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Effect of phosphorus from soil with reference to *Lablab purpureus* crop (L.)

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Abstract

Phosphorus is an essential macronutrient nutrient, as a part of key plant structure compounds and as a catalysis in the conversion of numerous key biochemical reactions in plants. Phosphorus can be found in the soil in organic compounds and also in minerals. Nevertheless, the amount of readily available phosphorus is very low compared with the total amount of phosphorus in the soil. This study was conducted in rhizospheric and non-rhizospheric soil of *Lablab purpureus* (L) for successive three years.

Keywords: Phosphorus, Macro -element, Rhizosphere, Soil-microorganisms

1. Introduction

Phosphorus is a macro element within the soil that represents soil fertility. It is available in the form of phosphate ions in soil which is converted by soil microorganisms [1]. Plants obtain converted phosphorus from ions of phosphate from the soil with the help of AM fungi. The rate of phosphorus is examined to check the effect on AMF colonization and propagules. The availability of phosphorus in kg/ha was categorized as very low (<15), low (16-30), moderate (31-50), High (51-65) and very high (>66). The presence of phosphorus in the collected soil samples can be determined by two methods. The Olsen's method [2] was used for neutral alkaline soils while the Bray and Kurtz [3] method is used for acidic soils.

2. Materials and Method

Material: Soil samples of Rhizosphere of *Lablab purpureus* (L) crop.

Method: Olsen's ($NaHCO_3$) Sodium bicarbonate ($NaHCO_3$) solution extracts some exchangeable or surface- absorbed Al- P, Fe-P, calcium phosphate and other phosphates [2].

Reagents used:

Sodium bicarbonate (Olsen's reagent) 0.5M $NaHCO_3$, pH 8.5:

Dissolved 84 g of $NaHCO_3$ in water and the volume was increased to 2 liters. This was mixed thoroughly and pH adjusted to 8.5 using 1 M NaOH (4 g NaOH /100 ml) solution. Usually 20-25ml NaOH solution is required for 2-liter $NaHCO_3$ solution. The solution was then stored in a glass or polyethylene bottle.

Reagent A:

12 g of ammonium molybdate $(NH_4)_6\ Mo_7O_{24}$, $4H_2O$)] was dissolved in 250 ml of distilled water. Simultaneously, 0.29 g of antimony potassium tartrate ($K_2Sb_2\ (C_4H_2O_6)_2$, $3H_2O$) was dissolved in 100 ml of water. These two solutions were added to 1000 ml of 2.5M H_2SO_4 and mixed thoroughly. The final volume of this solution was made to 2000 ml and it was stored in Pyrex glass bottle in a cool, dark place.

Reagent B:

1.056 g of ascorbic acid ($C_6H_8O_6$) was dissolved in 200 ml reagent A. It must be noted that this solution should not be kept for more than 24 hrs. at room temperature.

Sulfuric acid 2.5M:140 ml of concentrated $H_2SO_4$was diluted to 1 liter using distilled water.

Standard stock Phosphorus solution:

Exactly 0.439 g of potassium dihydrogen orthophosphate (KH_2PO_4) A.R. grade (dried in oven at 60°C for 1h and cooled in desiccators) was dissolved in half a liter of distilled water. To this, 25 ml of 7N H_2SO_4 was added and volume made to one liter with distilled water. This gave 100 ppm P standard stock solution. From this solution, a 2-ppm solution was made by diluting it 50 times [4].

Standard Curve:

For the preparation of the standard curve, 1, 2, 3, 4, 5 and 10 ml of 2 ppm. P solutions were taken in 25 ml volumetric flasks. To these, 5 ml of the extracting solution (Olsen's or Bray and Kurtz P1) was added. When Olsen's extractant was used, 5 ml aliquot was acidified using 2.5M H_2SO_4 to pH 5.0. To this, some amount of distilled water was added to make the volume to 20 ml which was followed by addition of 4 ml of reagent B. A blank solution of $NaHCO_3$, distilled water and 4 ml of reagent B was prepared and the intensity of the blue color read in a photoelectric colorimeter using 730-840 nm filters or on a spectrophotometer at 882 nm.

Exactly 2.5 g of 2 mm air dried soil (0.1 g accuracy) was weighed and added into a 150 ml Erlenmeyer flask. To this, some amount of Darco G 60 or equivalent grade p-free activated charcoal was added. Then, 50 ml of Olsen's reagent (soil to solution ratio of 1:20) was added and shaken on the reciprocating shaker for 30 minutes (180+oscillations/min.). Similarly, a blank was made without soil filter through Whatman filter paper no. 40 into clean and dry beaker and the flask was shaken immediately before pouring suspension into funnel. 5 ml of aliquot (extract) was taken and poured in a 25ml volumetric flask; this was acidified using 2.5M H_2SO_4 to pH 5.0. To this, distilled water was added to make volume 20 ml and followed by addition of 4 ml of reagent B. The intensity of blue color was read on spectrophotometer or colorimeter as described for standard curve above.

Calculation

$$\text{Available P (kg/acre)} = \frac{R \times \text{Volume of extract} \times 2.24 \times 10^6}{\text{Volume of aliquot} \times \text{weight of soil} \times 10^6}$$

Where,

R- μg P in the aliquot (obtained from standard curve)

3. Results and Discussion

In 2015, Phosphorous content of soil recorded from four localities were ranges in between 14 to 20Kg/acre. All localities medium content of phosphorus was recorded. The maximum phosphorous 20kg/acre was recorded for Rhizosphere soil in October, December, January, February and non-Rhizosphere in January at L-1. The maximum phosphorous 20 kg/acre was also recorded for Rhizosphere soil in October, November, December and January at L-4. The minimum phosphorous 14 Kg/acre was recorded in November at L-4, December at L-2 and March at L-2 for Rhizosphere soil (Table 1).

In 2016, Phosphorous content of soil recorded from four localities were ranges in between 14 to 22Kg/acre. All localities medium content of phosphorus was recorded. The maximum phosphorous 22 kg/acre was recorded for Rhizosphere soil in November and February and non-Rhizosphere in March at L-1. The minimum phosphorous 14 Kg/acre was recorded in November at L-4 for non-Rhizosphere soil and December at L-2 and March at L-2 for Rhizosphere soil (Table 2).

Table 1: P_2O_5 in the soil Rhizosphere and Non-Rhizosphere (Year 2015)

Sr No.	Locality	P_2O_5Kg/acre											
		Oct		Nov		Dec		Jan		Feb		Mar	
		R	NR	R	NR	R	NR	R	NR	R	NR	R	NR
1	L-1	20 M	19 M	19 M	18 M	20 M	18 M	20 M	20 M	20 M	18 M	18 M	17 M
2	L-2	15 M	18 M	15 M	17 M	14 M	16 M	16 M	17 M	15 M	17 M	14 M	18 M
3	L-3	20 M	18 M	20 M	20 M	20 M	17 M	20 M	20 M	19 M	18 M	17 M	15 M
4	L-4	19 M	17 M	14 M	18 M	15 M	17 M	19 M	20 M	19 M	19 M	20 M	19 M

L-1 Chochinde, L-2 Dasgaon , L-3 Kondivate and L-4 Kol

Table 2: P_2O_5 in Rhizosphere and Non-Rhizosphere (Year 2016)

Sr No.	Locality	P_2O_5Kg/acre											
		Oct		Nov		Dec		Jan		Feb		Mar	
		R	NR	R	NR	R	NR	R	NR	R	NR	R	NR
1	L-1	20 M	18 M	19 M	22 M	20 M	17 M	20 M	19 M	20 M	22 M	21 M	22 M
2	L-2	15 M	14 M	15 M	17 M	14 M	15 M	16 M	20 M	15 M	19 M	17 M	17 M
3	L-3	20 M	19 M	20 M	19 M	20 M	19 M	20 M	19 M	19 M	18 M	20 M	19 M
4	L-4	19 M	20 M	14 M	16 M	15 M	17 M	19 M	18 M	19 M	20 M	20 M	18 M

L-1 Chochinde, L-2 Dasgaon , L-3 Kondivate and L-4 Kol

Table 3: P_2O_5 in Rhizosphere and Non-Rhizosphere (Year 2017)

Sr No.	Locality	P_2O_5Kg/acre											
		Oct		Nov		Dec		Jan		Feb		Mar	
		R	NR	R	NR	R	NR	R	NR	R	NR	R	NR
1	L-1	20 M	18 M	19 M	18 M	21 M	18 M	20 M	22 M	20 M	21 M	17 M	20 M
2	L-2	15 M	17 M	15 M	17 M	14 M	16 M	16 M	18 M	15 M	14 M	18 M	20 M
3	L-3	20 M	22 M	20 M	19 M	20 M	22 M	20 M	14 M	19 M	20 M	17 M	19 M
4	L-4	19 M	20 M	14 M	17 M	15 M	18 M	19 M	15 M	19 M	19 M	14 M	18 M

L-1 Chochinde, L-2 Dasgaon , L-3 Kondivate and L-4 Kol

In 2017, Phosphorous content of soil recorded from four localities were ranges in between 14 to 22Kg/acre. All localities medium content of phosphorus was recorded. The maximum phosphorous 22 kg/acre was recorded for non- Rhizosphere soil in October, December at L-3 and Rhizosphere in January at L-1. The minimum phosphorous 14 Kg/acre was recorded in November and March at L-4, December at L-2 foe Rhizosphere and January at L-3 for non- Rhizosphere soil.

4. Discussion:

Phosphorus (P) is used as part of the energy in the plant. Because of its negative charge, phosphate is easily leached from the soil. Plants are only able to take up phosphate when soils are at neutral soil pH values of 5.0-8.0 [3]. At low pH values (<5.0) phosphate combines with iron (Fe) and aluminum (Al) to form phosphates that are not soluble and cannot be taken up by plants. At high pH values (> 8.0), phosphate combines with calcium (Ca) to form calcium phosphate, which is neither soluble nor available for plants to take up from the soil. When phosphate occurs in one of these insoluble compounds, it becomes easy to remove from the soil when the soil particles eroded. In the present study, rate of phosphorus is examined to check the effect on AM fungal colonization as well as number of propagules in one of these insoluble compounds, it becomes easy to remove from the soil when the soil particles eroded. In the present study, rate of phosphorus is examined to check the effect on AM fungal colonization as well as number of propagules.

5. Conclusion

In the rhizospheric region phosphate ions are formed in the soil with the help of micro-organism i.e., AM fungi [5]. During this it was observed that phosphate ions increase the AMF colonization and propagules [6]. The phosphate contain of soil was recorded from four different localities. The amount phosphorus availability categorized very low, low, moderate and high. During the study it was observed that phosphorus content ranges 14 – 20 kgs/ hect in rhizospheric soil. Plant can absorb phosphorus in phosphate ions which are negative ion [7]. Due to phosphate ions activity of microorganism increases and plant can obtain natural growth and development [8].

Conflict of interest

No conflict of interest influenced in this research.

5. References

1. Cox G and Tinker PB. Translocation and transfer of nutrients in vesicular arbuscular mycorrhizas. I. The

arbuscule and phosphorus transfer: a quantitative ultrastructural study. *New Phytologist*, 1976; 77: 371–378.

2. Olsen, S. R., C. V. Cole, F. S. Watanabe and L. A. Dean 1954: Estimation of available phosphorus in soils by extraction with sodium bicarbonate. U.S. Dep. Agric. Circ. 939, USA.
3. Bray, R. H. and L. T. Kurtz 1945: Determination of total, organic and available forms of phosphorus in soils. *Soil Sci.* **59:** 39-45.
4. Watanable, F. S. and S. R. Olsen 1965: Test of an ascorbic acid method for determining phosphorus in water and NaHCO3 extracts from soil. *Soil Sci. Soc. Am. Proc.,* 29: 677-678.
5. Clayton, J. S. and D. J. Bagyaraj 1984: Vesicular arbuscular mycorrhizas in submerged aquatic plants of New Zealand. *Aquatic Botany* **19:** 251-262. low and high phosphorus concentration. *Biology and Fertility of Soils,* 44: 501–509.
6. Smith S., A. Smith and I. Jakobsen 2003: Mycorrhizal fungi can dominate phosphorus supply to plant irrespective of growth response, *Plant Physiology*, 133: 16-20.
7. Muller, I. and Hofner, W. 1991: Influence of arbuscular mycorrhiza on phosphorus uptake and recovery potential of maize (*Zea mays L.*) under water-stressed conditions. *Mycol. Res.*, 98:593-603.
8. Azcon, R., E. Ambrosano and C. Charest 2003: Nutrient acquisition in mycorrhizal lettuce plants under different phosphorus and nitrogen concentration, *Plant Science*, 165: 1137-1145.