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Nutrient Status and Microbial Population in Soil after Harvest of Rice (*Oryza sativa* L.) as Influenced by Various Levels of FYM and Cattle Urine Application

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Abstrct

An experiment was conducted during *kharif* of 2009 in sandy clay loam soil to study the growth and yield of rice as influenced by various levels of FYM and cattle urine application under Bhadra command area. The investigation consists of ten treatments replicated thrice. Among different treatments application of FYM at 7.5t/ha + cattle urine equivalent to 75 kg N/ha recorded significantly higher available nitrogen, phosphorus and potassium (272.0, 21.3 and 182.2 kg/ha, respectively). Whereas, significantly lower available nutrients viz., available nitrogen, phosphorus and potassium (293.2, 26.9 and 215.9 kg/ha, respectively) in soil was observed with the application of recommended dose of fertilizer + FYM at 10t/ha. Similarly, significantly higher microbial population viz., bactaria, fungai, actinomycetes, N fixers and P solubilizers (63.6×10^6 CFU/g, 34.0×10^4 CFU/g, 53.7×10^4 CFU/g, 59.2×10^5 CFU/g and 51.9×10^5 CFU/g, respectively) was recorded in soil with the application of FYM at 12.5 t/ha + cattle urine equivalent to 125 kg N/ha.

Key words : Nutrient status, Microbial population, FYM, Cattle urine, Rice.

Rice (*Oryza sativa* L.) is the principal food crop to billions of people around the world. India occupies a pride place in rice production among the food crops cultivated in the world. About 90% of rice grown in the world is produced and consumed in Asian countries. China and India account for more than half of the total acreage in the world. India has the largest area (43.18 million hectare) among rice growing countries and stands second in production (97.0 million tonnes) with a productivity of 2,101 kg/ha. In Karnataka, it is grown in an area of 1.42 million hectare with an annual production. Organic farming has gained popularity in recent years not only in India, but also in Australia, Argentina, USA, UK, Germany, South Africa, China, Japan and other Asian countries like Srilanka and Pakistan. The general acceptance of organic farming is not only due to greater demand for pollution free food, but also due to natural advantage in supporting the sustainability in agriculture. The essence of practicing organic farming lies in the use of naturally available resources like organic wastes, predators, parasites in conjunction with natural processes like decomposition, biological nitrogen fixation and resistance to achieve the needs of crop production. When rice crop is grown transplanted situation, there are chances of losses of nutrients with flooded condition. To reduce these losses, nutrients should be provided at right quantity and at right stage of crop. This is possible by applying suitable organic manures for transplanted rice crop, which inturn improves the organic matter status of soil. Organic matter not only helps to supply the nutrients, but also improves the physical condition of soil. Further, organic matter acts as a food for microorganisms and encourages the multiplication of their population, which inturn improves the mineralization of nitrogen in soil and thus, fertility and productivity of the soil is improved. In these aspects no systematic studies were carried out to find out the response of transplated rice to varying levels of FYM and cattle urine. Therefore, an attempt was made to study the effect of FYM and cattle urine on growth and yield of

Table 1. Nutrient composition of different FYM and cattle urine.

Parameters	FYM	Cattle urine
pH	7.8	7.4
EC (ds/m)	0.16	1.3
OC (%)	10.71	2.5
N (%)	0.59	0.51
P (%)	0.3	0.02
K (%)	0.42	0.62
Ca (%)	2.1	0.0054
Mg (%)	0.95	0.0113
S (ppm)	4200	0.31
Fe (ppm)	1151.2	2.89
Zn (ppm)	89.2	3.52
Cu (ppm)	41.1	1.01

rice in Bhadra command area, to achieve maximum production.

Methods

An experiment was conducted during *kharif* of 2009at Agriculture Research Station, Kathalagere, Davanagere Dist, Karnataka. The soil of the experimental site was sandy clay loam with slightly acidic in pH (5.4), slightly high in organic carbon (0.60%), low in available nitrogen (279.6kg/ha), medium in phosphorus (22.6 kg/ha) and low in potassium (197.1 kg/ha). The experiment was laid out in randomized complete block Design with ten treatments was replicated thrice. Recommended dose of fertilizer (100 : 50 : 50 kg N, P_2O_5 and K_2Okg/ha) was applied through chemical fertilizers. N was applied in three split doses viz 50% as basal, 25% at 30 days after sowing and remaining 25% at 60 days after sowing as top dressing with full dose of P and K as basal. The fertilizer application was done in treatment (T_{10}). The manurial treatments, FYM was applied as basal dose and cattle urine was applied in two splits. The nutrient composition of FYM and cattle urine is given in Table 1. The rice variety—JGL-1798 was used for this experiment. The land was ploughed using bullock drawn MB plough and leveled. Then raised beds of 1 m × 1m width were prepared. The beds were prepared near to the main field and seeds were sown in nursery bed at 62 kg/ha and twenty five days old seedlings were planted at a spacing of 20 cm × 10 cm (one seedling/hill). Irrigation at 2.5 cm water height was maintained from planting to 10 days after planting (DAP) and 5 cm water height was maintained from 11 DAP to physiological maturity. pH was estimated by using glass electrode pH meter (1). Electrical conductivity was measured by conductivity bridge (2). Organic carbon per cent was determined by wet oxidation method (1). Available nitrogen was determined by alkaline permanganate method (2). Available phosphorus was determined by Brays method and available potassium was estimated by Flame photometer method (2). The rhizosphere soil samples collected from experimental plots were analyzed for different soil microorganisms viz., total bacteria, total fungi, total actinomycetes, N fixers and P solubilizers, using standard dilution plate count technique and plating on specific nutrient media.

Table 2. Nutrient status of soil after harvest of rice as influenced by various levels of FYM and cattle urine application. FYM : Farm yard manure NS : Non-significant.

Treatments (t/ha + kg / ha)	pH	EC (dS/m)	OC (%)	Nitrogen (kg/ha)	P_2O_5 (kg/ha)	K_2O (kg/ha)
Initial nutrient status of soil	5.4	0.09	0.60	279.6	22.6	197.1
T_1 : FYM 7.5 + cattle urine equivalent to 75 kg N	5.4	0.10	0.61	293.2	26.9	215.9
T_2 : FYM 7.5 + cattle urine equivalent to 100 kg N	5.5	0.09	0.61	290.3	26.0	211.1
T_3 : FYM 7.5 t + cattle urine equivalent to 125kg N	5.5	0.11	0.62	289.9	25.3	205.1
T_4 : FYM 10 t + cattle urine equivalent to 75 kg N	5.4	0.09	0.62	288.6	25.0	204.8
T_5 : FYM 10 t + cattle unrine equivalent to 100 kg N	5.6	0.10	0.61	286.0	25.0	203.6
T_6 : FYM 10 t + cattle urine equivalent to 125 kg N	5.6	0.10	0.61	282.0	24.6	198.8
T_7 : FYM 12.5 t + cattle urine equivalent to 75 kg N	5.5	0.10	0.63	281.7	24.2	198.7
T_8 : FYM 12.5 t + cattle urine equivalent to 100 kg N	5.4	0.11	0.63	280.6	22.8	198.4
T_9 : FYM 12.5 t + cattle urine equivalent to 125 kg N	5.6	0.10	0.64	279.9	22.8	198.0
T_{10} : Recommended dose of fertilizer + FYM 10 t	5.5	0.09	0.61	272.0	21.3	182.2
SE ±	0.11	0.01	0.01	4.11	1.20	5.83
CD at 5%	NS	NS	NS	12.3	3.59	17.5

Table 3. Microbial population in soil before and after harvest of rice as influenced by various levels of FYM and cattle urine application. FYM : Farm yard manure.

Treatments (t/ha + kg/ha)	Total bacteria no. × 10^6 CFU/g	Total fungi no. × 10^4 CFU/g	Total actinomycetes no. × 10^4 CFU/g	Total nitrogen fixer no. × 10^5 CFU/g	Total P solubilizers no. × 10^5 CFU/g
Initial population	42	16	32	37	33
T_1 : FYM 7.5 t + cattle urine equivalent to 75 kg N	44.6	17.9	33.0	44.9	39.5
T_2 : FYM 7.5 t + cattle urine equivalent to 100 kg N	46.2	20.7	35.7	45.1	41.5
T_3 : FYM 7.5 t + cattle urine equivalent to 125 kg N	48.0	21.7	38.3	46.1	43.0
T_4 : FYM 10 t + cattle urine equivalent to 75 kg N	50.6	24.7	39.0	47.1	43.8
T_5 : FYM 10 t + cattle urine equivalent to 100 kg N	51.0	27.5	41.7	48.6	45.0
T_6 : FYM 10 t + cattle urine equivalent to 125 kg N	56.4	30.3	44.5	53.1	48.3
T_7 : FYM 12.5 t + cattle urine equivalent to 75 kg N	58.3	31.0	46.3	53.2	48.7
T_8 : FYM 12.5 t + cattle urine equivalent to 100 kg N	58.4	31.7	47.7	53.9	49.6
T_9 : FYM 12.5 t + cattle urine equivalent to 125 kg N	63.6	34.0	53.7	59.2	51.9
T_{10} : Recommended dose of fertilizer + FYM 10 t	44.8	27.6	38.8	38.9	34.1
SE ±	2.48	1.6	3.3	2.2	1.4
CD at 5%	7.4	4.7	9.9	6.5	4.2

Results and Discussion

Effect of FYM and Cattle Urine Application on Soil Nutrient Status

Soil pH, electrical conductivity and organic carbon content in the soil were not influenced by the application of various levels of FYM and cattle urine. Significantly lower amount of nitrogen (272.0 kg/ha), phosphorus (21.3 kg/ha) and potassium (182.2 kg/ha) in soil after harvest of the crop was observed with recommended dose of fertilizer (100 : 50 : 50 kg N : P :K/ha)+ 10 tonnes of FYM/ha. However, it was onpar with FYM at 12.5 t/ha + cattle urine equivalent to 125 kg N/ha, FYM at 12.5 t/ha + cattle urine equivalent to 100 kg N/ha, FYM at 12.5 t/ha + cattle urine equivalent to 75 kg N/ha and FYM at 10 t/ha + cattle urine equivalent to 125 kg N/ha (Table 2). This might be due to higher grain and straw yields of crop, which resulted in extraction most of the soil nutrients. The higher amount of nitrogen (292.6 kg/ha), phosphorus (26.9 kg/ha) and potassium (215.9 kg/ha) in soil after harvest of the crop was observed with FYM at 7.5 t/ha + cattle urine equivalent to 75 kg N/ha. This FYM might have helped to improve the soil physical, chemical and biological properties leading to overall improvement in soil health in the long run. In general application of organic manures like FYM at higher dose than the recommendedation improved the NPK status of soil. It was mainly due to mineralization of nitrogen from organic manures through increased activity of soil organisms (3). The results are in conformity with the findings of Roul and Sarawgi (4).

Effect of FYM and Cattle Urine Application on Microbial Population in Soil

The lower microbial population was recorded with the application of FYM at 7.5 t/ha + cattle urine equivalent to 75 kg N/ha (44.6 × 10^6 CFU/g, 17.9 × 10^4 CFU/g, 33.0 × 10^4 CFU/g, 44.9 × 10^5 CFU/g and 39.5 × 10^5 CFU/g, of total (bacteria, fungi, actinomycetes, nitrogen fixers and P solubilizers, respectively), whereas, significantly higher microbial population was recorded (63.6 × 10^6 CFU/g, 34.0 × 10^4 CFU/g, 53.7 × 10^4 CFU/g, 59.2 × 10^5 CFU/g and 51.9 × 10^5 CFU/g, of total bacteria fungi actinomycetes, nitrogen fixers and P solubilizers, respectively) with the application of FYM at 12.5 t/ha + cattle urine equivalent to 125 kg N/ha. Addition of cattle urine was highly beneficial in improving bacterial population of soil (Table 3). Similarly, Majumdar et al, (5) inferred that application of urine to the soil results in increased microflora in soil. Cattle urine was able improve the microbial population when it applied with FYM, it increases total microbial population in the soil.

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