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Fixation of NH_4, P and K by a Red Soil Under Two levels of Moisture.

The fixation and release pattern of NH_4 and K are related in many ways to the physical and chemical characteristics of soil minerals and the environmental conditions of the soils. In the present study an attempt was made to investigate the fixation characteristics of three major nutrients by sandy clay loam. A red sandy clay loam soil (CEC 13.9 me/100 g. of soil) from Coimbatore belonging to Palathurai series was air dried, sieved through 2 mm sieve and 500 g. of soil was taken in wide mouthed glass jars. The treatments included three levels of N @ 0,100 and 200 ppm, three levels of P_2O_5 @ 0, 25 and 50 ppm and K_2O @ 0, 100 and 200 ppm as ammonium sulphate, super phosphate and muriate of potash respectively in all possible combinations at two moisture levels. One set was maintained at constant moisture level (about 30%) roughly corresponding to field capacity by weighing the jars containing the soil every day and adding distilled water to replenish the evaporation loss. The second set was subjected to alternate wetting and drying at room temperature roughly corresponding to the conditions existing in the field. The calculated quantities of the nutrients solutions and water were added to the soil in the jars and thoroughly mixed and left for equilibration. The first set of samples was drawn from each treatment 24 hours after the addition of nutrient solutions and thereafter at an interval of 30, 60 and 90 days. The soil samples were analysed for avilable N, P and K employing appropriate methods (Subbiah and Asija, 1956 ; Olsen, *et al* 1954, and Stanford and English, 1949). The amount of nutrients fixed in 24 hours, 30, 60 and 90 were statistically analysed and the data are presented in Table

The fixation of NH_4 was more under constant moisture level than under alternate wetting and drying conditions. This trend was maintained under all levels of N, P and K and under all the four stages of sampling. The constant moisture level (about 30 per cent) maintained for the present study probably increased the above characteristics of the clay minerals thus creating a condition for maximum fixation of NH_4 (Ramanthan *et al.* 1973). The fixation of NH_4 increased significantly with increase in concentration and incubation of the total amount of NH_4 fixed in three months, 17.63 per cent was fixed in 24 hours, 66.72 per cent in 30 days and 80.01 per cent in 60 days and a gradual flattening of the fixation was observed afterwards.

The increased fixation of NH_4 with increase in the concentration of K could be explained that, at neutral pH NH_4 was more efficient in replacing K resulting in increased fixation of NH_4

Regarding fixation of P an earlier observation (Ramanathan *et al.* 1973) that P fixation is not influenced by the two moisture conditions is confirmed

TABLE

I. NITROGEN :						
	Moisture I		Moisture II		S. E.	C. D.
Mean	61.05		53.67		0.3359	0.6585
	No	N1	N2		S. E.	C. D.
Mean	3.612	57.69	110.8		0.4116	0.8067
	K_0	K_1	K_2		S. E.	C. D.
Mean	53.07	57.86	61.15		0.4116	0.8067
	S1*	S2	S3	S4	S. E.	C. D.
Mean	14.96	56.61	72.98	84.86	0.4753	0.9317
II. PHOSPHORUS :						
	P0	P1	P2		S. E.	C. D.
Mean	0.9084	9.448	18.05		0.0453	0.0888
	S1	S2	S3	S4	S. E.	C. D.
Mean	7.836	8.865	10.22	10.93	0.0524	0.1027
III. POTASSIUM :						
	Moisture I		Moisture II		S. E.	C. D.
Mean	51.41		55.08		0.2882	0.5649
	K0	K1	K2		S. E.	C. D.
Mean	10.59	53.43	95.76		0.3532	0.6923
	S1	S2	S3	S4	S. E.	C. D.
Mean	20.13	53.01	63.66	76.21	0.4079	0.7997

* S1, S2, S3 and S4 represent the stages of sampling viz., 24 hours, 30 days, 60 days and 90 days of incubation.

for red soil also. There was significant increase in the P fixation with increase in the concentration of added P. This observation was true under all levels of N and at all stages of sampling. Of the total amount of P fixed the percentages of P fixation were 71.67, 81.08 and 93.4 for 24 hours, 30 days and 60 days respectively which were always higher than the values for N and K fixation. During P fixation, a fast reaction was over within 24 hours. The susequent reaction was slow and almost linear upto 60 days. This might be due to the exchangeable Al, responsible for the P fixation at a rapid rate at the initial stage and the non exchangeable Al at later stages as reported by Jai Prakash and Bhaskar (1974).

The fixation of K was more under alternate wetting and drying condition in contrast to NH_4 conforming to earlier reports Ramanathan

et al. 1973). The increased addition of K increased the quantity of K in the exchange complex which in turn increased the fixed K. The reaction to attain equilibrium between the different forms of K is speeded up by the expansion and contraction caused by alternate wetting and drying (Talibudeen, 1972). The mechanism of K fixation is also explained to be the result of precipitation of K in the interior of the clay lattices or due to the contraction of the sheet of clays after the entry of K ions causing entrapment of K (Mehrotra *et al.* 1972). The influence of NH_4 on the fixation of K was not well pronounced, though with highest level of NH_4 there was a slight increase with increase in the levels of K application under both moisture levels the fixation of K increased significantly throughout the incubation period. Out of the total amount of K fixed over a period of three months, 26.14 per cent was fixed in 24 hours, 64.53 per cent in 30 days and 83.53 per cent in 60 days which is in contract to the inference of Grewal and Kanwar (1967) that nearly 90 per cent of K was fixed in one day and equilibrium established in seven days.

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