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COMPARATIVE SOIL FERTILITY STUDY ON GHIOR, GOPALPUR, ISWARDI AND SARA SERIES

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Abstract: A field investigation was carried out in Kotchandpur to find out the comparative nutrient status, viz. pH, N, P, K, S, Zn and B. 70 soil samples from four representing soil series namely Ghior, Gopalpur, Iswardi and Sara were collected and analysed in the regional laboratory of SRDI, Daulatpur, Khulna. The pH of the collected soil samples indicated neutral to slightly alkaline in nature except some soils of medium low land under Ghior soil series and medium high land under Ishwardi soil series that were acidic in nature. K, SO₄-S and B deficiencies were not too severe as that of nitrogen, phosphorus and zinc deficiency. The database may be used as a basis for conducting priority research programme.

Key words: Soil fertility; Plant nutrients

Introduction

Evaluation of soil fertility is essential for economic use of fertilizers and other management practices. Soil fertility is the capability to provide all essential nutrient elements in proper amount and in a suitable balance. Most of the farmers of Bangladesh are illiterate, and, they do not know how much and what kinds of fertilizers are essential for successful crop production in specific land. Generally they apply fertilizers in traditional way and at improper dose. As a result they do not get desired yield. Moreover, they become economically losers. Knowledge of soil fertility thus helps to control the misuse of costly fertilizers, retard the degradation of soil health and increase crop production at a desired level. Several studies (Hossain 1998; Islam and Sarkar 1993; BARI 1983; and BARC 1983) were conducted to characterize the fertility status of one or more of the elements for their specific purposes but the fertility status and soil fertilizer interaction for the soils of four series of Kotchadpur have not been undertaken specifically. Therefore, the piece of research work was undertaken in the Regional Laboratory of Soil Resource Development Institute (SRDI), Daulatpur, Khulna with a view to obtain informations on the types and magnitude of different essential nutrient elements specially N, P, K, S, Zn and B of four soil series soils in order to set research priorities.

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Materials and Methods

Four soil series namely Ghior, Gopalpur, Ishwardi and Sara were selected to represent the area and 70 soil samples (0-15 cm depth) were collected for laboratory analysis following the instructions outlined by PCARR, 1980. The soil samples were collected from different land type such as high land, medium high land, low land and medium low land. The collected samples were processed for the analyses of different nutrient elements.

Soil pH was determined by Metrohm 691 glass electrode pH meter using soil and water ratio of 1:2.5; total nitrogen was determined by Kjeldahl method, available P by Olsen's method using 0.5 M NaHCO₃ extracting solution and SO₄-S was estimated turbidimetrically using acid seed solution. K was determined by N NH₄OAC; and Zn was determined by DTPA extraction on atomic absorption spectrophotometer. B was determined colorimetrically by CaCl₂ extraction using azomethine-H solution. The critical level used to interpret the soil test values for K was 0.2 meq/ 100g and that of P, S, Zn and B was 14, 14, 2 and 0.2 µg/ml respectively.

Results and Discussion

The analytical results of the collected soil samples with respective fertility classes have been presented in Table 1. The soil pH of the study area (4.4 to 8.6) indicated that most of the soils were neutral to slightly alkaline in nature except some soil samples of medium low land under Ghior soil series which is acidic (pH 4.4) in nature. The exceptional results might be due to the accumulation of CO₂ that might be produced as a result of respiration of root and aerobic bacteria that depressed soil pH (Quddus *et al.* 1996). The overall soil pH of the area may not be harmful for crop production. The results of total nitrogen varied from 0.083 to 0.219% and fertility classes for both upland crops and wet land rice were designated as low for most of the soils, medium for some high land soils under Ishwardi and very low under Sara soil series.

The low organic matter content of soil, leaching and gaseous losses of nitrogen might be influential in decreasing nitrogen content in the area. Phosphorus concentration ranged from 4.01 to 14.96 µg/g (table-1) and indicated low phosphorus content that were all under critical level except two soils from medium high land under Gopalpur soil series (14.96 µg/g). The fertility classes were identified in both upland crops and wetland rice as low to very low that were alarming for crop production. Phosphorus status of eight samples under Ghior series were very low that might be due to the fixation of soil P as a result of low soil pH (table-1). The potassium level (0.25 to 0.68 meq/100g) were above critical level indicated "optimum" to "very high" for all types of land. SO₄-S (11.83 to 44.92 µg/g) of the area was above critical level except 10 soil of high land under Sara series (11.83 µg/g). The fertility classes were optimum to very high for both upland crops and wetland rice except Sara series that were low soil fertility class for both crops. The lower organic matter content along with high leaching potentiality might be the causes of SO₄-S deficiency (Sakai, 1978). Available boron level of the collected soil varied from 0.41 to 0.71 µg/g, and were all above critical levels. The soil fertility classes based on boron content was "medium" to "optimum" except soils of medium high land under

Table 1. Soil test values and fertility classes of different soils.

Sample size	Soil series	Land type	pH		Reaction class	Total Nitrogen		Phosphorus		Zinc	
			Min.	Max.		%	Uc and Wr	Uc	Wr	µg/g	Uc and Wr
4	Ghior	LL	6.4	7.7	Neutral	0.138	Low	5.25	Very Low	0.30	Very Low
4	Ghior	MLL	4.4	6.5	Acidic	0.148	Low	4.01	Very Low	1.01	Medium
13	Gopalur	HL	6.3	8.1	Slightly Alkaline	0.094	Low	12.61	Low	0.37	Very Low
2	Gopalur	MHL	7.1	7.8	Slightly Alkaline	0.132	Low	14.96	Low	0.27	Very Low
7	Ishwardi	HL	6.6	8.2	Slightly Alkaline	0.219	Medium	12.11	Low	0.41	Very Low
30	Ishwardi	MLH	5.7	8.3	Neutral	0.128	Low	7.70	Low	0.51	Low
10	Sara	HL	6.1	8.6	Slightly Alkaline	0.083	Very Low	8.95	Low	0.22	Very Low
Critical Level								14		2	
Range			4.4 – 8.6			0.083 – 0.219		4.01 – 14.96		0.22 – 1.01	
CV (%)			13.07	8.0		30.35		39.92		56.31	

Continued Table 1.

Sample size	Soil series	Land type	pH		Reaction class	Potassium		Sulphur		Boron		
			Min.	Max.		Uc	Wr	Uc	Wr	Uc	Wr	
4	Ghior	LL	6.4	7.7	Neutral	0.56	Very High	41.07	Very High	0.41	Medium	
4	Ghior	MLL	4.4	6.5	Acidic	0.68	Very High	40.26	Very High	0.47	Optimum	
13	Gopalpur	HL	6.3	8.1	Slightly Alkaline	0.41	High	20.99	Medium	0.43	Medium	
2	Gopalpur	MHL	7.1	7.8	Slightly Alkaline	0.39	High	44.92	Very High	0.51	Optimum	
7	Ishwardi	HL	6.6	8.2	Slightly Alkaline	0.51	Very High	22.44	Medium	0.57	Optimum	
30	Ishwardi	MLH	5.7	8.3	Neutral	0.36	Optimum	30.37	High	0.71	High	
10	Sara	HL	6.1	8.6	Slightly Alkaline	0.25	Medium	11.83	Low	0.50	Optimum	
Critical Level						0.2		14		0.2	µg/ml	
Range						4.4 – 8.6	0.25 – 0.68	11.83 – 44.92		0.41 – 0.71		
CV (%)						13.07	8.0	29.23	37.84		51.43	

LL = Low land, MLL = Medium low land, HL = High land, MHL = Medium high land
 Uc = Fertility class for upland crops, Wr = Fertility class for wetland ri

Ishwardi series that were in high soil fertility class. The lower soil P^H of the area and kinetics of chemical changes during soil submergence might be responsible for available boron. Zinc status (0.22 to 1.01 µg/g) of the soils of the area were all below critical level indicated “low” to “very low” soil fertility classes for both upland crops and wetland rice. Zinc availability decreased probably due to their low redox potential (Sakai, 1980).

Conclusion

Elements, especially nitrogen, phosphorus and zinc should be considered as a reasonably “high priority”. Pot tests suggested by Hunter (1980), using the modified missing element technique should be used as further quick screening for nutrient deficiencies and verification of the analytical results obtained.

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