

## **Influence of Organic and Inorganic Fertilizer on Microbial Activity in Rice Soil of Odisha**

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### **Abstract**

A field experiment was conducted during 2009 using organic, inorganic fertilizer and integration of both in lateritic inceptisol of Bhubaneswar, which lies between the longitude of 85° 48' and 85° 49' and latitude of 20° 16' and 20° 17' N and comes under Agro-Eco region 12.2 type with rice-rice cropping sequence. After harvest of *kharif* rice crop the plant and soil samples were analyzed to access the influence of fertilizer on microbial activity. Application of readily available source of energy farm yard manure (FYM) increased the microbial population in soil, which influenced the decomposition process. The highest bacterial population was found when fertilizer was added along with FYM. The highest grain yield of 33.85 q/ha was found in the treatment of 100% NPK + FYM. Integrated use of organic and inorganic fertilizers, enhanced the yield about 40% over only inorganic (100% NPK) fertilizers.

**Key words :** Fertilizer, FYM, Yield, Microbial activity.

Rice-rice is an important cropping system in the costal ecosystem of eastern odisha. The system needs more amount of nutrients to produced higher yield. Use of inorganic fertilizers and scanty use of organic manures results in lower crop yields. Long term experiments at many locations have indicated that application of recommended dose of inorganic fertilizer is not able to sustain high productivity of rice-rice system, Nambiar et al. (1). Hegde (2) emphasized on the importance of integrated nutrient management. Indiscriminate use of high analysis chemical fertilizers results in deficiency of secondary and micronutrients in soil (3). Hot humid climate and heavy rainfall associated with leaching of bases have resulted in development of soil acidity problem and have low E. C, poor exchangeable bases and low available of P, S and B in most of the cases (4). The major reactions are soil mainly biochemical in nature involving hydrolysis and oxidation brought about by various hydrolytic enzymes liberated by microorganisms. The actinomycetes participated mostly in decomposition of resistant components of plant residues and formation of humus. In general the bacterial and fungal population immediately proliferated upon organic amendment (5). Application of Farm Yard Manure (FYM) increased population of soil microbes (6, 7). The highest microbial biomass was observed under

the integrated use of organic manure (FYM) + inorganic fertilizer (NPK) (8). Continious use of FYM along with optimum level of NPK increased the organic content of soil (9).

### **Method**

The present investigation was conducted at lateritic inceptisol (udic ustochrept) soil of Bhubaneswar during *kharif* of 2009 with rice (cv Lalata). The experiment comprised of four replication with six treatment combinations viz. T<sub>1</sub>—control, T<sub>2</sub>—50% NPK, T<sub>3</sub>—100% NPK, T<sub>4</sub>—100% NPK + FYM, T<sub>5</sub>—100% NPK + lime, T<sub>6</sub>—100% NPK + lime. The experiment was laid out in randomized block design. The initial soil sample was collected from a depth of 0—15 cm and analyzed following the method described by Jackson (10). The soil was sandy loam in texture with clay content (%) 17, B. D 1.55 g/cc, pH (1 : 2.5) 5.80, EC (ds/m) 0.12, organic carbon (g/kg) 4.3, available N (kg/ha) 187, available P (kg/ha) 19.4, available K (kg/ha) 43.4, available K (kg/ha) 43.4, available S (kg/ha) 22.2.

Population of soil micro organisms such as bacteria, fungi and actinomycetes in different treatments were studied by plate count technique of Wollum (11) through serial dilution technique using respective media for each group.

**Table 1.** Effect of manure and fertilizer on grain and straw yield (q/ha) of rice.

Treat-ments	Treat-ment details	Grain yield (q/ha)	Straw yield (q/ha)	Har-vest index
T <sub>1</sub>	Control	10.94	15.23	41.80
T <sub>2</sub>	50% NPK	21.32	28.6	42.17
T <sub>3</sub>	100% NPK +	24.21	29.45	45.12
T <sub>4</sub>	100% NPK + FYM	33.85	38.43	46.83
T <sub>5</sub>	100% NPK + FYM + Lime	30.25	32.75	48.02
T <sub>6</sub>	100% NPK + Lime	24.28	28.43	46.06

## Result and Discussion

### Grain Yield

The results revealed that highest rice grain yield of 33.85 q/ha was recorded with the plot which received 100% NPK and FYM (T<sub>4</sub>) (Table 1). On other hand, lowest grain yield of 10.02 q/ha was obtained with control plot where no nutrient was applied. Application of nutrient in form of inorganic or organic form increased the rice grain yield. The grain yield of 30.25 q/ha due to application of FYM treatment with lime. Straw yield has been followed the similar trend with that of grain yield. Highest straw yield of 38.43q/ha was recorded with T<sub>4</sub> (100% NPK + FYM) where lowest yield of 15.23 q/ha was observed with control plot where no nutrient was applied. Grain yield and straw yield were significantly higher due to application of FYM along with 100% NPK. Harvest index of treatments was calculated (Table 1). The highest index of 48.02 was observed with application of lime with organic and inorganic fertilizers. Whereas lowest harvest index of 41.80 was observed with control plot where no nutrient is applied.

### Microbial Population

The microbial population was studied after harvest of rice crop during *kharif* season and presented in Table 2. The result revealed that bacterial population was highest followed by fungi and actinomycetes in all the treatments. It was observed that the treatment receiving 100% NPK with FYM (T<sub>4</sub>) gave the highest value of  $12.77 \times 10^7$  (CFU/g) number of bacterial population and  $7.23 \times 10^5$  (CFU/g) number of fungi. The actinomycetes population was highest  $3.03 \times 10^5$

**Table 2.** Effect of treatments on microbial population (CFU/g) (Average of 4 replication).

Treat-ments	Treat-ment details	Bacterial	Fungi	Actino-mycetes
T <sub>1</sub>	Control	$5.78 \times 10^7$	$46. \times 10^5$	$1.1 \times 10^5$
T <sub>2</sub>	50% NPK	$5.13 \times 10^7$	$6.6 \times 10^5$	$1.7 \times 10^5$
T <sub>3</sub>	100% NPK	$6.20 \times 10^7$	$7.15 \times 10^5$	$1.42 \times 10^5$
T <sub>4</sub>	100% NPK+FYM	$12.77 \times 10^7$	$7.23 \times 10^5$	$3.03 \times 10^5$
T <sub>5</sub>	100% NPK+ FYM + Lime	$10.70 \times 10^7$	$5.9 \times 10^5$	$2.6 \times 10^5$
T <sub>6</sub>	100% NPK+Lime	$8.75 \times 10^7$	$5.1 \times 10^5$	$0.6 \times 10^5$

in FYM along with 100% NPK treated plot. The microbial population was lower in the control plot where no nutrient was applied. Similar findings were also observed by Fraster et al. (5) and Chadrayan et al. (6). When readily available source of energy were provided along with organic nutrients, the microbial population increased. The lowest microbial population was observed in control plot (T<sub>1</sub>) where no inorganic fertilizer was applied. Growing rice crop without any nutrient leads lower carbon content which indirectly affects the microbial population. On other hand as the higher doses of inorganic fertilizer applied in other plots the microbial population was significantly increased than that of the control plot as per the finding of Suresh et al. (12).

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