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Short Communication

Assessment of Phosphorus in Soils of District Shikarpur, Pakistan

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ABSTRACT

A laboratory study was conducted to evaluate the phosphorus status of soils in Taluka Garhi Yasin of district Shikarpur, Pakistan. The soils from 50 different sites at 0 - 15 and 15 - 45 cm depth were sampled. The physico-chemical properties of the soils showed that majority of the soils were heavy (clayey & silty clay) in texture, all the soils were highly calcareous, EC ranging from 0.22 to 9.37 dS/m, pH varied from 7.33 to 8.42 and majority of the soils were low in organic matter. The phosphorus data showed wide range in soils from 1.49 to 27.57 (Olsen) and 0.78 to 7.8 (AB-DTPA) mg P kg^{-1}. Generally soils were deficient in P (< 10 mg kg^{-1}). There was highly significant correlation (r = 0.945) between the two P methods. The relationship between Olsen P with clay and silt + clay was positive and significant. Therefore, the soils of Taluka Garhi Yaseen were deficient in P, suggesting phosphatic fertilizer application for optimum yield.

Key Words: Phosphorus; Olsen; ABDT-PA; Shikarpur

INTRODUCTION

Unavailability of phosphorus mostly depends upon the soil conditions such as pH, activity of metallic ions in soil solution, nature of soil, type and amount of clays present in soil, its fertility status and the proper rate of P application etc. The available fertilizer phosphorus decreases with time and ultimately is changed back to un-available soil forms (Penas & Sander, 1997). Phosphorus response may be more predictable with variable-rate of fertilization, which matches soil test P and P fertilizer rate on a site-specific basis (Bronson *et al*., 2003).

Taluka Garhi Yaseen of district Shikarpur is a major rice producing area. The main cropping system practiced is wheat-rice. Water table of the area is just near the surface. Continuous soil saturation within the profile makes phosphorus less available to plants. At the same time, continuous and intensive cultivation makes the soils exhausted in plant nutrients and low producing. Hence, application of phosphatic fertilizers has been adopted as a practice by the farming community. The applied phosphorus rates are much less as compared to the recommended rates of at least 60 kg P_2O_5 ha^{-1}. As a result the soil status of the available P is likely to decrease over time. Pakistani soils on an average are poorer in available P (Sillanpaa, 1982). In district Sanghar, Solangi (1995) showed a variable Olsen P content ranging from 4.2 to 40.5 and 0.5 to 32.1 mg P kg^{-1} in surface and sub-surface soils, respectively. The overall objective in assessing the quantity of available P is to identify the nature and extent of nutrient deficiencies well in advance and to make appropriate plans for future.

MATERIALS AND METHODS

One hundred soil samples were randomly secured from 50 different sites of Taluka Garhi Yaseen, district Shakarpur, Pakistan, at 0 - 15 and 15 - 45 cm depth. For each sample three profiles were dug at one meter apart in a triangular form. A composite sample was then prepared from each profile at each depth. The samples were air dried, ground, passed through 2 mm stainless steel sieve and stored in plastic bags and analysed for texture by Hydrometer method (Kanwar & Chopra, 1967), EC, pH, $CaCO_3$, organic matter as out-lined in Handbook No. 60 and available phosphorus was determined by two methods (i) Olsen method of Olsen *et al.* (1954) and (ii) Ammonium bicarbonate diethylene triamine penta acetic acid (AB-DTPA) method of Sultanpour and Schwab (1977), followed by ascorbic acid method of Murphy and Riley (1962).

RESULTS AND DISCUSSION

Some physico-chemical properties viz. texture, EC, pH, organic matter and lime of the soil samples were analysed. Majority of the soil samples (78%), were heavy (clayey or silty clay) in texture followed by loams (20%) of various kinds (Fig. 1). The proportions of light textured soils were rather small (2%). EC of (1:2) soil water extract ranged from 0.23 to 9.37 at 0 - 15 and 0.22 to 3.31 dS/m at 15 - 45 cm. Thus salinity was not a problem in most of the soils. All soil samples had pH values less than 8.5. Soils were poor in organic matter and ranged between 0.30 to 1.47 and 0.1 to 1.03% for 0 - 15 and 15 - 45 cm depth, respectively. Soils of the area were highly calcareous.

Table I. Olsen and AB-DTPA P (mg/kg) of the soils of taluka Garhi Yasin, district Shikarpur, Pakistan

Profile No.	Site	Olsen P (mg kg^{-1}) Depth (cm)		AB-DTPA P (mg kg^{-1}) Depth (cm)	
		0-15	15-45	0-15	15-45
1	Baksho Ujan	3.91	2.42	2.34	1.56
2	Hussain Hajam	10.99	5.77	4.68	3.51
3	Abdul Rahim Dakhan	3.54	4.47	1.95	2.73
4	Khan Kalhoro	8.57	8.20	5.46	5.07
5	Noaosharo Abro	9.69	8.57	6.24	5.07
6	Kandhar	15.65	3.54	7.02	2.73
7	Gahija	6.71	6.15	4.29	3.90
8	Jindo Dero	6.89	6.33	4.68	3.51
9	Pir Bux Bhutto	6.71	8.38	3.90	5.07
10	Kabalo	4.84	4.10	3.12	3.34
11	Ghari Yasin	5.59	1.61	3.12	1.95
12	Tagio Dhar Udho	3.54	2.61	2.73	1.56
13	Noor Gah Unar	10.24	2.05	5.85	1.17
14	Tarai	2.24	1.49	1.17	0.78
15	Garhi Jeha	3.73	2.98	1.56	0.78
16	Hazara	3.73	1.49	2.34	1.17
17	Tajo Dero	10.24	6.89	5.85	4.29
18	Madeji	27.57	4.47	12.09	1.56
19	Chango Rahuja	4.28	4.84	2.73	3.12
20	Ghulam Qadir Dekhan	6.52	6.89	3.51	4.29
21	Muhammad Hassan	4.28	1.49	3.12	1.17
22	Bapho	2.61	5.22	1.56	3.12
23	Abid Markhiani	11.92	5.77	7.80	4.29
24	Wallace Abad	8.20	5.77	5.46	3.90
25	Achar Sadhayo	5.59	5.03	3.90	3.51
26	Chato Mangi	6.33	4.47	3.51	2.34
27	Sangi	3.73	3.17	1.95	1.56
28	Umer Markhiani	4.84	2.79	1.95	1.56
29	Waryaso	8.01	4.47	3.12	1.56
30	Khohiari	5.59	3.54	3.12	1.17
31	Saindad Wagan	2.98	4.10	1.95	2.73
32	Kazki Mari	3.17	4.28	2.34	3.12
33	Fazal Josh	8.75	9.31	3.51	4.68
34	Nim	6.71	5.40	3.51	2.34
35	Lal Udho	19.74	3.73	10.95	2.73
36	Fazalabad	5.77	6.33	4.29	3.51
37	Gahano Wah	4.84	4.84	3.12	3.12
38	Salar	3.73	7.45	2.73	4.68
39	Wahani	8.20	10.80	5.07	6.63
40	Banbhihar	4.84	7.45	3.51	4.68
41	Udha	4.66	2.61	3.51	1.56
42	Kot Habib Mahar	5.59	4.28	3.90	3.51
43	Ruk	9.87	5.96	6.24	3.90
44	Amrot	5.22	6.52	3.51	3.90
45	Masti Khan	6.33	5.77	3.90	3.12
46	Mirzapur	6.52	5.40	3.90	2.73
47	Wakar Jarm	3.73	3.17	2.34	1.95
48	Palio Kalhoro	2.05	4.66	1.17	3.12
49	Shahpur Jakhro	6.33	5.77	3.51	3.12
50	Jalal Jakhro	5.59	2.79	3.12	1.95
Minimum		2.05	1.49	1.17	0.78
Maximum		27.57	10.80	7.80	5.07
Average		6.82	4.93	3.92	2.95

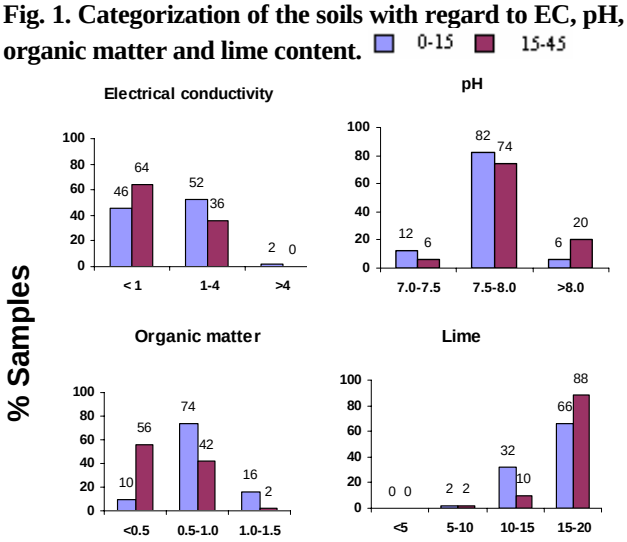
Table II. Correlation coefficient of available phosphorus with some physico-chemical properties of soils

Soil test method	Correlation coefficient (r)					
	Clay	Silt+Clay	EC	PH	OM	Lime
Olsen P	0.253*	0.200*	-0.055	0.058	-0.029	-0.032
			N.S	N.S	N.S	N.S
AB-DTPA P	0.239*	0.139 N.S	-0.080	0.019	-0.018	0.026
			N.S	N.S	N.S	N.S

*= Significant at 5% level; N.S = Non-significant; O.M = Organic matter

Olsen P content of the soils varied from as low as 1.49 to as high as 27.57 mg P kg^{-1} and majority of the soil samples were low in Olsen P. AB-DTPA extractable P showed the trend similar to that of Olsen P content. It ranged between 1.17 to 7.8 mg P kg^{-1} in surface horizons, while in the sub surface horizons it was 0.78 to 5.07 mg P kg^{-1}. Overall average for both the depths was 3.43 mg P kg^{-1} soil. Like Olsen P, majority of the soil samples were low in AB-DTPA extractable P (Table I).

Fig. 1. Categorization of the soils with regard to EC, pH, organic matter and lime content.



Relationship of available P with some physico-chemical properties. There was positive and significant correlation of Olsen P with clay and silt + clay content, negative and non-significant correlation with EC, organic matter and lime content. However, there was positive but non-significant correlation of Olsen P with pH of the soil.

The data regarding AB-DTPA P showed positive and significant correlation with clay, positive but non-significant correlation with silt + clay, pH and lime content. While, negative and non-significant correlation was observed with EC and organic matter content of the soil (Table II).

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