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EFFECT OF COIR DUST BLENDED FERTILIZERS ON CARBON AND NITROGEN CHANGES IN A COASTAL SANDY SOIL

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ABSTRACT

The effect of blending coconut coir dust with fertilizers on the changes in carbon and nitrogen fractions in a coastal sandy soil of Kerala was evaluated under laboratory conditions. The results indicated that the available nitrogen decreased progressively with time of incubation in all the treatments. The organic carbon content showed a similar trend as that of available nitrogen. The ethanol benzene extractable carbon has decreased whereas acid extractable carbon increased after eight months of incubation. It appears that the application of N P K fertilizer generally favours the accumulation of humic acid in the soil. There was no marked changes in the ammonical nitrogen during the period of incubation. The N P K treatment increased the nitrate nitrogen content of the soil whereas with N P K + coir dust treatment the increase was marginal suggesting nitrification inhibition property of coir dust.

INTRODUCTION

Coir dust a by-product of coconut based coir industry could be profitably used as an amendment in the management of coastal sandy soils for establishing coconut seedlings (Nambiar et al., 1983). The coir-dust blended fertilizer is known to improve the soil physical environment resulting in improved growth and vigour of coconut seedlings (Joshi, Nambiar and Hameed Khan, 1982). Joshi et al, 1985 (unpublished data, Central Plantation Crops Research Institute) reported slowing down the rate of urea nitrogen mineralisation when coir dust was blended with urea. The coir dust contains 25–30 per cent lignin, 33 per cent cellulose (Pillai and Warrier, 1952; Prabhu, 1958). The low amount of nitrogen (Joshi et al., 1982) which result in high C/N ratio makes the material refractory. The high phenol content may have greater influence on the mineralisation of soil as well as added fertilizer nitrogen. In the present study an attempt has been made to judge the effect of blending coir dust with fertilizers on the changes in carbon and nitrogen fractions on the coastal sandy soils of Kerala.

MATERIALS AND METHODS

A coastal sandy soil (Quartzipsaments) cotaining 0.08 per cent organic carbon, 92 kg/ha mineralisable nitrogen, 22 kg/ha available phosphorus, 99 kg/ha available potassium was used for study. The soil was acidic (pH 6.6) and mechanically analysed to contain 98.2 per cent sand, O. 2 per cent silt and 0.7 per cent clay. The retted coir dust which was used for the study tested 0.5 per cent N, 0.08 per cent P and 0.5 per cent K. The C : N ratio of the retted coir dust was found to be 1:28.

The incubation study which was undertaken in poly bags had three treatments *viz.*, soil+NPK; soil+coir dust and soil+coir dust+NPK. The coir dust was applied at the rate of 500 g/treatment and NPK was applied as 0.64 g N (ammonium sulphate), 0.42g P_2O_5 (superphosphate) and 1.56 g K_2O (muriate of potash) per treatment. (The rate of fertilizers were fixed as double the dose of normal recommended fertilizer to a coconut palm comprising of about 8000 kg of soil from a volume deduced by taking 1.8 m radius and 50 cm depth having the bulk density of soil 1.57). The treatments were replicated four times and the incubation study was continued for eight months at room temperature (27±1°C). The moisture was maintained at 50 per cent field capacity throughout the study. Sampling was done periodically: first three samples were collected at 15 days intervals and subsequent three samples at first, second and third month and analysed for organic carbon (Walkley and Black's method as described by Jackson, 1967), carbon fractions (Kononova and Kononova 1960), mineralisable N (Subbiah and Asija, 1965), ammonical N (Yuen and Pollard, 1952) and nitrate N (Sims and Jackson, 1971).

RESULTS AND DISCUSSION

The Table I depicts changes in the available nitrogen content as influenced by coir dust treatment. The data suggests that available nitrogen decreased progressively with time of incubation in all the three treatments, the maximum decrease being in the soil treated with coir dust alone. This is probably due to the immobilization of a fraction of available nitrogen as organically bound form and in the case of NPK treatment, the slight decrease may be due to microbial utilization. On the other hand when NPK was applied along with coir dust the available nitrogen increased from 198 to 219 ppm after 30 days and beyond which it decreased to values around 200 ppm.

The organic carbon content showed a similar trend as that of available nitrogen (Table II). The treatment NPK

Table I. *Available nitrogen (ppm) as influenced by coirdust application*

	Date of collection of samples						
Treatment	4.7.83	26.7.83	11.8.83	29.8.83	30.9.83	29.11.83	7.3.84
T_1 Sand+NPK	211.3	228.3	215.8	208.5	190.3	205.7	214
T_2 Sand+coirdust	60.3	51.8	49.0	38.5	35.5	43.3	32.6
T_3 Sand+coirdust+NPK	198.8	203.8	219.3	207.8	180.0	199.3	201.5

Table II. *Organic carbon (%) as influenced by coirdust application*

Treatment	Date of collection of samples						
	4.7.83	26.7.83	11.8.83	29.8.83	30.9.83	29.11.83	7.3.84
T_1 Sand+NPK	0.120	0.1675	0.1225	0.1260	0.0875	0.1025	0.099
T_2 Sand+Coirdust	0.5825	0.4925	0.5700	0.5875	0.5875	0.5195	0.410
T_3 Sand+Coirdust+NPK	0.5750	0.5657	0.5500	0.5500	0.5475	0.5412	0.446

alone influences a marginal decrease in organic carbon content of the soil beyond 75 days whereas in soils treated with coir dust and coir dust+NPK the decrease was moderate. This may be due to fast degradation of refractory organic compounds in the coir dust by the increased activity of microbes.

Table III shows the change in the fractions of organic carbon as influenced by coir dust application. The ethanol benzene extractable carbon has decreased to the extent of 81 to 96 ppm in different treatments whereas acid extractable carbon increased after eight months of incubation, the maximum increase was noticed in soil treated with coir dust+NPK followed by coir dust alone. The maximum acid extractable carbon (123 ppm) was obtained in the soil treated with coir dust+NPK. It appears that application of NPK, and coir dust+NPK generally favoured the accumulation of humic acid and decreased the fulvic acid content in the soil. However, when the soil was treated with coir dust alone the decrease was in the order of 87 and 112 ppm of fulvic acid and humic acid respectively.

The data on NH_4^+ –N revealed no marked change during the period of incubation (Table IV). However, in the treatment coir dust alone NH_4^+ –N was found to decrease from 7.8 to 3.2 ppm at the end of 225 days. This is probably due to immobilization of NH_4^+ –N by

Table III. *Carbon fractions (ppm) as influenced by coirdust application*

Treatment	Ethanol benzene extractable carbon (ppm)		Acid extractable carbon (%)		Fulvic acid carbon (ppm)		Humic acid carbon (ppm)	
	Date of collection of samples							
	4.7.83	4.4.84	4.7.83	4.4.84	4.7.83	4.4.84	4.7.83	4.4.84
T_1 Sand+NPK	250.50	168.75	31.50	93.75	95.25	69.75	81.00	135.75
T_2 Sand+coirdust	282.75	186.0	35.25	104.25	144.00	57.00	69.00	180.75
T_3 Sand+coirdust+NPK	285.00	189.75	42.75	123.00	137.25	111.00	56.25	156.00

Table IV. *Ammonical nitrogen (ppm) as influenced by coirdust application*

Treatment	Date of collection of samples						
	4.7.83	26.7.83	11.8.83	29.8.83	30.9.83	29.11.83	7.3.84
T_1 Sand+NPK	197	193.0	199.0	191.0	160.0	183.0	196.0
T_2 Sand+coirdust	7.800	6.15	5.38	3.33	3.1	5.1	3.2
T_3 Sand+coirdust+NPK	182.0	183.0	162.53	188.0	174.0	179.0	186

compounds of coir dust. In the NPK alone and coir dust + NPK treatments slight depression in NH_4^+ –N was noticed at 75 and 30 days of sampling respectively. NH_4^+ –N content increased to 209 ppm in NPK alone and 204 ppm in NPK + coirdust at the end of 225 days of incubation. The differences in NH_4^+ –N content in the soil treated with NPK and NPK + coir dust is equivalent to the amount of NH_4^+ –N immobilised by the coir dust.

In the case of No^-_3–N fraction (Table V) the NPK treatment increased the No^-_3–N from 0.57 to 4.2 ppm whereas in the NPK+coir dust treatment the increase was marginal. This clearly showed the nitrification inhibition property of coir dust.

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Table V. *Nitrate nitrogen (ppm) as influenced by coirdust application*

Treatment	Date of collection of amples						
	4.7.83	26.7.83	11.8.83	29.8.83	30.9.83	29.11.83	7.3.84
T_1 Sand+NPK	0.5707	0.8550	1.480	1.875	2.075	2.4875	4.20
T_2 Sand+coirdust	0.6218	0.1775	0.2125	0.150	0.3825	0.2200	0.35
T_3 Sand+coirdust+NPK	1.1025	1.2825	1.8150	1.7325	1.8125	0.9125	1.22

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