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PHOSPHORUS AND IRON ENRICHED COMPOST FOR SUSTAINABLE SOIL, FERTILITY AND ENHANCED SUGARCANE PRODUCTION

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Abstract

In general, compost improves soil health and crop yields through the supply of organic matter, macro and micronutrients. Since, the organic manures alone is not sufficient to boost the cane yield to the peak the commercial fertilizers are in extensive use. Now a days due to non-availability of sufficient organic manure and hectic hike in cost of commercial fertilizers, the integrated approach is most prevalent, which are supplementary and complementary to each other. At this juncture, field investigation was carried out to study the efficacy of P, Fe (0, 50, 75 and 100% of the recommendation) enriched compost on sugarcane. The results envisaged that, though the 100% P, Fe enriched compost *viz.,* sugarcane compost with sewage sludge (3:1) @ 750 kg ha^{-1} registered the highest cane yield, (35.2% over control) besides the highest post harvest soil available P, Fe, however it could hot outfit the benefits derived at 75% enrichment level. Hence 25% of costly inorganic P, Fe inputs can safely be reduced without any economic yield loss if the above nutrients are supplied as enriched compost.

Keywords: Enriched compost, sugarcane compost, sewage sludge, supplementary and complimentary use

Introduction

Among the plant nutrients required for sugarcane, phosphorus and iron have gained considerable recognition under Indian situation. In India, more than 42% (Dey *et al.,* 2002) and 11.2 % (Gupta, 2005) of soils have been reported to be P and Fe deficient to alleviate the deficiency of these nutrients, both organic and inorganic sources of nutrients are being employed continuously. Super phosphate and ferrous sulphate are the most common using fertilizers to correct this deficiency. The major problem observed here is the poor crop recovery; their high degree of water solubility leading to fixation and with other inorganics to form sparingly soluble compounds, besides, their high cost warrants the development of improved and cost effective technologies to increase the efficiency of applied nutrients. The supplementary and complementary use of organics with inorganics will augment the efficiency of these substances. In addition, with the application of organics there will be saving of fertilizer.

Materials and Methods

A field investigation was carried out at Mamangalam village, Chidambaram taluk, Tamil Nadu to study the efficiency of P and Fe enriched compost on sugarcane. The experiment soil was sandy loam, belonging to *Typic Ustropepts* having the pH 7.8, organic carbon (OC) 4.52 g kg^{-1}, cation exchange capacity (CEC) 13.5 c mol p+ kg^{-1}, olsen-P 14.9 kg ha^{1} and DTPA - Fe 2.69 mg kg^{-1}. The treatments consisted of three types of organics *viz.,* no organics, sugarcane waste compost and sugarcane waste compost + sewage sludge (3:1) enriched with four levels of each P, Fe as well as their combinations (0, 50,75 and 100% of recommendation) in a Factorial Randomized Block Design with two replications. The enrichment of organics with P and Fe as per treatment combination was carried out under laboratory conditions for a period of one month by allowing sufficient moisture so that the chelation reaction will take place. The Fe enriched manure were incorporated as basal as per treatment schedule @ 750 kg ha^{-1}. The sugarcane variety Co 86032 was planted as test crop. The other nutrients as well as the cultivation practices were followed as per schedule of recommendation. The crop was harvested at maturity. The yield data was recorded, the post harvest soil samples were collected, processed and analysed for their olsen-P and DTPA-Fe following standard procedures.

Results and Discussion

The levels of P, Fe as well as their combinations as an enriched organics of either sugarcane waste compost or sugarcane waste compost + sewage sludge (3:1) significantly increased the cane yield and sugar yield (Table 1). For every increased addition of P, Fe as well as their combinations as enriched manure, there observed a corresponding increase but this increase was significant only upto 75% of recommended P, Fe beyond which the increase observed was non significant. The highest cane and sugar yield of 119.0 and 15.111 ha^{-1} respectively was associated with 100% of P and Fe as enriched sugarcane waste compost + sewage sludge (3:1) @ 750 kg ha^{-1} along with recommended N and K (M_2S_{16}). However, either the cane or the sugar yield could not excel the yield obtained at 75% of P, Fe enriched compost (M_2S_{12}) (either sugarcane waste compost (M_1) or sugarcane waste compost + sewage sludge (M_2) incorporated @ 750 kg ha^{-1} in conjunction with recommended N and K. This particular combination of 75% level remarkably increased the cane yield to the tune of 31.3% the corresponding increase at 100% level was 36.9% over P and Fe control (M_0S_1).

The higher yield response of sugarcane due to P, Fe enriched compost incorporation could be attributed to the better availability and subsequent crop uptake of plant nutrients by the solubilization effect of organic acids liberated upon mineralisation of enriched compost and the retension of more plant nutrients by the phenomenon of chelation for a longer periods might have resulted in better absorption leading to enhanced cane yield (Satisha, 2000).

The results of post harvest soil available P and Fe showed that it ranged between 15.9 kg ha^{-1} under no manure (M_0) and 17.8 kg ha^{-1} under enriched sugarcane waste compost + sewage sludge (3:1) (M_2) and 2.47 mg kg^{-1} (S_1) and 3.89 mg kg^{-1} (S_4) respectively. For every incremental addition of either P or Fe there was a progressive and significant increase in P or Fe status of soil respectively either Fe at graded levels (S_1, S_2, S_3 and S_4) or P at graded levels (S_1, S_5, S_9 and S_{13}) did not affect P or Fe availability as the case may be, though a mild reduction in their availability was noticed due to antagonism however it was nullified when supplied both P and Fe as enriched compost. The enhanced P, Fe availability due to the addition of enriched manure could be attributed to their solubility effect of native nutrients and consequent contribution to the labile pool (Durairaj, 1978); the release of organic acids during mineralization helps in the formation of stable complexes or by chelating the cations responsible for fixation leading to enhanced availability (Gangwar *et al.,* 2003). The humic substances also enhance the Fe availability by preventing their transformation as insoluble hydroxides (Stumm and Morgan, 1970).

The results of the present investigation suggest that the possibility of utilizing the sugarcane waste compost and sewage sludge as P, Fe enriched manures.

Table 1 : Effect of enriched compost on cane, sugar yield and post harvest nutrient status

Manures levels	**Cane yield ($t\ ha^{-1}$)**			**Sugar yield ($kg\ ha^{-1}$)**			**Olsen-P ($kg\ ha^{-1}$)**			**DTPA-Fe ($mg\ kg^{-1}$)**		
	M	**M_1**	**M_2**	**M**	**M_1**	**M_2**	**M**	**M_1**	**M_2**	**M**	**M_1**	**M_2**
S_1	83.9	86.4	85.2	9.56	9.91	9.75	14.5	15.1	15.3	2.38	2.51	2.51
S_2	88.2	92.1	91.3	9.97	10.97	10.86	14.7	16.1	16.3	2.42	3.42	3.44
S_3	95.4	100.3	100.0	10.81	11.96	11.92	14.4	16.2	16.6	2.95	3.87	3.88
S_4	99.1	103.4	104.2	11.32	12.39	12.49	14.5	16.4	16.4	3.35	4.09	4.22
S_5	91.2	95.2	94.1	10.40	11.42	11.32	15.7	17.3	17.5	2.50	2.68	2.72
S_6	96.2	100.2	99.5	11.36	12.44	12.36	15.1	17.2	17.4	2.61	2.93	2.94
S_7	100.2	104.5	105.8	11.84	13.07	13.23	15.0	17.1	17.3	2.68	3.04	3.06
S_8	101.9	106.5	107.2	12.49	13.88	13.31	15.1	17.3	17.3	2.71	3.26	3.28
S_9	96.2	100.3	102.1	11.06	12.25	12.47	17.5	19.1	19.3	2.40	2.95	2.95
S_{10}	101.0	105.6	106.0	11.70	13.53	13.06	16.4	18.4	18.5	2.78	3.45	3.46
S_{11}	105.3	114.8	115.5	12.31	14.20	14.25	16.2	18.0	18.0	2.88	3.61	3.64
S_{12}	109.1	116.6	115.1	13.07	14.34	14.41	16.0	18.3	17.8	2.87	3.61	3.68
S_{13}	100.7	104.2	104.6	11.70	12.83	12.88	19.4	21.2	21.0	2.31	2.83	2.82
S_{14}	101.6	107.7	108.4	12.43	13.93	14.03	17.7	19.5	19.2	2.49	3.35	3.36
S_{15}	108.2	117.8	117.3	12.96	14.65	14.80	17.7	19.3	19.3	2.52	3.41	3.42
S_{16}	112.2	118.8	119.0	13.48	15.08	15.11	17.5	19.4	19.5	2.65	3.52	3.48
M	S.Ed.	C.D ($p=0.05$)		S.Ed.	C.D ($p=0.05$)		S.Ed.	C.D ($p=0.05$)		S.Ed.	C.D ($p=0.05$)	
S	1.1	2.2		0.200	0.39		0.36	0.7		0.066	0.13	
M×S	2.5	5.1		0.401	0.84		0.84	1.6		0.154	0.31	
	5.2	NS		0.884	NS		1.45	NS		0.267	NS	

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