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NOTE

A Preliminary Study on Mechanism of Phosphorus Solubilization by Phosphobacterium in Different Types of Soils

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The phosphate solubilization by phospho bacteria was studied for four profile samples having different layers. The pH, electrical conductivity, total and available phosphorus were measured for each soil sample initially and after incubating for 3, 6, 9 and 12 days. An increase in the total and available phosphorus was observed as the incubation period was increased.

Phosphorus is the master key element in crop production. It is present as insoluble inorganic and organic compounds and in natural sources like rock phosphate, bone meal and basic slag. They are converted to the available forms by microorganisms.[1] The phosphate solubilizing bacteria are mostly of the genus *Bacillus*. The work in India on phosphate solubilizing bacteria has begun with *Phosphobacterium* cultures obtained from USSR FOSFO 24 (a Czechoslovakian culture) and an indigenous culture isolated from *cassia occidentalis*. The present study was undertaken to know the amount of phosphate solubilization by *Phosphobacteria* in four profile samples having differnt layers (12 samples).

The experiments were conducted at bio-fertilizer production unit Kudumianmalai at Pudukottai District, Tamil Nadu. Four profile samples were collected (from Soil Testing Laboratory, Kudumiyanmalai) having a range of pH values. They were incubated with *Phosphobacterium* inoculant for 3, 6, 9 and 12 days. The electrical conductivity was measured on Systronics conductivity meter. The total and available phosphorus were calculated by Bray and Kurtz method[2] and the pH was measured using Elico pH meter. From each profile 3 soil samples were collected at a depth of 0–15 cm, 15–30 cm and 30–45 cm respectively.

If the depth of the soil column increases the total phosphorus content decreases. This is mainly due to the leaching of soil nutrients from the subsurface soil to 'c' horizons. This process is known as illuviation of soil nutrients. If the depth of the soil increases, the electrical conductivity also increases. This is the indication of the presence of total soluble salts present in the soil.[3] The total and available phosphorus for all the soil series analysed at different depth levels are presented in Table-1. The initial analysis before incubation reveals that there is decrease phosphorus content for the increase in depth while no such observation is made

TABLE-1
DATA SHOWING ELECTRICAL CONDUCTIVITY, pH, TOTAL AND AVAILABLE PHOSPHORUS (P) FOR INITIAL ANALYSIS AND AFTER INCUBATION PERIODS

Name of the soil	Depth (cm)	Initial Analysis				3 days after incubation		6 days after Incubation		9 days after Incubation		12 days after Incubation	
		EC mmhos/cm	pH	Total P (kg/ha)	Available P (kg/ha)	Total P (kg/ha)	Available P (kg/ha)	Total P (kg/ha)	Available P (kg/ha)	Total P (kg/ha)	Available P (kg/ha)	Total P (kg/ha)	Avialable P (kg/ha)
Profile I													
I Layer	0–15	0.26	7.1	2462.5	20.0	2490.0	25.0	2522.5	30.0	2540.0	32.5	2540.0	32.5
II Layer	15–30	0.36	7.0	2440.0	22.5	2455.0	27.5	2477.5	32.5	2495.0	32.5	2495.0	32.5
III Layer	30–45	0.40	7.0	2435.0	25.0	2447.5	30.0	2455.0	35.0	2465.0	37.5	2465.0	37.5
Profile II													
I Layer	0–15	0.56	6.4	2065.0	17.5	2077.5	22.5	2102.5	25.0	2115.0	27.5	2115.0	27.5
II Layer	15–30	0.62	6.4	2040.0	17.5	2055.0	22.5	2075.0	25.0	2082.5	27.5	2082.5	27.5
III Layer	30–45	0.65	6.5	2017.5	17.5	2035.0	22.5	2052.5	27.5	2060.0	27.5	2060.0	27.5
Profile III													
I Layer	0–15	0.36	8.6	2207.5	20.0	2230.0	25.0	2247.5	27.5	2262.5	30.0	2262.5	30.0
II Layer	15–30	0.42	8.7	2205.0	20.0	2227.5	25.0	2247.5	27.5	2260.5	30.0	2260.5	30.0
III Layer	30–45	0.46	8.8	2200.0	20.0	2220.0	25.0	2240.0	30.0	2250.0	30.0	2250.0	30.0
Profile IV													
I Layer	0–15	0.16	8.7	2112.5	20.0	2130.0	22.5	2140.0	25.0	2147.5	27.5	2147.5	27.5
II Layer	15–30	0.21	8.7	2107.5	20.0	2122.5	22.5	2132.5	25.0	2140.0	27.5	2140.0	27.5
III Layer	30–45	0.23	8.8	2100.0	20.0	2110.0	22.5	2122.5	25.0	2130.0	27.5	2130.0	27.5

for available phosphorus. EC is found to increase with increase in depth and pH is maintained constant.

The initial analysis shows that Profile-I is a neutral soil, Profile-II is acid soil, Profile-III is saline soil and Profile-IV is alkaline soil.

After the initial analysis, the soils were incubated with *Phosphobacterium* inoculant. The analysis after three days of incubation reveals that there is an increase in total and available phosphorus content in all profile soils. The increase in total phosphorus in the subsurface of acid soil is mainly due to the accumulation of insoluble iron and aluminium phosphate in the soil column.[4] The same observation for the saline soil is due to the fixation of calcium and sodium as phosphates in the soil.[5]

Similar experimental observation is made for all the soil profiles after six days of incubation. The highest phosphorus solubilization is recorded in the order Profile I > Profile III > Profile II > Profile IV.

The percentage increase in total and available phosphorus decreases as the incubation period is increased. Though a considerable increase is noticed for nine days after incubation compared to the initial values, there is very little increase when compared to six days after incubation. For 12 days after incubation, there is absolutely no increase in the phosphorus content from the nine days values.

Thus the activation of phosphate solubilization process is increased as the incubation period is increased and it reaches a limiting value after nine days of incubation. Beyond that even after 15 or 18 days of incubation, there is no change in the available and total phosphorus. This period of nine days incubation may be termed as saturation period.

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