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EFFECT OF ORGANIC MANURES ON SOIL PROPERTIES AND YIELD OF FINGER MILLET *(ELEUSINE CORACANA) GAERTN*

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ABSTRACT

Pot experiment was conducted during 1993 on ragi grown on a sandy clay loam soil to know the periodic changes in 0-15 cm soil depth on pH, organic carbon (O.C.), available N, P and K due to application of organic manure in conjunction with fertilizer. Application of organic manures alone or in combination with fertilizer increased the soil pH, organic carbon (O.C.), available N, P and K and grain yield when compared to NPK alone. The addition of FYM compared to green leaf manure and vermicompost increased soil pH significantly. The organic carbon (O.C.) content of GLM treated soil was significantly superior to VC treatment but was at par with FYM treatment at all the stages of plant growth. At all the stages organic manures in combination with fertilizer were superior in influencing available N, P and K compared to NPK (fertilizers) alone. There was no significant difference in the grain yield due to application of organic manures individually or in combination with fertilizers compared to NPK but maximum yield was noticed on adding 50% fertilizer N as GLM + 50% N + P + K.

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Introduction

Organic matter is an indispensable component of soil and plays an important role in the maintenance and improvement of soil fertility. Organic matter not only act as a source of plant nutrients and energy for soil micro organisms but also influence the availability of native nutrients. Results have revealed that a judicious combination of both organic and inorganic materials help in improving the soil fertility and in maintaining sustained levels of productivity compared to use of fertilizers alone. This study was undertaken to know the periodic changes in soil reaction, organic carbon, available N, P and K of the soil in 0-15 cm soil depth due to the application of different sources of organic manures.

Materials and Methods

A green house experiment was conducted on sandy clay loam soil of Gandhi Krishi Vignana Kendra, Bangalore during *Kharif* season of 1993 using Indaf-8 variety of duration 110 days finger millet *(Eleusine coracana* G.) as a test crop. The recommended dose of N, P_2O_5 and K_2O is 50 kg, 50 kg and 25 kg/ha, respectively and supplied through urea plus organic manures, single superphosphate and muriate of potash. Physico-chemical properties of the soil were pH (1:2:5) 5.4, organic carbon 0.3 per cent, alkaline $KMnO_4$-N 228 kg ha^{-1}. Brays extractable P_2O_5 57kg ha^{-1} and NH_4OAC extractable K_2O 125 kg ha^{-1}.

The surface soil samples (0-15 cm) were calculated from all the treatments tillering, flowering and harvest stages. The soil samples were dried in shade, ground and sieved (<2mm) for analysis. The pH of soil was determined in 1:2:5 soil water suspension (Jackson, 1973), organic carbon was analysed by Walkley and Black's wet digestion method, available N by alkaline $KMnO_4$ method (Subbaiah and Asija, 1965), available phosphorus was extracted with Brays-1 reagent and estimated calorimetrically (Jackson, 1973) and available potassium in the soil was extracted with neutral normal ammonium acetate solution estimated by flame photometer (Jackson, 1973).

Results and Discussion

At all the stages of crop growth higher pH was observed in soils treated with organic sources alone (Table II) when compared to NPK. Among the organic sources, maximum pH was observed with the addition of FYM (6.06, 6.08 and 5.84 at tillering, flowering and harvest stage respectively). However, when organics

Table - I. Chemical composition of organic manures (on oven dry weight basis)

Organic manures	Chemical composition		
	N	P	K
	---------- Per cent ----------		
FYM	1.16	0.62	1.54
GLM	1.83	0.21	2.52
Vermicompost	0.64	0.36	1.00

were combined with fertilizers the pH decreased. Least pH was observed in soil that received NPK (5.41, 5.24 and 5.18 at tillering, flowering and harvesting respectively). Among organic manures alone, FYM recorded maximum pH at all the stages of crop growth compared to GLM and VC probably due to complexing of exchangeable and free Al-ions by aliphatic and aromatic hydroxy acids produced during decomposition (Grewal *et al., 1981*).

The organic sources were superior at all the stages in raising the organic carbon content of the soil compared to NPK (Table II). GLM treatment recorded maximum organic carbon content (0.54, 0.43 and 0.38 per cent at tillering, flowering and harvest respectively). Organic carbon was reduced due to combined application of organic manures and fertilizers compared to manures alone. Lowest organic carbon content was observed in the soil which received NPK. The organic carbon content of the soil show a decreasing trend with different stages of crop growth at all the stages. Significant increase in organic carbon due to application of GLM compared to VC and FYM may be attributed to excessive microbial activity in the soil and fast decomposition in case of GLM (Patil and Kulkarni, 1992).

The available N content (Table III) in the soil decreased with the advancement of crop growth at all the stages of organic manures combined with fertilizers were superior in influencing available N compared to NPK. At tillering stage 50% N GLM + 50% NF + P + K recorded maximum available N (268.48 kg/ha) whereas maximum available N at floering and harvest was observed with application of GLM + P + K (224.63 and 182.93 kg ha^{-1} respectively). This was due to higher rate of decomposition and mineralization of GLM, which immediately released more of nitrogen to the soil nitrogen pool when compared to FYM and VC. Similar findings were also reported by Murthy *et al.* (1990).

The application of organic manures alone or in combination with fertilizers increased the available P content (Table III) of the soil upto flowering stage. Organics with fertilizers recorded maximum available N at all the stages of crop growth. Among the treatments, FYM +P + K recorded maximum available P content (82.34 and

Table - II. Effect of different sources of organic manures with and without fertilizers on soil reaction and organic carbon content of the soil at different crop growth stages

Treatment	Soil reaction (pH)			Organic carbon (%)		
	Tillering stage	Flowering stage	At harvest	Tillering stage	Flowering stage	At harvest
T_1 : FYM	6.06	6.08	5.84	0.49	0.40	0.34
T_2 : GLM	5.65	5.65	5.50	0.54	0.43	0.38
T_3 : VC	5.75	5.80	5.70	0.48	0.37	0.33
T_4 : FYM+P+K	5.85	5.90	5.83	0.48	0.37	0.34
T_5 : GLM+P+K	5.57	5.51	5.46	0.51	0.41	0.36
T_6 : VC+P+K	5.70	5.74	5.64	0.45	0.36	0.32
T_7 : 50%N FYM+50%NF+P+K	5.57	5.61	5.54	0.36	0.32	0.29
T_8 : 50% N GLM+50%NF+P+K	5.43	5.40	5.31	0.40	0.34	0.31
T_9 : N VC+50%NF+P+K	5.50	5.54	5.44	0.34	0.31	0.29
T_{10} : NPK	5.41	5.24	5.18	0.29	0.27	0.25
S.Em±	0.0390	0.0358	0.0452	0.0140	0.0129	0.0133
C.D. at 5%	0.116	0.1060	0.0410	0.0410	0.0400	0.0400

*Significant at 5% level

Table - III. Effect of different sources of organic manures with and without fertilizers on available nitrogen, phosphorus and potassium content of the soil at different stages of crop growth and grain yield.

Treatment	Available nitrogen (Kg ha^{-1})			Available phosphorus (Kg ha^{-1})			Available potassium (Kg ha^{-1})			Grain yield (g/pot)
	Tillering stage	Flowering stage	At harvest	Tillering stage	Flowering stage	At harvest	Tillering stage	Flowering stage	At harvest	
T_1 : FYM	251.16	186.12	167.25	70.43	83.15	72.10	149.85	129.96	116.84	3.67
T_2 : GLM	263.70	198.95	174.93	64.38	74.26	68.46	155.73	133.66	94.82	4.01
T_3 : VC	260.79	189.32	167.25	60.01	68.46	60.60	138.80	124.13	109.22	3.45
T_4 : FYM+P+K	258.43	218.21	151.57	82.34	94.12	78.46	167.20	140.80	145.60	4.17
T_5 : GLM+P+K	267.21	224.63	182.93	79.60	85.68	74.95	184.24	152.00	137.16	4.32
T_6 : VC+P+K	264.36	192.54	135.90	80.20	86.64	75.87	150.58	147.20	144.12	4.06
T_7: 50%N FYM+50%NF+P+K	267.46	215.00	158.47	82.10	89.81	81.05	151.58	94.13	108.32	4.62
T_8 : 50% N GLM+50% NF +P+K	268.48	215.00	167.25	75.04	87.00	79.87	168.47	118.30	75.35	5.16
T_9 : N VC+50%NF+P+K	260.65	198.95	139.60	75.04	84.80	80.76	145.16	83.20	82.00	4.41
T_{10} : NPK	236.60	221.23	130.60	76.36	81.46	67.28	137.73	75.20	60.11	5.07
S.Em±	2.8452	7.0725	5.7819	1.8881	1.8207	2.0602	3.2273	4.6211	4.3051	0.144
C.D. at 5%	8.4540	21.0140	17.1789	5.6100	5.4100	6.1210	9.5890	13.7300	12.7910	0.427

*Significant at 5% level

94.12 kg ha^{-1} at tillering and flowering stages respectively). However, 50% N FYM + 50% NF + P + K recorded maximum available P (81.05 kg ha^{-1}) at harvest. Lowest available P content was noticed in the soil that received VC only. Increase in the P content in the initial stage was attributed to P release from the added organic matter upon decomposition to the soil. However, FYM was significantly superior compared to GLM and VC treatments due to higher content of P (0.62%) in FYM when compared to GLM (0.21%) and VC (0.36%). Similar observation were made by Debnath and Hajra (1972).

At all the stages of crop growth organic sources were superior in content of available K (Table III) in the soil than NPK alone. Maximum available K content was observed due to addition of GLM + P + K at tillering (152 kg/ha) stage. Whereas, FYM + P + K recorded maximum available K content (145.60 kg/ha) at harvest. At tillering stage, significant increase in the available K content of the soil due to addition of organic manures was attributed to release of potassium in large amounts at the beginning of decomposition and later stages decrease in available K content of soil was observed due to uptake by the crop.

The significant increase in the grain yield (Table III) of ragi was observed due to addition of 50% N GLM + 50% NF + P + K compared to NPK with a maximum grain yield of 5.16 g per pot which can be attributed to favorable physical and chemical properties which determines the productivity and fertility of the soil and also because of higher uptake of nutrients by grain due to that treatment (Subbareddy *et al.*, 1993). Among the organic sources, GLM recorded maximum grain yield of organic manures and fertilizers increased the grain yield of ragi compared to manures alone. Addition of VC recorded minimum (3.45 g/pot) grain yield of ragi. However, grain yield due to VC treatment may be due to lower availability of nutrients and lower uptake by grain. Difference among the GLM, FYM and VC treatments can be attributed to differences in nutrient availability and nutrient uptake in these treatments.

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