.90
CD 5%	369.24	373.32	–	–	–	–

tometrically (1). Economics of different treatments were estimated based on prevailing local market prices. Nutrient concentrations in different organic manures are presented.

Results and Discussion

Nutrient Content of Organic Sources

The pooled data on nutrient concentration analysed in different organic sources revealed that (Table 1) the highest organic carbon content of 29.43% was noticed in sheep manure followed by press mud (27.20%), vermicompost (21.75%), poultry manure (20.85%), pig manure (17.20%) FYM (16.43%) and the lowest were observed with crossbreed urine (0.79%) by following the standard procedures Tandon (2).

Productivity and Profitability of Rice

The treatments differed significantly among themselves towards grain and straw yield. Significantly highest grain yield of 5,139 kg/ha was recorded with the application of 15 ton FYM as basal dose and top dressed with 75 kg nitrogen through cattle urine on nitrogen equivalent basis (Table 2), followed by the application of 15 ton FYM as basal dose and top dressing with 75 kg nitrogen through vermi compost (4,972 kg/ha) and found significantly superior over other treatments (3). The higher yield may be due to higher availability of nutrients released in cattle urine and higher nutrient content in organic sources. The lowest yield was obtained with the application of 10 ton FYM as basal dose and top dressing with 50 kg nitrogen through cattle urine (4,306 kg/ha). The highest gross returns, net returns and benefit cost ratio were achieved from the crop receiving 15 ton FYM as basal dose and top dressing with 75 kg nitrogen through cattle urine (Rs 62,028, 39,907 and 2.21 respectively) and found higher than other treatments. The higher production of grain and straw yield and lower cost of production of manures were the main attributes for higher gross returns, net returns and B : C ratio.

Soil Nutrient Status

The soil available nutrients like nitrogen, phosphorus and potassium were analyzed after the harvest of paddy crop and the results are presented in Table 3. The soil analysis results indicated that after

Table 3. Soil physico-chemical properties as influenced by integrated sources of organic manures to rice (after harvest of second crop).

Treatments	pH	EC (dS/m)	OC (%)	Av. N (kg/ha)	Av. P_2O_5 (kg/ha)	Av. K_2O (kg/ha)
T_1 : FYM 10 t/ha as basal dose + top dressing with 50 kg N/ha through cattle urine	6.92	0.412	0.64	303	33.93	143
T_2 : FYM 10 t/ha as basal dose + top dressing with 75 kg N/ha through cattle urine	7.01	0.571	0.65	313	34.22	156
T_3 : FYM 15 t/ha as basal dose + top dressing with 50 kg N/ha through cattle urine	7.20	0.388	0.65	327	36.23	165
T_4 : FYM 15t/ha as basal dose + top dressing with 75 kg N/ha through cattle urine	7.21	0.511	0.72	381	46.47	223
T_5 : FYM 10 t/ha as basal dose + top dressing with 50 kg N/ha through vermi compost	7.04	0.442	0.65	310	38.36	185
T_6 : FYM 10 t/ha as basal dose + top dressing with 75 kg N/ha through vermi compost	6.87	0.518	0.68	342	44.80	194
T_7 : FYM 15 t/ha as basal dose + top dressing with 50 kg N/ha through vermi compost	7.03	0.612	0.66	326	42.78	198
T_8 : FYM 15 t/ha as basal dose + top dressing with 75 kg N/ha through vermi compost	7.11	0.483	0.70	357	45.30	211
CD 5%	NS	NS	0.41	33.2	8.92	14.41

the harvest of crop there was no significant difference between the treatments with respect to soil pH, since the plots were applied with organic manures which helps in buffering the soil pH during the processes of organic matter decomposition. There was no much change in electrical conductivity (EC) values among the different treatments. However, the EC values were much below the critical range in all the treatments. The soil organic carbon (SOC) content increased significantly in the plots treated with organics (0.64—0.72%) over the initial SOC of 0.63%. The increase in SOC may be attributed to slow decomposition of applied and native Soil organic matter under prevailing anoxic and continuous submerged condition. The significant increase in available nitrogen (381 kg/ha), available phosphorus (46.47 kg/ha) and available potassium (223 kg/ha) was noticed in FYM applied at 15 t/ha as basal dose + top dressing with 75 kg N/ha through cattle urine over initial soil available nitrogen (2,98 kg/ha) and found superior over other treatments in the study. These results are in conformity with those of Gunri et al. (4).

Conclusion

These findings suggest that the basal application of 15 tons FYM and top dressing with 75 kg nitrogen through cattle urine on nitrogen equivalent basis is the optimum integrated organic source for obtaining higher productivity.

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