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Effect of Different Organic Nutrient Sources on Soil Properties

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ABSTRACT

A field experiment was conducted in *kharif*, 2011 to evaluate the effect of organic and inorganic nutrient sources on soil nutrient status with okra as test crop on medium textured soil. The experiment was laid out in RBD with treatments including organic fertilisers namely Aishwarya and New Suryamin; and organic manures namely EM compost and Urban compost. The treatments consisted of T_1 (control), T_2 (Inorganic NPK 120-60-60), T_3 (New Suryamin @ 50 kg ha^{-1}), T_4 (New Suryamin @ 25 kg ha^{-1} + 50% RDF), T_5 (Aishwarya @ 120 kg ha^{-1}), T_6 (Aishwarya @ 60 kg ha^{-1} + 50% RDF), T_7 (EM compost @ 5 t ha^{-1}), T_8 (EM compost @ 2.5 t ha^{-1} + 50% RDF), T_9 (Urban Compost @ 5 t ha^{-1}) and T_{10} (Urban Compost @ 2.5 t ha^{-1} + 50% RDF). Nutrient status at 30 and 90 DAS was high in the treatments with organic and inorganic combinations, with values of highest N recorded in T_{10} (Urban compost + Inorganic NPK) and highest P and K in T_6 (Aishwarya + Inorganic NPK). Soil organic carbon was recorded highest by Urban compost (T_9) with 1.63 and 1.21% at 30 and 90 DAS, respectively and as a consequence microbial load was also high. The study infers that urban compost could be utilized as organic nutrient source in cultivation of vegetable crops, particularly as a component of integrated nutrient management.

Key words : Bacterial populations, Organic fertilisers, Soil nutrient status, Urban compost.

Environmental issues are capturing more and more of the world's attention, researchers and scientists are aiming at improving environmental quality through the adoption of techniques and measures that have a reduced impact on the environment. Pollution is becoming a serious problem in agricultural regions. For example, various mineral fertilizers and agrochemicals lead to pollution and serious health problems in humans, hence alternative production techniques which employ biological or organic compounds for nutrient supply and pest control are needed (Turemis, 2002). Organic farming is not new to Indian farming community. Several forms of organic farming are being successfully practiced in diverse climate, particularly in rainfed, tribal, mountains, hill and resource poor areas of the country. Among all farming systems, organic farming is gaining wide attention among farmers, entrepreneurs, policy makers and agricultural scientists for varied reasons such as minimizing the dependence on chemical inputs (fertilizers; pesticides; herbicides and other agro chemicals). Thus it safeguards/improves quality of resources and environment; it is labour intensive and provides an opportunity to increase rural employment and achieve long term improvements in the quality of resource base. Organic materials such as compost, animal manures, and municipal wastes when used as primary sources of plant nutrients, or part of a management system often referred as organic farming. The food produced through such farming is commonly termed as organic food and is relatively free from toxic residues.

MATERIAL AND METHODS

A field experiment was conducted in the College Farm, College of Agriculture, Rajendranagar, during *kharif,* 2011 on a neutral sandy clay soil with EC of 0.17 dS m^{-1} and medium fertility status. The experiment was laid out in randomized block design with three replications. The treatments consisted of T_1 (control), T_2 (Inorganic NPK 120-60-60), T_3 (New Suryamin @ 50 kg ha^{-1}), T_4 (New Suryamin @ 25 kg ha^{-1} + 50% RDF), T_5 (Aishwarya @ 120 kg ha^{-1}), T_6 (Aishwarya @ 60 kg ha^{-1} + 50% RDF), T_7 (EM compost @ 5 t ha^{-1}), T_8 (EM compost @ 2.5 t ha^{1} + 50% RDF), T_9 (Urban Compost @ 5 t ha^{-1}) and T_{10} (Urban Compost @ 2.5 t ha^{-1} + 50% RDF). Inorganic N, P and K were supplied through urea, single super phosphate and muriate of potash, respectively. Organic and inorganic nutrient sources were applied as per the treatments before sowing of okra. The nutrient composition of the different organic nutrient sources used in this study was analyzed as per the standard procedures and are presented in Table 1. Soil samples collected at vegetative phase (30 DAS) and at fruiting stage (90 DAS) were analyzed for pH, EC, soil organic carbon, available N, P and K as per the procedures outlined by Tandon (1995). The microbial load (Clarke, 1965) was recorded at both the stages of crop on fresh soil samples. The results were subjected to statistical analysis as per the procedures outlined by Snedecor and Cochran (1973).

RESULTS AND DISCUSSION:

Data on soil physico-chemical and chemical properties are presented in table 2.

Soil pH:

During the crop growth period, different treatments showed nonsignificant variation in pH, with values ranging from 7.2 (T_2 – Inorganic NPK) to 7.8 (T_9 – Urban compost) at 30 DAS and from 7.1 (T_2 – Inorganic NPK) to 7.7 (control) at 90 DAS.

Electrical conductivity (EC):

EC of soil samples at vegetative stage (30 DAS) varied from 0.11 to 0.34 dS m^{-1}. The highest EC was observed in the treatment T_2 (Inorganic NPK), followed by T_8 (EM compost + Inorganic NPK) with 0.30 dS m^{-1}. The lowest EC (0.11 dS m^{-1}) was found in T_1 (control) as well as in T_5 (Aishwarya) and T_7 (EM compost). The effect of different treatments on EC was statistically significant at 30 DAS and was nonsignificant at 90DAS. EC was high whenever inorganic sources were applied.

Available N:

Data on soil available N was affected significantly by different sources of its supply. At both the stages of crop growth period soil available N was recorded higher by 50% organic + 50% inorganic recommended dose combination compared to either double the dose of respective organic source alone or recommended dose of inorganic sources alone. Similar observations were made by Mallik *et al.* (2000) in their experiment with sewage sludge.

Available P:

The highest soil available phosphorous was recorded by T_6 where Aishwarya + Inorganic NPK were applied at both 30 DAS (114.24 kg ha^{-1}) and 90 DAS (124.9 kg ha^{-1}). The treatments applied with both organic and inorganic nutrient sources (50% of the recommended dose) recorded more available P than the treatment with recommended dose of inorganic NPK (T_2) significantly. Soil available phosphorous was higher by 68.31 per cent in T_5 (Aishwarya) and by 5 per cent in T_3 (New suryamin) when compared to application of

Table 1. Salient characteristics of organic nutrient sources.

S.No.	Characteristics	New Suryamin	Aishwarya	EM compost	Urban compost
I.	**Physico-chemical properties**				
	a) pH	6.6	6.6	5.7	7.4
	b) EC (dS m^{-1})	1.21	6.3	1.71	0.56
II.	**Chemical properties**				
	a) Total Organic carbon (%)	3.59	26.4	15.8	23.46
	b) Nitrogen (% N)	1.27	0.672	0.756	0.868
	c) Phosphorus (% P)	1.08	1.20	1.19	1.20
	d) Potassium (% K)	0.57	1.22	0.24	0.45

Table 2. Effect of different organic nutrient sources on soil physico-chemical properties and soil nutrient status

Treatments	At 30 DAS					At 90 DAS				
	pH	EC ($dS\ m^{-1}$)	Soil nutrient status ($kg\ ha^{-1}$)			pH	EC ($dS\ m^{-1}$)	Soil nutrient status ($kg\ ha^{-1}$)		
			N	P	K_2O			N	P	K_2O
T_1 Soil alone	7.7	0.11	177	55.2	236	7.7	0.13	188	59.3	266
T_2 Inorganic NPK	7.2	0.34	181	56.7	278	7.1	0.23	189	61.2	311
T_3 New Suryamin	7.7	0.12	185	59.7	340	7.4	0.21	196	64.2	363
T_4 New Suryamin + Inorganic NPK	7.6	0.20	186	73.9	372	7.4	0.16	206	86.6	387
T_5 Aishwarya	7.7	0.11	183	81.8	317	7.7	0.21	191	103.0	350
T_6 Aishwarya + Inorganic NPK	7.6	0.24	191	114.2	415	7.6	0.20	203	124.9	437
T_7 EM Compost	7.7	0.11	182	67.2	300	7.5	0.18	190	66.4	346
T_8 EM Compost + Inorganic NPK	7.7	0.30	189	74.6	352	7.4	0.31	202	88.1	384
T_9 Urban Compost	7.8	0.12	183	71.6	298	7.6	0.14	192	75.4	323
T_{10} Urban Compost + Inorganic NPK	7.6	0.27	204	108.2	366	7.2	0.20	211	114.3	379
CD (5%)	N.S.	0.05	11.7	8.38	83.3	N.S.	N.S.	13.1	20.4	39.9

inorganic NPK. Among organic nutrient sources, besides the P content, the clay content and water retention of Aishwarya also might have been the cause for highest soil available phosphorus. Addition of organic manure increased soil moisture contents (Boateng *et al*., 2006), which might be the reason of improved P availability in soil.

Available K_2O:

The highest available K was recorded by T_6 (Aishwarya + Inorganic NPK) as in case of phosphorus throughout the crop growth period. All the treatments recorded significantly higher content of available K_2O when compared to T_1 (control). Broadly, at both the stages of crop growth higher values were recorded in organic and inorganic (50% recommended dose) combinations compared to sole application of recommended dose of inorganics or organics. The available K_2O content was increased by 23.99, 38.50, 17.24 and 22.06 per cent at 30 DAS and by 12.5, 40.4, 23.5and 21.7 per cent at 90 DAS over T_2 (Inorganic NPK) with T_4 (New Suryamin + Inorganic NPK), T_6 (Aishwarya + Inorganic NPK), T_8 (EM compost + Inorganic NPK) and T_{10} (Urban compost + Inorganic NPK), respectively.

Soil organic carbon (SOC):

The soil organic carbon contents at 30 and 90 DAS are presented in Table 3. At vegetative stage (30 DAS), the highest OC (1.63%) was recorded by T_9 (Urban compost) and the lowest (0.90%) by T_1 (control). The treatments with organics alone as in T_3 (New suryamin), T_5 (Aishwarya), T_7 (EM compost) and T_9 (urban compost) recorded 29%, 39%, 42% and 48% over the treatment with inorganic NPK alone (T_2). At fruiting stage (90 DAS), soil organic carbon varied from 0.85 and 1.21 per cent. The highest organic carbon content (1.21%) was recorded by T_9 (Urban compost) and the treatment T_2 (Inorganic NPK) recorded 0.94%. The treatments with organics alone in T_3 (New Suryamin), T_5 (Aishwarya), T_7 (EM compost) and T_9 (Urban compost) recorded 5.3, 23.4, 21.2 and 28.7 per cent, respectively more soil organic carbon content than T_2 (Inorganic NPK). Poornesh *et al*. (2004) also reported increased organic carbon in soil by the application of urban garbage compost.

Table. 3. Effect of organic nutrient sources on soil organic carbon and microbial load.

Treatments	At 30 DAS		At 90 DAS	
	SOC(%)	Bacterial load (x 10^9 CFU g^{-1})	SOC(%)	Bacterial load (x 10^9 CFU g^{-1})
T_1 Soil alone	0.90	3.66	0.85	4.33
T_2 Inorganic NPK	1.10	25.00	0.94	23.33
T_3 New Suryamin	1.42	31.66	0.99	36.33
T_4 New Suryamin + Inorganic NPK	1.25	28.33	0.94	35.66
T_5 Aishwarya	1.53	40.00	1.16	44.00
T_6 Aishwarya + Inorganic NPK	1.50	24.33	1.08	28.00
T_7 EM Compost	1.56	52.33	1.14	44.66
T_8 EM Compost + Inorganic NPK	1.37	28.00	1.12	36.33
T_9 Urban Compost	1.63	58.66	1.21	45.66
T_{10} Urban Compost + Inorganic NPK	1.58	36.00	1.10	36.00
CD (5%)	0.36	5.72	0.15	5.72

Microbial load:

The data pertaining to microbial load *i.e.,* bacterial at 30 and 90 DAS are presented in Table 3. During the vegetative stage (30 DAS) the colonies ranged between 3.6 x 10^9 CFU g^{-1} (T_1 - control) and 58.6 x 10^9 CFU g^{-1} (T_9 - Urban compost). The treatment with inorganic sources alone in T_2 recorded 25 x 10^9 CFU g^{-1}. The results showed that treatments with organics alone has more bacterial load when compared with that of treatments with combined use of both organics and inorganic sources. There was an increase in bacterial load by 11.75 per cent in T_3 (New Suryamin) over T_4 (New Suryamin + Inorganic NPK), 64.4 per cent in T_5 (Aishwarya) over T_6 (Aishwarya + Inorganic NPK), 86.9 per cent in T_7 (EM compost) over T_8 (EM compost + Inorganic NPK) and 74.2 per cent in T_9 (Urban compost) over T_{10} (Urban compost + Inorganic NPK). Inorganic NPK whether alone or in combination with organics recorded significantly lower bacterial load when compared with application of organic sources alone. There was a significant increase in the bacterial load in all the treatments over T_1 (control). At 90 DAS, the highest number of colonies was found in the treatment T_9 (Urban compost) and the lowest number of colonies were found in T_1 (control) with 4.3 x 10^9 CFU g^{-1}. The treatment with inorganic sources alone in T_2 recorded 23.3 x 10^9 CFU g^{-1}. Organic sources alone recorded significantly higher values when compared to their combination with inorganic NPK with an exception of New Suryamin. There was an increase in bacterial load by 59.4 per cent in T_5 (Aishwarya) over T_6 (Aishwarya + Inorganic NPK), 22.9 per cent in T_7 (EM compost) over T_8 (EM compost + Inorganic NPK) and 26.8 per cent in T_9 (Urban compost) over T_{10} (Urban compost + Inorganic NPK). All the treatments recorded significantly higher values over the treatment T_1 (control). During the initial crop growth period inorganics recorded CFU's of bacterial load on par whether applied alone or in combination with organics whereas at 90 DAS bacterial load was significantly higher when they were applied in combination with organic sources compared to inorganic NPK indicating the beneficial effect of organics till the fruiting stage. alone. Sastre *et al.* (1996) found that the sewage sludge amendment increased the soil microbial activity and CO_2 production.

Soil organic carbon was highest when treated with organic composts especially with the urban compost alone in T_9. The microbial load recorded was highest in T_9 followed by the treatment with EM compost. This study infers that the soil nutrient status, organic carbon and microbial load were better when combination of both organic and inorganic nutrient sources were used rather than organics alone. Use of the urban compost prepared from urban solid waste and EM compost prepared from industrial sludge in combination with 50% of recommended dose of inorganics could help in meeting a part of the fertilizer requirements and could be utilized in vegetable production as a part of integrated nutrient management.

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