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AVAILABLE PHOSPHORUS AND pH STATUS OF ATTOCK SOILS

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Some 22,948 soil samples obtained from farmers' fields were tested by kit method to find out available phosphorus (PPs) status and pH level during 1985-99. It was observed that pH of 80.35 % of analysed samples was between 8.0 - 8.5, while 90.30 % of samples had available P_2O_5 less than 5 mg kg" of soil. Fertilizer recommendations were provided to the farmers accordingly.

Key words: Attock soils, p~os:e~.?E!~ a n ds p t aH u s

INTRODUCTION'

Fertilizer recommendations for efficient and economic crop production are based on soil testing as one of the essential factors. Soil tests in the laboratory include both for salinity and fertility appraisal but it is somewhat a lengthy process involving sample preparation and analyses for many parameters. Rapid assessment of soil with respect to available phosphorus and soil reaction (pH) is necessary and it is possible with the help of a soil testing kit.

Often pH is not a direct cause of poor plant growth 'but is associated with other factors e.g. AI or Mn toxicity or Ca, Mg or Mo deficiency which affect growth (Pearson, 1975). Phosphorus is more available at a soil pH 6.5-7.0 than at either higher or lower values (Hartmann et al., 1988). The difference in P availability at pH values between 7.2-8.1 was statistically non-significant .but P has synergistic effect with N, K and Mg while it is antagonistic with S, Zn, Mn and Fe (Ahmad et al., 1990).

The soils under high rainfall have lower pH values than those in irrigated areas, which are not saline and have low status P availability (Ahmad et al., 1988). pH is an important consideration in the selection of right type of phosphatic fertilizer. Superphosphate fertilizers do not appreciably affect soil pH, pH is also very much correlated with sodicity problem i.e. pH > 8.5 almost invariably indicates an exchangeable sodium percentage (ESP) > 15 and presence of alkaline earth carbonates and vice versa. Due to the intensive cropping, soil reserves of phosphorus are being depleted @0.23 mg kg' annum"; 17% soils have pH > 8.5 and 93 % soils are deficient in available phosphorus (Anonymous, 1994).

Phosphorus is absorbed by plants either as H_2P0_4 (when pH < 7) or as $HP0_4^{-2}$, (when pH > 7) and availability of phosphate and micronutrients (Fe, Mn, Cu, Zn, B) is impeded by high pH values (NFDC, 1996). Rehman et al, (1995) analysed 20,906 soil samples to determine fertility and salinity status of Attock district under advisory service Lu 1"!014U;t: fertilizer recommendation" tu the farmers according to the respective analysis ut the soils. Quickest methodology for phosphurusfertilizer recommendations was determined (Akram et al., 1993) and then it was found that soilP level of 15 mg kg" is suitable for acquiring 95 % relative yield of wheat (Akram et al., 1994).

MATERIALS AND METHODS

The whole area of district Attock was regularly surveyed by the laboratory staff every year and homogeneous composite soil samples from 6-8 sites up to a depth of 15 cm were taken by auger of 2.5 cm diameter and testing was at least duplicated. A chart with- coloured strips was used for matching the soil colour developed by adding 4-6 drops of thymol blue indicator for pH. If pH was > 8.5, then samples were brought to laboratory for detailed analysis. Similarly, a pinch of soil to be tested was taken in the depression ,of a procelain plate and 8-10 drops of borax solution, 1-2 drops of molybdic acid solution and one drop of stannous chloride solution were added to the sample respectively and allowed to stand for 30 seconds. The intensity of colour developed was compared with standard coloured chart (Malik et al., 1984).

Criteria: The following criteria for a nutrient were pointed out in a review by Rehman and Ghani (1990): When the crop yield was < 50 % of its potential and no fertilizer applied, the native nutrient level is low. If the yield is 50-75 %, then nutrient level is medium. Again if the yield is 100 %, the level is high. On these bases the following criteria were developed by Soil Fertility Department, Government of the Punjab for performing routine soil analysis at all district Soil Fertility Laboratories.

Table 1. Yearwise analyses of Attock soil samples using kit method

Year	Total samples	pH			Available phosphorus (mg kg^{-1})		
		< 8.0	8.0-8.5	> 8.5	0-5	5 -10	> 10
19Rn-Rfl	2nnn	R94	1f124	~7	241~	142	-
1986-87	82'0	102	718	-	798	22	-
1987-88	1965	358	1590	17	1698	267	-
1988-89	2563	278	2215	70	2285	278	-
1989-90	1443	109	1310	24	1358	85	-
1990-91	1441	168	1255	18	1266	175	-
1991-92	988	88	878	22	896	92	-
1992-93	930	76	840	14	868	62	-
1993-94	673	126	532	15	603	62	8
1994-95	1803	428	1358	17	1683	106	14
1995-96	1930	410	1482	38	1606	306	18
1996-97	1392	274	1090	28	1240	140	12
1997-98	1897	380	1500	17	1708	163	26
1998-99	2548	463	2046	39	2300	238	10
Total	22948	4154	18438	356	20722	2138	88
%asre		18.10	80.35	1.55	90.30	9.32	038

Table 2. Fertilizer recommendations

Crops		Phosphorus (PPs) to be applied (kg ha") Native available P_2O_5 (kg ha")		
Common names	Botanical names	0-12.5	12.5-25	> 25
Wheat	*Triticum aestivum*			
(Irrigated)		102.5	77.5	52.5
(Rainfed)		67.5	50.0	35.0
Gram	*Cicer arietinum*	67.5	50.0	35.0
Raya	*Brassica juncea*	67.5	50.0	35.0
Maize	*Zea mays*			
(Irrigated)		135.0	100.0	67.5
(Rainfed)		102.5	77.5	52.5
Groundnut	*Arachis hypogaea*	90	67.5	45.0
Potato	*Solanum tuberosum*	112.5	85.0	57.5
Sugarcane	*Saccharum officinaruni*	112.5	85.0	57.5
Cotton	*Gossypium hirsutum*	45.0	32.5	22.5
Lentil (Rainfed)	*Lens culinaris*	35.0	25.0	17.5
Pearl millet	*Pennisetum typhoides*	35.0	25.0	15.0

Source: Rapid Soil Fertility Survey and Soil Testing Institute, Lahore, Pakistan.

Available Phosphorus

Status	Value (mg kg^{-1})	Colour intensity (%) (developed after the test)
i) Low (deficient)	0-5	5,10,20
ii) Medium (sufficient)	5-10	30,40,45
iii) High (adequate)	> 10	60,80,100

pH Value (Depending upon intensity of the sample colour and its comparison with standard colour chart):

i) S 8.0, ii) 8.2, 8.4, 8.5, and iii) 8.6, 8.8, 9.0

- If pH of the soil is :::;8.0, then all the nutrients are easily available to plants except Fe, Mn, and B which become less available.
- If pH is 8.0-8.5, then phosphorus and micronutrients are available at a low level except Mo.
- If pH is ~ 8.5, then there exists problem of alkalinity. Then detailed analysis of such soils is done in the laboratory for gypsum requirement (GR).

RESULTS AND DISCUSSION

Yearwise detail of the samples (22,948) analysed by soil testing kit has been given in Table 1. The data show that 18.10 % ofthe samples had pH::; 8.0, while that of majority of samples (80.35 %) ranged between 8.0 - 8.5, whereas 1.55 % had pH more than 8.5. Similarly, 90.30 % of samples had available phosphorus < 5 mg kg^{-1}, 9.32 % had 5-10 mg kg^{-1} and only 0.38 % samples had> 10 mg pp; kg^{-1} soil.

Fertilizer recommendations were provided to the farmers on the basis of soil tests. It was reported that pH of the soil increased a bit upon initial application of the fertilizers but later on it declined towards neutral due to soil buffering capacity. Thus there is no apprehension in this regard and it is advised to use any type of fertilizer which is available in the market. For promoting the use of phosphatic fertilizers, the following recommendations were made (Table 2). The number of required bags (50 kg weight) can be calculated according to the percentage of available phosphatic fertilizer (SSP = 18 %, NP = 23 %, DAP and TSP = 46 % PPs, respectively). Maximum benefit from phosphatic fertilizers can be achieved if used at the time of sowing. These fertilizers have residual effect and subsequent crops are benefitted if full dose of P_2O_5 fertilizer is applied to the previous crop which utilizes only 18 - 20 % of PPs. A large quantity of well-rotten farm yard manure may be applied or green manuring should be done to increase the efficiency of phosphatic fertilizers.

To boost up crop productivity at national level, the farmers should be educated about the useful role of phosphatic fertilizers.

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