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Estimation of Phosphorus Contents from the Soil of Tehsil Kahuta

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Abstract: A study was conducted to investigate the phosphorus status of Tehsil Kahuta of district Rawalpindi. A total of ninety composite soil samples were collected from different sites. Out of ninety, 78 samples (87%) were found of poor (< 5 mg k kg^{-1}soil) level while 11 samples (12%) had satisfactory (5-10 mg k kg^{-1}soil) level and 1 soil sample (1%) was found with adequate (> 10 mg k kg^{-1}soil). The maximum phosphorus content 10.5 mg k kg^{-1} soil was recorded in Loona Kahuta site while minimum phosphorus 2.0 mg k kg^{-1} soil was recorded in Kalar Saidhan site. The Loona Kahuta site had maximum average potassium 5.5-mg k kg^{-1}soil. Fertilizer recommendations were advised to farmers according to soil problems.

Keywords: Phosphorus status, fertility, salinity/sodicity, soil pH, soil texture.

Introduction

Plant growth depends upon soil fertility, the inherent ability of soils to supply nutrient elements to plants. A soil is regarded as unfertile if it does not support the plant growth in which we are interested. Soil fertility is related to the amount of available nutrients, while others measure it by the yield capacity and still others look it to be a function of organic matter or even soil texture. In brief, soil fertility refers to the availability status of essential macro and micronutrients in the soil (Tisdale *et al.*, 1993).

Farm Yard Manure (FYM) is especially beneficial, as it takes care of the physical problems of soil and nutritional problems of the plants (Ghafoor *et al.*, 1990) and its continuous use resulted in lowering of soil pH, increase in organic matter, cation exchange capacity (CEC) and exchangeable cations (Lohia *et al.*, 1980). Bhariaguvanshi (1988) observed that long term application of FYM and fertilizers did not effect soil pH, however water holding capacity (WHC) was improved by 25% in sandy loam and 35% in clay loam soils, while use of fertilizers alone increased the salt content (conductivity) of soil.

According to Aggarwal and Lahiri (1981), soil fertility studies on stabilized and unstabilized dunes in India indicated an increasing trend in organic carbon, total nitrogen and stabilization of C / N towards 10:1 in surface soils of stabilized dunes. The total phosphorus and potassium were generally high and comparable in both the dunes. Mineralized nitrogen constituted the major part of total nitrogen and its content was relatively higher in un-stabilized dunes. The total nitrogen contents varied with the aspect of dune, being higher in central and left flanks of the wind ward side. Gupta *et al.* (1992) states that available P, K and Organic carbon content of soil can be maintained to their original contents with the application of 8.2, 2.4 and 7.5 Mg farm yard manure (FYM) / ha / year, respectively, along with 120 Kg N / ha.

The Kahuta tehsil fall under sub humid areas of Rawalpindi district with sandy loam to loam textured soil. Objectives of this study were to evaluate soil phosphorus status of Kahuta tehsil on the basis of soil samples analyzed at Soil Fertility Survey and Soil Testing Institute, Rawalpindi.

Materials and Methods

Ninety composite soil samples from different sites of tehsil Kahuta of district Rawalpindi were collected from 0-15 and 15-30 cm depths to asses the soil fertility. Previous crop history was recorded for formulating the recommendations. Samples were air dried, ground and passed through 2mm sieve and analyzed for physico chemical characteristics. Soil texture was determined by measuring saturation percentage of soil (Malik *et al.*, 1984). Soil pH was recorded (Schofield and Taylor, 1955) and electrical conductivity (EC) at 25 °C was measured by preparing soil and water suspension (1:1) and samples were analyzed for available phosphorus (Watanabe & Olsen, 1965).

The following criteria were used for classification.

a. Soil Texture

Textural Class	Saturation Percentage		
Sand	0	to	20 %
Sandy Loam	21	to	30 %
Loam	31	to	45 %
Clay Loam	46	to	65 %
Clay	66	to	100%

b. Soil Salinity / Sodicity

Status	EC dS/m	pH
Normal	< 4	< 8.5
Saline	> 4	< 8.5
Saline Sodic	> 4	< 8.5
Sodic	< 4	> 8.5

c. Nutrient Status

Status	Extractable Phosphorus mg kg^{-1}
Poor	0-5
Satisfactory	5-10
Adequate	> 10

The data was subjected to statistical analysis for standard deviation and computation of means (Steal and Torrie, 1980).

Results and Discussions

The data concerning soil pH, salinity / sodicity, texture and available phosphorus is given in (Table 1) while minimum, maximum and average values of all the determinations are given in Fig. 1,2 and 3. The soil analysis data of different sites of Kahuta tehsil indicate that pH values of the area varied from 6.9-7.8 (Fig. 1). These soil samples were considered non saline. So, 100% soil samples were normal and safe from the salinity hazards, thus the picture revealed by the total dissolved salts (TDS), that the area was free from salts in 1971 (Muhammad, 1978), but salinity and sodicity patches

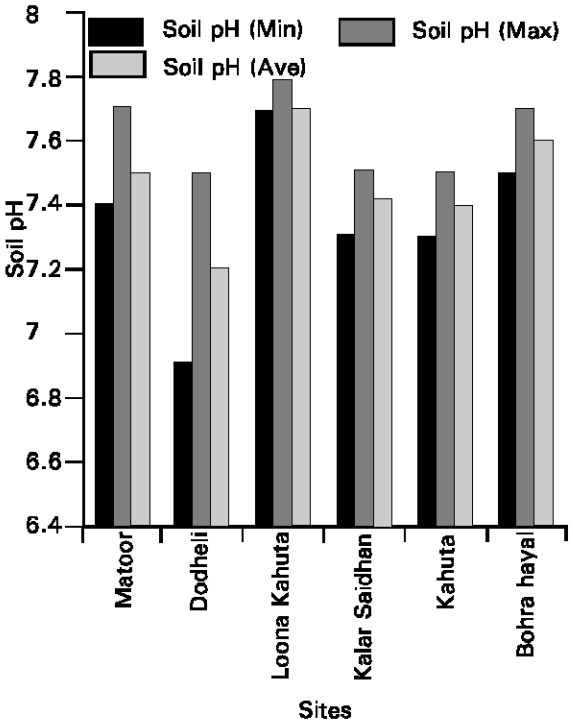

Fig. 1: A graph showing minimum, maximum and average values of soil pH in different sites of Tehsil Kahuta

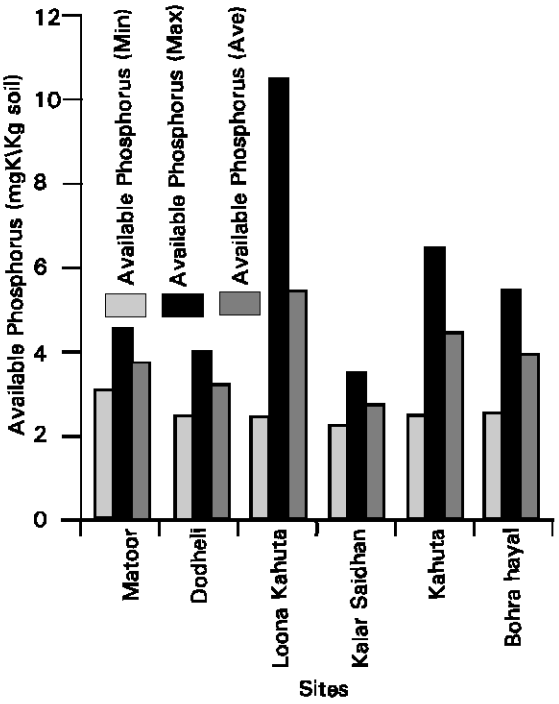

Fig. 3: A graph showing Min, Max and Average values of available Phosphorus in Tehsil Kahuta

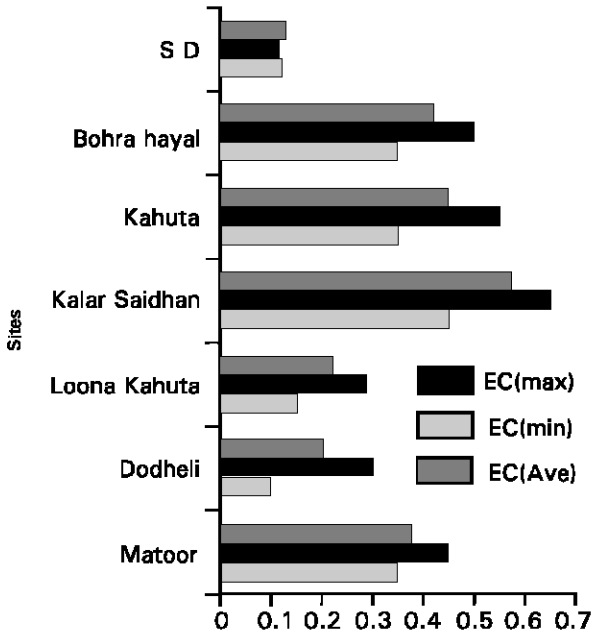

Fig. 2: A graph showing minimum, maximum and average values of electrical conductivity (EC).

may have developed later gradually due to application of brackish water either by pumped or collected from salts loaded run off in the reservoirs. As regards the texture 20% samples were sandy loam, 78% loam and 2 % were clay loam in all the sites of Kahuta tehsil.

The data further revealed that in available phosphorus, 87% soil samples were poor, 12% at satisfactory and 1% had adequate level. Most of the samples analyzed had satisfactory level of phosphorus in Loona Kahuta, Kahuta and Bhora Hayal. The maximum available phosphorus (15.0 mg k kg^{-1}soil) was recorded at Loona- Kahuta followed by (6.5 mg k kg^{-1}soil) from Kahuta area (Fig. 3). Minimum phosphorus (2 mg k kg^{-1}soil) recorded at Kalar Saidhan (Fig. 3). The high P level at Loona-Kahuta site may be due to sandy loam texture of the soil (Table 1). Lower available P at Kalar Saidhan may be due to loam nature of the soil (Table 1).

Keeping in view, the farmers were recommended to grow wheat (*Triticum aestivum* L.) and rapes and mustard (*Brassica spp*) with chick pea (*Cicer arietinum*) alternatively in winter (Rabi), while ground nut *(Arachis hypogaea)* and pulses with maize *(Zea mays*) and sorghum (*Sorghum vulgare*) in summer (Kharif) season in the same field to restore the soil fertility.

The practice of rotating the guar *(Gyamoposis spp*) and Jantar and dhancha *(Sesbania spp*) at full maturity enhances the soil fertility, besides using recommended doses of chemical fertilizers to obtain full benefits. Application of FYM once in two years will promote the crop yield by improving physical, chemical, biological and nutritional properties of the soil.

Table 1: Number of soil samples analyzed for soil texture, soil pH, salinity / sodicity, available phosphorus

Site	Soil Texture			Soil pH		Salinity & Sodicity				Available Phosphorus			G. Total
	L	M	H	<8.5	>8.5	N	S	SS	Sod	P	Sat	A	
Matoor	-	15	-	15	-	15	-	-	-	15	-	-	90
Dodheli	-	13	2	15	-	15	-	-	-	15	-	-	90
Loona-Kahuta	12	3	-	15	-	15	-	-	-	13	1	1	90
Kalar-Saidhan	-	15	-	15	-	15	-	-	-	15	-	-	90
Kahuta	-	15	-	15	-	15	-	-	-	9	6	-	90
Bohra-hayal	6	9	-	15	-	15	-	-	-	11	4	-	90
Total	18	70	2	15	-	15	-	-	-	78	11	1	540
%age	20	78	2	15	-	15	-	-	-	87	12	1	-
Mean	9	12	2	15	-	15	-	-	-	13	4	1	-
SD	3	4.5	0	15	-	15	-	-	-	15	4.5		-

L = Light (Sandy loam) N = Normal P = Poor M = Medium (Loam)
S = Saline Sat = Satisfactory H = Heavy (Clay Loam) SS = Saline Sodic
A = Adequate Sod = Sodic S D = Standard Deviation

Similarly the farmers were motivated for water testing and application of gypsum so that their soils might not be further degraded. The plants like sordan grass (*Sorghun bicolor , S. sudanese*) and kicker (*Acacia spp*) for timber and fuel purposes should be grown on barren soils to avoid soil erosion and to protect the top fertile layer of soil. It is recommended to adopt site specific recommendations to conserve the soil and obtain maximum possible economic return. It is concluded that the soil of Kahuta tehsil was satisfactory to poor in available phosphorus. The productivity of soil is declining due to imbalance use of fertilizer. There is no severe problem of excessive salt but needs care. Awareness about balanced fertilizer usage should be propagated among the farmers.

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