

Influence of Moisture Regimes on The Transformation of Applied Phosphorus in Calcareous Soil of Vaishali

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ABSTRACT

The present study was undertaken to investigate the effect of moisture regimes on the transformation of applied phosphorus in calcareous saline alkali soil of Vaishali in Bihar with pyrites by physico-chemical method. The experiment was conducted in calcareous saline alkali soil using two types of phosphate carriers- SSP and DAP. Each applied 0,40 80ppm of P_2O_5 and pyrites as amendments 0,2 & 4 tonnes/ha. The soil with above treatments were maintained at two moisture regimes viz. field capacity & waterlogged and incubated at room temp. Soil samples were drawn at 4 times interval i.e. 0,20, 40 & 60 days. different soil inorganic fractions were measured like occluded Fe-P, Al-P, Ca-P and available P (Olsen's method) Al-P, Fe-P etc. Besides these DTPA extractable Fe and Mn were also determined in the samples. After analysis find out that occluded Fe-P in calcareous saline alkali soil indicate that under field capacity without phosphate carriers and amendments had given trends first fall at 20 days followed by rise at 40 days and finally fall which might be due to hydrophilic nature of Na^+ ions present in the soil causing such synthesis. In waterlogged condition without amendments with different doses of phosphate carrier calcareous saline alkali soil were found to give the same trend as that of field capacity in case of occluded Fe-P.

Keywords : DTPA, Fe-P, Al-P, Ca-P, Physico-Chemical Method

INTRODUCTION

It has been observed that western part of Bihar which receives less than 1120 mm of annual rainfall a good proportion of arable lands have developed salinity in small or big patches, such soil are calcareous in nature and have high Na conc. Soil reaction of these soils varies from 8.5 to 10.5 and they are poor in fertility status. Network of irrigation canals have aggravated this situation due to mobility of Na to surface layer. Studies have shown that unless such soils are reclaimed either by application of organic or inorganic amendments the fertility of them can not be raised. Various parameters have been measured during reclamation studies of calcareous saline alkali soil of North Bihar.

No systematic work has been done to study the release of PO_4^{3-} ions in these soils using different phosphate carriers under various moisture regimes. Variation in moisture condition may cause changes in PO_4^{3-} release pattern in calcareous saline alkali soil with and without amendments. To assess the phosphorus availability a study on the behavior of different fractions of phosphorus under different moisture condition is essential.

Simply the soil of old Bihar is divided into following physiological regions that is alluvial soil on either sides of river Ganga & Plateau region of Chhotanagpur of Jharkhan (Now). Among these, weathering, composition of material soil profile, soil texture, age & vegetation showed differ appreciably this resulted in formation of many soil types. But according to soil association map of Bihar soil divided into 23 broad soil association groups, among three groups stretching in the north of Ganga & rest in south of Ganga & plateau of chhotanagpur. About 80% area of Bihar is covered with calcareous and calcareous saline alkali soil were subjected to present investigation. There is no denying of fact that phosphate is one of the major nutrients of plant without which successful crop husbandry cannot be thought off.

The present investigation was started with the main objective of assessing different inorganic forms of P like occluded Fe-P Al-P with and without pyrites as amendments under field capacity and waterlogged conditions. Along with these DTPA extractable Fe and Mn, available soil P (Olsen's P) were also measured, because it was apprehended that use of pyrites may affect the availability of the above affect the availability of the above these three elements of great importance in agriculture in soil.

On the basis of above facts present work influence of moisture regimes on the transformation of applied phosphorus in calcareous saline alkali soil of north Bihar with pyrites by physico-chemical method was studied in which parameters like occluded Fe-P and DTPA extractable Fe and Mn were measured.

MATERIALS AND METHOD

(A) Section of Soil

Soil samples were collected from Lalganj in district Vaishali from 0-15 cm depth soil with slope varies from 0 to 3% on the basis of physio chemical properties Lalganj. Soil were named as calcareous saline alkali soil. The soil sample were partially air dried. The bulk soil samples for chemical analysis were passed through 6 mm.

(a) Characteristics of experimental soil:

Parameters	Values of Calcareous saline alkali soil
pH	10.5
E.C (mmhos/cm)	4.16
W.H.C	34.38%
F.C	26.38%
CaCO ₃	30.625%
Organic Matter	0.31%
Texture	Clay loam
Fe	10 ppm
Mn	10 ppm
P ₂ O ₅	20 ppm
Fe-P	Nil
Al-P	Nil

Occluded Fe-P	358 pmm
Ca-P	170 ppm.

(b) Chemical Characteristics of Pyrites:

Chemical	Average Percentage
S (Total)	16-20
Fe ₂ O ₃	14-18
MgO	0.1-0.5
CaO	1-5
Al ₂ O ₃	8-12
SiO ₂	45-50
C	2-5
Other Micronutrients	Traces

(c) Chemical Characteristics of Phosphate Carries:

Chemicals	Avarage Percentage	
	SSP	DAP
Water soluble phosphate (P ₂ O ₅)	16	54
Available N ₂	-	21

(B) Extraction of Occluded Fe-P

1 gm soil sample extracted with 0.5 N H₂SO₄ to remove Ca-P was washed twice with 25 ml portions of saturated NaCl Solⁿ then suspended in 40 ml of 0-3 M sodium citrate Solⁿ and 5ml of M NaHCO₃ with heating at 80°C. Now 1gm of Na₂S₂O₄ was added rapidly stirring. The suspension was kept at 80°C for 15 Minutes & centrifuged. The supernatant Solⁿ was collected in a 100 ml volumetric flask. After washing, 5ml of dithionite citrate extract was placed in 150ml flask and added with 10 ml distilled water & 2 ml of H₂O₂. Now Solⁿ was heated continuously with one drop of 0.5 N FeCl₃ for oxidation. After completion of oxidation then dried on steam plate then added with 10 ml of 2 N NaOH.

After dried, the supernatant liquid was decanted into 50 ml vol. flask and made to volume.

(c) Medhod for Phosphorus determination:

Chlorostannous Molybdo-phosphoric blue colour method in sulphuric acid system-occluded Fe-P were determined.

(a) Preparation of Reagent :

(i) Sulphomolybdic acid solution :- Exactly 250 gm of C.P. $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24} \cdot 4 \text{H}_2\text{O}$ was dissolved in 200ml of distilled water at 60°C . The solution was filtered to remove sediment. Then, 275ml of Phosphorus free and Arsenic free conc. H_2SO_4 was diluted to 750 ml with distilled water. After cooling the ammonium Molybdate Solⁿ was added after this it was diluted with water to exactly 1000ml.

(ii) Chlorostannous Acid reductant : About 25 gm of $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ was dissolved in 50 ml of Conc. HCl with warming. The Solⁿ was diluted to 500 ml with boiled distilled water.

(iii) Development of Molybdophosphoric Blue Colour : The test solⁿ aliquot was placed in 50 ml volumetric flask and then added with sulphomolybdic acid solution & chlorostannous acid reductant solution, then intensity of blue colour was Measured & pansmission percentage was observed.

(D) Preparation of Standered solution of Phosphorus :

Two phosphate standard primary & Secondary were prepared.

(i) Primary phosphate slandered (50ppm of P) 0.2195 gm of KH_2PO_4 was dissolved in about 400ml of distilled water in 1000ml volumetric flask. Then 25ml of 7N H_2SO_4 was added and Solⁿ was meade to 1000ml volume

RESULTS AND DISCUSSION

It is observed that under filed capacity and waterlogged condition with variation in time, in the treatments check (without PO_4^{3-}) at) O tonnes Py/ha. there is first fall in occluded Fe-P at 20 days followed by rise at 40 days and finally fall giving Sigmoid type of curve.

At 40 ppm of P_2O_5 as SSP & DAP without amendments and with amendments (2 and 4 tonnes Py/ha) and without PO_4^{3-} carrier, there is first rise at 20 days followed by fall at 40 and 60 days occluded Fe-P under both moisture regimes.

At 40 and 80 ppm of P_2O_5 as SSP/DAP under filed capacity and waterlogged condition respectively with 2 tonnes of amendments similar trends have been found as that of no phosphate carriers under 2 tonnes of Py/ha described earlier. . However, at 80 ppm of P_2O_5 as SSP/DAP without amendment under both moisture levels and 40ppm of P_2O_5 as SSP/DAP without amendment under both oisture levels and 40pmm of P_2O_5 as SSP/DAP under waterlogged condition with 2 tonnes pyrites/ha reverse reaction have been observed followed by rise later on. At filed capacity there is first increase at 20 days followed by decreases at 40 days and finally rise at 60 days when phosphate were applied to the tone of 80ppm/of P_2O_5 /ha with 2 tonnes of py/ha.

It showed remarkable record that in general there is rise in occluded Fe-P under both the water regimes in respective of phosphate carriers applied at 40 & 80 ppm of P_2O_5 with 4 tonnes of py/ha. this represented by following table

Table : showing changes in occluded Fe-P (in ppm) under Moisture regimes in calcareous saline Alkali soil (Lalganj) Vaishali

P-Carriers		Period of sampling (in days)							
Levels of		Filed capacity				Waterlogged			
P ₂ O ₅ (in ppm)		0	20	40	60	0	20	40	60
A. Without Ammedment :									
SSP	0	358	221	423	351	358	301	406	399
DAP		358	228	426	358	358	302	407	400
SSP	40	358	407	398	351	358	454	423	399
DAP		358	408	477	437	358	368	422	400
SSP	80	358	230	415	534	358	328	376	451
DAP		358	313	384	477	358	288	469	469
(B) With 2 tonnes py/ha									
SSP	0	358	425	383	351	358	405	379	248
DAP		358	421	383	352	358	408	375	247
SSP	40	358	434	380	359	358	234	450	277
DAP		358	436	342	322	358	295	399	453
SSP	80	358	469	460	551	358	508	437	438
DAP		358	422	407	450	358	534	431	415
(C) With 4 tonnes ph/ha									
SSP	0	358	423	415	376	358	450	385	338
DAP		358	427	414	353	358	459	399	330
SSP	40	358	371	407	526	358	383	388	461
DAP		358	377	401	460	358	389	423	437
SSP	80	358	477	516	586	358	388	450	454
DAP		358	390	408	500	358	386	470	500

Thus, We find that under waterlogged condition without amendments with different doses of phosphate carries the reactions were found to give the same trend as that of the same soil maintained at field capacity. In this connection it may be pointed out that due to vital role played by Na⁺ and CO₃⁼ ions the occluded Fe-P were synthesized following the same pattern as that of field capacity.

Pyrites have generally lowered down occluded Fe-P in the soil in the treatment receiving no phosphate irrespective of doses after 20 days of the reactions as noted earlier, i.e. soil maintained at field capacity.

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