GAU Res. J. 1994, 19 (2) : 15-19

A Survey of Capacity, Intensity and Rate of Release Factors of Soil Phosphorus in Different Subgroups of Soils of South Gujarat

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ABSTRACT

The survey of capacity (Olsen's P), intensity (EPP) and rate of release (Organic C/organic P ratio) factors of phosphorus was carried out in different sub groups of soils of South Gujarat. The soils of all the sub groups were found low in intensity factor. The soils of vertic ustochrepts and Lithic ustochrepts were found to be medium in capacity and high in the rate of release characteristics of P. The soils of typic ustochrepts were found to be medium in capacity and rate of release factor while soils of Fluventic ustochrepts were found to be high in capacity and rate of release factor of P.

The values of all the sub group soils of South Gujarat were found to vary for the Olsen's available P from 0.61 to 57.17 ppm, for EPP from 6.40 to 7.80 and organic C/organic P ratio from 12.59 to 426.08 with the mean values of 9.19, 7.16 and 143.38, respectively. Olsen's P and EPP show a negative significant correlation (r = -0.22) in different sub groups soils of South Gujarat. There was no significant correlation between Olsen's P and organic C/organic P ratio in different sub group soils of South Gujarat.

(Received on 30th July, 1990)

INTRODUCTION

Phosphorus has long been recognized as an essential constituent of all living cells and organisms. No tangible survey of the factors of phosphate availability has been carried out in different sub group soils of South Gujarat. Determination of capacity (Olsen's P), intensity (EPP) and rate of release parameters of different sub group soils of South Gujarat made it possible to define which of the sub group soils of South Gujarat have better supply of phosphorus.

MATERIALS AND METHODS

Ninety six surface soil samples from cultivators' fields of vertic ustochrepts, Typic ustochrepts, Lithic ustochrepts and Fluventic ustochrepts sub group soils of South Gujarat were collected. The soil sample were grouped in different sub groups as per 7th approximation (Smith, 1970). The collected soil samples were analysed for capacity, (Olsen's P), intensity (EPP) and rate of release (Org. C/Org. P ratio) factors. Olsen's P was determined by using 0.5 m $NaHCO_3$ (pH = 8.5) extractant as suggested by Olsen *et al.* (1954). White and Beckett

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(1964) procedure was followed for the determination of equilibrium phosphate potential (EPP). The organic carbon was determined as per Walkely and Black's Titration method as described by Jackson (1967). The organic phosphorus was determined as suggested by Legg and Black (1955).

RESULTS AND DISCUSSION

The variable trends of capacity, intensity and rate of release factors in various sub groups are well reflected in the present study.

(1) Vertic ustochrepts

A perusal of Table-1 shows that available phosphorus as determined by Olsen's extractant ranged between 0.61 and 57.17 ppm with an average of 9.84 ppm. The values for equilibrium phosphate potential ranged between 6.40 to 7.69 with an average value of 7.11. The minimum and maximum values for organic C/organic P ratio were recorded as 12.59 and 426.08, respectively having an average value of 146.22.

(2) Typic ustochrepts

The results of this sub group soils shows that Olsen's extractant phosphorus varied from 1.23 to 19.05 ppm with an average value of 6.68 ppm. The range of equilibrium phosphate potential was found to range from 6.69 to 7.80 with an average of 7.21. The minimum and maximum values for organic C/organic P ratio of this sub-group soils were 58.08 and 336.00, respectively having an average ratio of 159.12 (Table 1).

(3) Lithic ustochrepts

The results in Table-1 revealed that available phosphorus as determined by Olsen's method ranged between 1.23 to 49.18 ppm with an average value of 6.66 ppm. The lowest and highest values of equiilibrium phosphate potential were observed to be 7.07 to 7.79, respectively with a mean value of 7.34. The values for organic C/organic P ratio ranged from 29.83 to 333.65 witth an average value of 125.80.

(4) Fluventic ustochrepts

The values for Olsen's P varied from 14.75 to 17.82 ppm for equilibrium phosphate potential from 6.63 to 7.45 and of organic C/organic P ratio from 99.60 to 181.33. The mean values for all these characteristics taken in the same order were 16.59, 7.09 and 143.14, respectively (Table 1). The values of all the sub group soils of South Gujarat for the Olsen's available P varied from 0.61 to 57.17 ppm, for EPP from 6.40 to 7.80 and organic C/organic P ratio from 12.59 to 426.08. The mean values for all the characteristics taken in the same order were 9.19, 7.16 and 143.38 (Table 1).

In general, looking to the overall picture for the status of capacity factor, the availability of phosphorus was found to be in the following decreasing order; Fluventic ustochrepts > vertic ustochrepts > Typic ustochrepts > Lithic ustochrepts.

It was further observed that the Typic ustochtepts and Lithic ustochrepts sub-group soils could be rated more or less similar in respect to capacity factor (Table 1).

As far as the status of intensity factor is concerned, the availability of phosphorus was observed in the following decreasing sequence. Fluventic ustochrepts > Vertic ustochrepts > Typic ustochrepts > Lithic ustochrepts.

TABLE 1

Range and average values of Olsen's P equilibrium phosphate potential (EPP) and organic C/organic P ratios of different sub group soils of South Gujarat.

Sr. No.	*Soil sub-groups*	*Olsen's P (ppm)*		*EPP**		*Org. C/erg. P ratio*	
		Range	*Average*	*Range*	*Average*	*Range*	*Average*
1.	Vertic ustochrepts	0.61 — 57.17	9.84	6.40 — 7.69	7.11	12.59 — 426.08	146.22
2.	Typic ustochrepts	1.23 — 19.05	6.68	6.69 — 7.80	7.21	58.08 — 336.00	159.12
3.	Lithic ustochrepts	1.23 — 49.18	6.66	7.07 — 7.79	7.34	29.83 — 335.65	125.80
4	Fluventic ustochrepts	14.75 — 17.82	16.59	6.63 — 7.45	7.09	99.60 — 181.33	143.14
	General	0.61 — 57.17	9.19	6.40 — 7.80	7.16	12.59 — 426.08	143.38

Equilibrium Phosphate Potential

The Vertic ustochrepts and Fluventic ustochrepts sub group soils could be rated more or less similar in respect to intensity factor. The Fluventic ustochrepts and Vertic ustochrepts contained more Olsen's P and EPP as compared to Typic ustochrepts and Lithic ustochrepts because of difference in physiographic situation. The low equilibrium phosphate potential (intensity factor) indicated the higher availability of phosphorus and vice versa.

Considering the status of rate of release factor, the availability of phosphorus was found to be in the following decreasing order; Lithic ustochrepts > Fluventic ustochrepts > Vertic ustochrepts > Typic ustochrepts.

The low rate of release factors indicated high organic P mineralization. Vertic ustochrepts and Fluventic ustochrepts sub group soils could be rated more or less similar with each other in respect of mean value of rate of release factor (Table 1). Neptune *et al.* (1974) observed that with variation in the ratio of C, N, s to p for the Brazilian soil could be due to the presence of variable amounts of inositol phosphorus. The average value (123.8) of organic C/organic P ratio of Lithic ustochrepts sub group soils was the lowest among all the sub groups. This may be due to high organic P mineralization potential. Somani and Saxena (1971) reported that organic C/organic P ratio have been found to be narrow indicating a high organic P miheralization potential in soils of Rajasthan.

TABLE 2

Correlation coefficient values between Olsen's P, EPP and organic C/organic P ratios in different sub group soils of South Gujarat.

	*EPP**	*Organic C/organic P ratio*
Olsen's P	-0.220**	-0.067
EPP*	–	0.060

* Equilibrium phosphate potential.

** Significant at 5 per cent level.

The co-efficient of correlations were worked out for different parameters presented in Table 2 which indicated that Olsen's available phosphorus and equilibrium phosphate potential (EPP) has a negative significant correlation (r = -0.220*). It was further observed that no significant correlation was found between Olsen's P vs. organic C/organic P ratio (r = -0.067) and equilibrium phosphate potenti vs. organic C/organic P ratio (r = 0.060) in d ferent sub group soils of South Gujara Kanzaria (1974) observed significant correl tion between Morgan's P and organic C/organ P ratio, EPP and organic C/organic P ratio deep black soil, but no significant relation w observed between Morgan's P and EPP.

REFERENCES

Jackson, M. L. (1967). Soil chemical analysis Prentice Hall of India Pvt. Ltd., New Delhi.

Kanzaria, M. V. (1974). Factors affecting phosphate availability in some soils of Western India. Ph. D. Thesis. Uni. of Udaipur, Udaipur.

Legg, J. O. and Black. C. A. (1965). Determination of organic phosphorus in soils. II Irrigation method. *Soil Sci. Soc. Am. Proc.* **19** : 139.

Neptune, A. M. L., Tabatabai, M. A. and Hanway, J. J. (1975). Sulfur fractions and carbon nitrogen phosphorus - Sulfur relationship in some Brazilian and Iowa soils. *Sci. Soc. Am. Proc.* **39** : 51.

Olsen, S. R., Cole, C. V, Watanebe, F. S. and Dean, L. A. (1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate. Circ. U. S. D. A. No. 939.

Smith, G. D. (1960). Soil classification. A comprehensive system 7th Approximation Published for the Soil Survey Staff.

Somani, L. L. and Saxena, S. N. (1971). Studies on the mineralization of organic P under the influence of crop growth in some soils of Rajasthan. *J. India Soc. Soil Sci.*, **19** : 261.

White, R. E. and Beckett, P. H. T. (1964). Studies on the phosphate potentials of soils. I. The measurement of phosphate potential. *Plant and Soil* **20** : 1.