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SHORT COMMUNICATION

PHOSPHORUS STATUS OF SOME REPRESENTATIVE CULTIVATED SOILS OF HATHAZARI UPAZILLA, CHITTAGONG, BANGLADESH.

In view of the vital importance of phosphorus as a plant nutrient and the critical situation of phosphorus availability in soil, the present investigation on the P status of some cultivated soils of Hathazari Upazilla, Chittagong was conducted. Surface soil samples of six soil series were collected and analyzed for soil texture and chemical properties including pH, organic carbon, cation exchange capacity, total nitrogen and available phosphorus (Olsen P; Olsen *et al*. 1954) according to standard methods (Jackson 1973). Phosphorus in the soil extracts was determined spectrophotometrically in the ascorbic acid blue color method (Murphy and Riley 1962). Statistical analyses were done by using Minitab program (Minitab Inc. 1996). The soil series were Bijipur, Pahartali, Mirsarai, Manu, Raojan and Noapara. Fifty one soil samples (0 - 15 cm) were collected taking 8 from Bijipur series, 6 from Pahartali series, 18 from Mirsarai series, 7 from Manu, 6 from Raojan and 6 from Noapara series. These soils are mainly intermittently and seasonally flooded imperfectly to poorly drained fine to medium textured floodplain soils.

The physical and chemical properties of the soils are presented in Table 1. Soil texture widely varied among and within soil series. For example, percentage of sand ranged from 14 (Raojan series) to 74 (Mirsarai series). The percentage of silt was in the range of 11 (Mirsarai series) to 55 (Raojan series). The percentages of clay varied from 12 (Bijipur series) to 41 (Raojan series). Soil pH varied from 5.0 to 6.9. In Bijipur, Phartali, Mirsarai, Manu, Raojan and Noapara series, the mean pH values were 5.4, 6.5, 5.5, 6.1, 5.6 and 5.5, respectively. Mean organic contents were 1.18, 0.83, 1.59, 0.73, 1.03 and 0.95% in Bijipur, Phartali, Mirsarai, Manu, Raojan and Noapara series, respectively. The soils may, therefore, be considered as poor in organic matter according to BARC (2005). The mean values of cation exchange capacity in Bijipur, Pahartali, Mirsarai, Manu, Raojan and Noapara series were 9.64, 11.81, 9.20, 16.90, 15.68 and 14.12 cmol kg^{-1}, correspondingly. The presently studied soils are, thus, poorly to moderately fertile on the basis of physico-chemical properties.

Total phosphorus concentration of the present soils ranged from 100 to 881 mg kg^{-1}. The total P ranged from 145 - 385, 251 - 881, 100 - 387, 437 - 519, 204 - 657 and 251 - 664 mg kg^{-1} in Bijipur, Pahartali, Mirsarai, Manu, Raojan and Noapara series, respectively (Table 2). The mean values in the corresponding soil series were 260, 496, 201, 491, 370 and 374 mg kg^{-1}. The mean available P (Olsen P) values of the six soil series were 22, 57, 6, 15, 12 and 23 mg kg^{-1} in Bijipur, Pahartali, Mirsarai, Manu, Raojan and Noapara series, respectively. Available P accounted for 2.98 to 11.49 percent of total P. This low proportion of availability may result from low pH of the soils (< 6.0 in most cases). Total P was significantly correlated with pH, organic carbon, and available P was significantly correlated with total P, percent clay and pH (Table 3).

Total P ranges of 850 to 1200 mg kg^{-1} with occasional values up to 1830 mg kg^{-1} in surface mineral soils were reported by Kaila (1963), while a range of 500 to 800 mg kg^{-1} was suggested by Stevenson (1986). Saarela *et al.* (2003) obtained a mean total P content of 1210 mg kg^{-1} in surface mineral soils. But, Bangladesh soils are generally low in total phosphorus (Karim and Khan 1956, Islam and Chowdhury 1966, Islam *et al.* 1981). Islam (1960) proposed an average value of 430 mg kg^{-1} total P as a standard for Bangladesh soils. On this basis, Pahartali (496 mg kg^{-1}) and Manu (491 mg kg^{-1}) soils contained sufficient phosphorus but the others were deficient. Total P in 53 paddy soils of Bangladesh ranged between 144 and 699 mg kg^{-1} with a mean of 367 mg kg^{-1} Kawaguchi and Kyuma (1977). SRDI (2008) identified the following categories of available (Olsen) P in loam to clay soils for upland crops: <7.5 mg kg^{-1} very low; 7.51 - 15.0 mg kg^{-1} low; 15.1 - 22.5 mg kg^{-1} medium; 22.51 - 30 mg kg^{-1} optimum; 30.1 - 37.5 mg kg^{-1} high and >37.5 mg kg^{-1} very high. In the present study, Mirsarai series fall in very low, Raojan low, Manu and Bijipur medium, Noapara optimum and Pahartali series fall in very high range of available P. Thus, these soils should need different amounts of fertilizer phosphorus. On the other hand, Bingham (1962) established categories for Olsen P on the basis of response by different crops as follows: <5 mg kg^{-1} low; 6 to 10 mg kg^{-1} moderate and >11 mg kg^{-1} high. Based on this classification, all soil series except Mirsarai can be considered high in available P. Results indicated that the soils differed significantly in their total and available P contents and so they should need variable doses of P fertilizers.

PHOSPHORUS STATUS OF SOME REPRESENTATIVE CULTIVATED SOILS OF HATHAZARI UPAZILLA, CHITTAGONG, BANGLADESH

TABLE 1: PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

Soil series	Mechanical composition (%)			pH	Org. C (%)	Total N (%)	C/N	CEC cmol kg^{-1}
	Sand	Silt	Clay					
Bijipur	57	28	15	5.4	1.18	0.12	9.83	9.64
Pahartali	45	35	20	6.5	0.83	0.08	10.37	11.81
Mirsarai	40	37	23	5.5	1.59	0.14	11.36	9.19
Manu	35	41	24	6.1	0.73	0.07	10.43	16.9
Raojan	16	46	38	5.6	1.03	0.09	11.44	15.68
Noapara	33	41	26	5.5	0.95	0.09	10.55	14.12

TABLE 2: TOTAL AND AVAILABLE PHOSPHORUS CONTENTS IN DIFFERENT SOIL SERIES

Series	Number of samples	Total P mg kg^{-1}		Available P mg kg^{-1}		Percent *
		Range	Mean	Range	Mean	
Bijipur	8	145 - 385	260 b	2 – 36	22 b	8.46
Pahartali	6	251 - 881	496 a	21 - 110	57 a	11.49
Mirsarai	18	100 - 387	201 b	0 – 26	6 b	2.98
Manu	7	437 - 519	491 a	11 – 22	15 b	3.05
Raojan	6	204 - 657	370 ab	2 – 40	12 b	3.24
Noapara	6	251 - 664	374 ab	1 – 72	23 b	6.15

* Available P as percentage of total P

TABLE 3: CORRELATION CO-EFFICIENTS BETWEEN P STATUS AND SOIL PROPERTIES

Variables	Correlation co-efficient	Level of significance
Total P Vs Percent clay	0.015	Non significant
Total P Vs pH	0.633	1%
Total P Vs Organic carbon	0.431	1%
Available P Vs Total P	0.803	1%
Available P Vs Percent clay	0.294	5%
Available P Vs pH	0.555	1%
Available P Vs Organic carbon	- 0.255	Non significant

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