AN AJSS

An Asian Journal of Soil Science

Volume 9 | Issue 1 | June, 2014 | 142-148 | e ISSN–0976–7231 | Open Access | www.researchjournal.co.in

Research Article

Spatial variability of fertility status of soils of upper Brahmaputra valley zone of Assam

A. BASUMATARY, RASHMI BARUAH AND B.K. MEDHI

Received : 21.06.2014; **Revised :** 18.05.2014; **Accepted :** 29.05.2014

MEMBERS OF RESEARCH FORUM :

Corresponding author :
RASHMI BARUAH, Department of Soil Science, Assam Agricultural University, JORHAT (ASSAM) INDIA

Co-authors :
A. BASUMATARY AND B.K. MEDHI, Department of Soil Science, Assam Agricultural University, JORHAT (ASSAM) INDIA

Summary

A study of the fertility status of the soils of Upper Brahmaputra Valley Zone of Assam representing Jorhat, Sivasagar and Golaghat district was made during 2010-11 using GPS and GIS technique. About 10 per cent villages were selected from each block of each district and a total of 1339 geo-referenced surface (0-15 cm) soil samples were collected from selected identified farmer's fields. The collected soil samples were analysed for available major nutrients and micronutrients. The available nitrogen (N) ranged from 178.16-439.04, 178.16-344.96 and 184.56-398.56 kg ha^{-1} for Jorhat, Sivasagar and Golaghat districts, respectively. Similarly, available P_2O_5 and K_2O varied from 14.81-39.49 and 102.63-244.18 kg ha^{-1}, 10.54-34.21 and 101.30-241.20 kg ha^{-1}, 14.28-36.38 and 138.76-316.07 kg ha^{-1} for Jorhat, Sivasagar and Golaghat districts, respectively. In respect of micronutrients, the DTPA-extractable Iron, Manganese, Zinc and Copper ranged from 10.68-168.56, 3.52-52.39, 0.26-0.88 and 0.22-10.88 $mgkg^{-1}$, respectively for Jorhat district, 11.25-129.15 3.52-52.39, 0.25-2.68 and 0.26-12.08 $mgkg^{-1}$, respectively for Sivasagar district and 23.45-201.90, 8.96-30.68, 0.23-1.25 and 1.09-10.88 $mgkg^{-1}$, respectively for Golaghat district. Hot water soluble boron (HWSB) varied from 0.29-0.95, 0.29-0.96 and 0.21-0.63 $mgkg^{-1}$ for Jorhat, Sivasagar and Golaghat districts, respectively. Irrespective of all the districts, soils exhibited deficiency in N, P_2O_5 and K_2O content ranging from 6.0 to 16.0 per cent for N, 11.0 to 15.0 per cent for P_2O_5 and 14.0 to 17.0 per cent for K_2O. Based on the critical levels of micronutrients, all soils were adequately supplied with DTPA extractable Fe, Mn and Cu. However, zinc was found to be mostly deficient nutrient in all these three districts followed by boron. Available zinc was found about 34 per cent, 23 per cent and 34 per cent deficient in Jorhat, Sivasagar and Golaghat district, respectively, whereas, in case of boron, it was recorded as 21 per cent, 17 per cent and 49 per cent in Jorhat, Sivasagar and Golaghat district, respectively. Correlation studies indicated that major nutrients showed positive and significant correlation with pH, while significant negative correlation was observed with micronutrients. Highly significant positive correlation was observed in between organic carbon and N, P_2O_5 and K_2O (r=0.231**, 0.120*, 0.385** for Jorhat district, r=0.487**, 0.142**, 0.159* for Golaghat district and r=0.150*, 175*, 0.108* for Sivasagar district). Similar significant positive trend was also recorded in between micronutrients and organic carbon.

Key words : Soil Macro, Micro nutrients, Assam soil

How to cite this article : Basumatary, A., Baruah, Rashmi and Medhi, B.K. (2014). Spatial variability of fertility status of soils of upper Brahmaputra valley zone of Assam. *Asian J. Soil Sci.*, **9**(1): 142-148.

Introduction

Soil is the most important basic natural resources which determine the ultimate sustainability of any agricultural system. Spatial variability of nutrient in soil influences its use for suitable management practices for maximizing the agricultural production. The decline in soil fertility due to imbalance fertilizer use has been recognized as one of the most important factors limiting crop yield (Nambiar and Abrol, 1989). Sound knowledge about soil fertility status is very much relevant for identifying constraint in crop husbandry for attaining sustained productivity and facility agro-technology transfer programme (Kumar *et al.*, 2009). Therefore, pragmatic information for major nutrients including micronutrients is essential to achieve balance nutrition to overcome soil fertility

and improve soil fertility on a sustainable basis. Keeping these aspects in view, an attempt has been made to generate information regarding site specific fertility status of some farmer's field in three selected districts of Upper Brahmaputra Valley Zone of Assam.

Resource and Research Methods

The available toposheets from NBSS and LUP, Jorhat and maps of these three districts along with village list collected from each block office of each districts were taken as basis for soil sample collection. From each block 10 per cent villages were identified and soil samples from such villages were collected randomly. Each sample collection site was earmarked with specific longitude and latitude data recorded through Global Positioning System. Geo-reference surface soil samples (0-15 cm) totaling 1339 numbers, representing each districts were collected during 2010-11 for chemical analysis.

The soil samples were air dried ground and sieved through 2 mm sieve. The processed soil samples were analyzed for basic soil parameters (pH, EC and OC) and for macronutrients (N, P, K) by using standard procedures (Jackson 1973, Bray's method (Bray and Kurtz, 1945) and neutral normal ammonium acetate, respectively). The available Fe, Mn, Cu and Zn in soil samples were extracted with DTPA solution (0.005M DTPA + 0.01 M $CaCl_2$ + 0.1M triethanolamine, pH 7.3 as outlined by Lindsay and Norvell (1978). The concentration of micronutrients in the extract was determined by atomic absorption spectrophotometer.

Research Findings and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Soil physico-chemical properties :

Soils of UBV zone of Assam were strongly acidic to slightly acidic (Table 1-3) in nature (pH 4.32-6.28). Only a few samples of Sivasagar district were found to be near neutral (pH > 6.50) range. Development of strongly acidic environment might be attributed to leaching of basic cations due to heavy rainfall while slightly acidic conditions may be due to recent deposits of alluvial materials.

The electrical conductivity which is an indication of salts concentration in soil varied from 0.01 to 0.24 dS m^{-1} (Table 1-3) and was found to fall under normal range (<0.8dSm^{-1}). This may be due to leaching of salts to lower horizons.

Organic carbon content ranged from 0.33 to 1.38 per cent in these three districts (Table 1-3). Jorhat (65.31 %) (Table 1) and Sivasagar (59.12 %) (Table 2) district had maximum samples under medium category; on the other hand Golaghat district (Table 3) had almost equal amount of samples under medium (46.39 %) and high (41.16 %) category. So, UBV zone is medium

Table 1 : Range and mean of major, micro & secondary nutrient status in soils of different blocks of Jorhat district of Assam

Name of the block	No. of samples	pH	EC	O.C. (%)	Av. N (kg ha^{-1})	Av. P_2O_5 (kg ha^{-1})	Av. K_2O (kg ha^{-1})	S (mg kg^{-1})	Zn (mg kg^{-1})	Fe (mg kg^{-1})	Cu (mg kg^{-1})	Mn (mg kg^{-1})	HWS –B (mg kg^{-1})
Kaliapani	42	4.91-5.98	0.01-0.05	0.51-0.85	188.16-401.76	15.39-39.49	102.66-223.20	13.25-25.05	0.42-0.84	60.66-168.56	0.33-9.32	4.29-19.39	0.42-0.95
		(5.45)	(0.02)	(0.65)	(303.31)	(25.63)	(164.04)	(17.83)	(0.63)	(86.73)	(3.19)	(12.58)	(0.64)
Dhekargarh	42	5.03-5.99	0.01-0.08	0.33-0.84	178.16-439.04	19.21-38.22	112.20-222.56	13.05-23.25	0.42-0.72	71.39-158.66	0.32-9.32	6.27-19.99	0.36-0.79
		(5.50)	(0.04)	(0.60)	(310.51)	(27.00)	(168.31)	(18.16)	(0.59)	(91.76)	(3.00)	(12.96)	(0.56)
Baghchung	36	5.06-6.08	0.01-0.18	0.34-0.99	188.16-401.76	19.21-31.02	121.74-201.36	13.71-23.75	0.26-0.88	70.34-138.68	0.22-10.88	4.56-20.43	0.31-0.89
		(5.68)	(0.06)	(0.67)	(294.44)	(24.96)	(156.68)	(18.72)	(0.60)	(97.74)	(3.04)	(12.29)	(0.59)
Selenghat	36	5.06-6.08	0.01-0.09	0.52-0.86	178.16-439.04	19.23-31.10	103.32-211.20	14.07-24.87	0.31-0.84	71.80-158.66	0.22-10.88	4.56-19.88	0.31-0.89
		(5.65)	(0.06)	(0.66)	(309.89)	(24.81)	(158.15)	(18.45)	(0.58)	(101.13)	(2.95)	(12.35)	(0.60)
Sipahikhula	48	5.04-5.99	0.01-0.09	0.41-0.98	188.14-401.25	16.03-31.55	102.63-241.20	14.06-24.21	0.26-0.83	66.98-123.98	0.36-10.88	6.84-52.39	0.36-0.84
		(5.50)	(0.04)	(0.68)	(285.45)	(25.25)	(166.11)	(17.83)	(0.63)	(92.64)	(4.21)	(13.70)	(0.58)
Titabor	42	5.11-5.97	0.02-0.24	0.52-0.77	189.91-376.12	14.81-35.03	112.50-203.20	12.78-24.71	0.33-0.77	72.83-123.09	2.81-10.51	3.52-25.13	0.29-0.89
		(5.70)	(0.06)	(0.62)	(287.59)	(24.50)	(152.65)	(17.28)	(0.59)	(92.09)	(5.91)	(11.70)	(0.54)
Ujani Majuli	48	5.55-6.04	0.01-0.09	0.54-0.94	219.88-346.00	20.14-38.96	178.65-244.18	14.56-28.36	0.46-0.77	10.26-32.42	0.55-4.35	10.11-18.96	0.38-0.71
		(5.82)	(0.05)	(0.75)	(300.17)	(27.14)	(207.94)	(22.10)	(0.60)	(21.51)	(2.18)	(14.45)	(0.55)
Majuli	48	5.48-6.28	0.01-0.09	0.59-0.96	216.51-412.18	20.14-38.96	143.78-244.18	14.56-28.36	0.45-0.73	10.68-29.67	0.50- 3.59	8.81-18.96	0.38-0.71
		(5.85)	(0.05)	(0.82)	(316.99)	(27.57)	(211.55)	(22.23)	(0.59)	(19.90)	(1.93)	(14.93)	(0.56)

in organic carbon content. This may be attributed to use of FYM and compost in the rice-rice cropping system for long period and also decomposition of left over stubbles which leads to increase in organic matter content.

Nutrient status :

Macronutrient status :

Available nitrogen :

Soils of UBV zone of Assam have found to be medium in available nitrogen (178.16-439.04 kg ha^{-1}) content (Table 1-3), which may be attributed to the use of urea and/or DAP as well as growing of green manuring crops. But, due to high rainfall, leaching loss was also observed as nitrogen (N) is mobile in soil. Therefore, we never reach to optimum N-efficiency in soils of UBV zone.

Available phosphorus :

As phosphorus (P_2O_5) of soils varied from 10.54-39.49 kg ha^{-1} (Table 1-3) which we can rate as medium. Considering 22.5 kg ha^{-1} as the critical limit for P_2O_5 availability, 11 per cent, 13 per cent and 15 per cent samples were found deficient in Golaghat, Sivasagar and Jorhat district, respectively (Table 6, 5 and 4). The efficiency of phosphorus fertilizer in soils of UBV zone is low due to presence of sesquioxide in large amount which fixes the applied phosphorus, but it comes in available form very slowly for the next season crop. Therefore, we can skip phosphorus application for 1 to 2 seasons depending on soil test value.

Available potassium :

The status of K_2O in soils of UBV zone was found to be medium in range as it varied from 101.30-316.07 kg ha^{-1} (Table 1-3). Taking 136.0 kg ha^{-1} as the critical limit 14 per cent and 17 per cent samples were found deficient in Jorhat and Sivasagar district (Table 4 and 5). In Golaghat district, there is no deficiency of K_2O (Table 6). Adequate availability of K_2O in these soils may be attributed to presence of k-rich minerals like mica, illite etc. But due to high rain fall and growing of hybrid crops has lead to draining of K in certain pockets of UBV zone.

Micronutrient status :

Available iron :

The available iron content of soils of UBV zone was ranged from 10.26- 201.90 mg kg^{-1} (Table 1-3). There was no deficiency of iron in the soils under investigation. Higher iron is attributed to the acidic pH, higher organic carbon and adoption of rice base cropping system.

Available manganese :

The available Mn content of UBV zone was ranged from 3.52- 52.39 mg kg^{-1} (Table 1-3). Based on critical limit (3.5 mg kg^{-1}) for Mn deficiency (Lindsay and Norvell, 1978) there was no deficiency of manganese in these soils. Manganese content seems to be effected by pH and iron content, as iron is directly correlated with Mn content in soils.

Available copper :

The content of available copper in soils of UBV zone is ranged from 0.22 to 12.08 mg kg^{-1} (Table 1-3) and all samples of these three districts were found to be sufficient in available copper content. Copper content is directly correlated with organic carbon.

Available zinc :

Available zinc in soils of UBV zone was ranged from 0.23-2.64 mg kg^{-1}. Based on critical limit of zinc deficiency 0.6 mg kg^{-1} (Lindsay and Norvell, 1978), 34 per cent of the samples were found deficient in Golaghat and Jorhat (Table 6 and 4) district and 23 per cent in Sivasagar district(Table 5).

Available boron :

The boron content of investigated soils varied from 0.21-0.96 mg kg^{-1} (Table 1-3) and maximum samples were found deficient for available B after zinc. As per literature, in acidic soils B availability is quite high compare to alkaline or saline/ sodic soils. But, in case of UBV zone, in spite of acidic pH, due to high rainfall, boron, which is mobile in soil, leached down and become unavailable to plant.

Interaction studies :

Macronutrients :

Available nitrogen :

Correlation studies shows that available N is positively and significantly correlated with organic carbon (r= and 0.231** and 0.487**, respectively) in soils of Jorhat and Golaghat district (Talashilkar *et al*., 2006; Sharma *et al*., 2008; Kumar *et al*., 2009). But in Sivasagar district there is no correlation between available N and pH, EC and organic carbon. Similar result is also shown by Sharma *et al*., 2008. It also negatively correlated with pH (r=-0.149**) and EC (r=-0.211**) in soils of Golaghat district.

Available phosphorus :

Phosphorus showed no correlation with pH, EC and organic carbon in Sivasagar district and Jorhat district (Sharma *et al*., 2008; Kumar *et al*., 2009). But it showed positive and significant correlation with OC (r= 0.142**) and available N (r= 0.263**), whereas, negative significant correlation with EC (r=-0.136**) in Golaghat district.

Available potassium :

There was non-significant correlation between available potassium and pH, EC and organic carbon in Sivasagar district. Talashikar *et al*., 2006 also reported non significant correlation between available K and pH. But in Golaghat district it showed

Table 2 : Range and mean of major, micro & secondary nutrient status in soils of different blocks of Sivasagar district of Assam

Name of the Block	No. of samples	pH	EC (dSm^{-1})	O.C. (%)	Av. N ($kgha^{-1}$)	Av. P_2O_5 ($kgha^{-1}$)	Av.K_2O ($kgha^{-1}$)	S ($mgkg^{-1}$)	Zn ($mgkg^{-1}$)	Fe ($mgkg^{-1}$)	Cu ($mgkg^{-1}$)	Mn ($mg\ kg^{-1}$)	HWSB ($mgkg^{-1}$)
Sivasagar	72	4.84-6.08	0.01-0.06	0.48-1.16	178.16-344.96	14.35-34.21	102.66-211.36	13.87-24.66	0.28-1.63	19.11-123.38	0.36-7.06	4.36-20.81	0.37-0.96
		(5.44)	(0.02)	(0.69)	(234.70)	(22.84)	(154.07)	(18.40)	(0.70)	(60.32)	(2.25)	(9.52)	(0.66)
Gaurisagar	48	4.35-6.11	0.01-0.11	0.44-0.84	178.16-344.96	16.22-29.63	102.66-198.64	11.34-25.36	0.36-1.24	54.37-111.66	0.32-9.21	9.02-27.06	0.33-0.78
		(5.47)	(0.03)	(0.57)	(229.59)	(23.04)	(153.51)	(17.75)	(0.72)	(85.60)	(3.30)	(13.31)	(0.56)
Amguri	36	4.55-6.70	0.01-0.14	0.52-0.90	178.16-344.96	15.96-29.02	101.30-241.20	14.33-24.12	0.25-1.39	71.80-129.15	0.26-9.67	8.99-19.80	0.31-0.89
		(5.63)	(0.06)	(0.68)	(231.77)	(22.04)	(157.63)	(18.45)	(0.60)	(95.66)	(3.41)	(12.74)	(0.59)
Nazira	66	4.46-6.04	0.01-0.21	0.44-0.75	188.14-314.21	15.23-34.21	102.63-201.20	10.58-27.54	0.31-2.64	50.21-104.25	0.33-9.67	4.38-52.39	0.31-0.90
		(5.35)	(0.04)	(0.60)	(233.37)	(22.21)	(150.77)	(17.56)	(0.76)	(77.96)	(2.52)	(12.74)	(0.56)
Sonari	60	4.35-6.19	0.01-0.06	0.44-1.16	188.16-314.21	10.54-34.21	110.12-223.20	10.84-28.12	0.46-1.32	53.02-108.56	0.36-12.08	4.38-17.21	0.37-0.96
		(5.28)	(0.03)	(0.61)	(234.46)	(22.31)	(144.28)	(19.57)	(0.82)	(76.58)	(3.54)	(12.37)	(0.57)
Lakowa	18	5.03-5.97	0.01-0.06	0.52-0.65	178.16-298.96	21.03-29.56	122.36-196.54	12.20-21.11	0.69-1.25	72.75-88.48	1.18-8.32	6.23-13.60	0.41-0.69
		(5.40)	(0.03)	(0.59)	(252.47)	(24.64)	(153.58)	(16.59)	(1.01)	(78.91)	(3.88)	(10.34)	(0.54)
Sapekhati	84	5.09-5.97	0.01-0.14	0.46-0.76	188.14-302.67	15.96-33.79	102.20-201.36	11.25-24.76	0.31-1.60	70.07-125.78	0.25-10.88	4.56-20.13	0.41-0.79
		(5.38)	(0.05)	(0.60)	(233.59)	(21.98)	(150.55)	(18.06)	(0.89)	(84.91)	(3.44)	(11.51)	(0.53)
Dimow	96	5.09-5.88	0.01-0.13	0.48-0.62	186.25-289.23	13.33-32.28	102.20-222.68	12.78-28.36	0.26-1.02	23.75-123.09	0.35-10.51	3.52-52.39	0.29-0.59
		(5.49)	(0.06)	(0.54)	(240.86)	(23.77)	(145.60)	(19.41)	(0.57)	(83.34)	(3.84)	(13.34)	(0.48)
West	18	5.24-5.83	0.01-0.09	0.58-0.72	212.14-298.65	22.28-28.38	126.39-200.12	14.61-25.98	1.02-2.45	11.35-76.82	0.52-3.42	10.35-14.61	0.43-0.62
Abhayapuri		(5.41)	(0.05)	(0.63)	(250.00)	(25.18)	(162.83)	(20.52)	(1.29)	(33.63)	(1.57)	(12.47)	(0.53)

Table 3 : Range and mean of major, micro & secondary nutrient status in soils of different blocks of Golaghat district of Assam

Name of the block	No. of samples	pH	EC	O.C. (%)	Av. N ($kg\ ha^{-1}$)	Av. P_2O_5 ($kg\ ha^{-1}$)	Av. K_2O ($kg\ ha^{-1}$)	S ($mg\ kg^{-1}$)	Zn ($mg\ kg^{-1}$)	Fe ($mg\ kg^{-1}$)	Cu ($mg\ kg^{-1}$)	Mn ($mg\ kg^{-1}$)	HWS –B ($mg\ kg^{-1}$)
Kothalguri	54	5.39-6.11	0.01-0.17	0.46-0.76	207.63-328.89	16.37-36.38	147.31-289.23	14.45-25.98	0.36-0.73	43.56-198.30	1.78-6.66	15.39-29.64	0.33-0.59
		(5.78)	(0.05)	(0.59)	(265.68)	(24.33)	(188.70)	(18.90)	(0.54)	(125.01)	(4.97)	(21.22)	(0.51)
Bokakhat	84	5.29-6.02	0.01-0.17	0.43-1.38	184.76-323.62	14.28-29.83	138.76-316.07	11.34-27.54	0.41-0.89	23.45-178.25	1.09-6.14	11.56-29.64	0.21-0.63
		(5.66)	(0.06)	(0.69)	(230.80)	(23.02)	(211.25)	(18.70)	(0.63)	(80.97)	(3.33)	(22.64)	(0.43)
Sorupathar	198	5.23-6.15	0.01-0.17	0.43-1.38	184.56-398.56	14.28-31.03	142.36-251.33	10.58-25.40	0.41-1.12	45.23-198.65	2.22-10.88	8.96-30.64	0.21-0.62
		(5.69)	(0.04)	(0.76)	(267.82)	(25.37)	(191.56)	(17.79)	(0.67)	(140.44)	(5.70)	(20.72)	(0.44)
Padumoni	48	5.47-6.11	0.01-0.06	0.47-1.28	209.48-326.38	21.14-30.26	164.32-217.64	10.84-28.12	0.23-1.25	46.38-198.65	1.57-4.78	15.78-29.62	0.21-0.59
		(5.81)	(0.03)	(0.81)	(285.23)	(25.41)	(195.13)	(17.64)	(0.73)	(123.97)	(2.61)	(22.80)	(0.35)
Morongi	66	5.46-6.11	0.01-0.06	0.45-1.28	210.16-378.80	21.34-34.62	167.44-225.66	12.20-28.32	0.43-1.12	66.32-201.90	1.49-3.54	12.39-30.32	0.21-0.60
		(5.73)	(0.03)	(0.78)	(292.28)	(25.69)	(199.59)	(17.92)	(0.79)	(145.52)	(2.27)	(24.72)	(0.39)
Kakodonga	18	5.46-6.04	0.01-0.04	0.49-0.91	240.10-316.32	20.56-29.64	188.52-219.27	19.63-26.68	0.55-0.77	74.77-196.21	2.15-4.04	12.11-28.24	0.31-0.61
		(5.71)	(0.02)	(0.75)	(284.82)	(24.70)	(206.14)	(23.53)	(0.63)	(134.65)	(2.58)	(21.19)	(0.47)
Dergaon	30	5.46-6.00	0.01-0.05	0.42-0.96	204.56-398.46	20.84-30.28	156.94-218.48	11.47-28.32	0.43-0.73	91.20-190.11	2.31-3.21	14.78-29.08	0.10-0.61
		(5.74)	(0.03)	(0.80)	(291.88)	(25.72)	(201.07)	(19.67)	(0.55)	(134.18)	(2.56)	(23.41)	(0.45)

Table 4 : Per cent categorization of major, secondary & micro nutrients into low, medium and high in different blocks of Jorhat district

Nutrients	Level (%)	Blocks							
		Kaliapani	Dhekorgorah	Bagchung	Selenghat	Sipahikhula	Titabor	Ujani Majuli	Majuli
Nitrogen	Low	11.90	14.28	19.44	16.67	16.67	14.28	8.33	10.42
	Medium	88.09	85.71	80.56	83.33	83.33	85.71	91.66	89.58
	High	---	---	---	---	---	---	---	---
Phosphorus	Low	19.04	11.90	13.89	11.11	12.5	16.67	12.5	10.42
	Medium	80.95	88.09	86.11	88.87	87.5	83.33	87.5	89.58
	High	---	---	---	---	---	---	---	---
Potassium	Low	14.28	14.28	19.44	16.67	18.75	16.67	---	---
	Medium	85.71	85.71	80.55	83.33	81.25	83.33	100.0	100.0
	High	---	---	---	---	---	---	---	---
Sulphur	Low	---	---	---	---	---	---	---	---
	Medium	85.71	78.57	66.67	66.67	75.0	88.09	31.25	22.92
	High	14.28	21.43	33.33	33.33	25.0	11.90	68.75	77.08
Zinc	Low	30.95	33.33	30.55	36.11	25.0	28.57	33.33	27.08
	Medium	69.05	66.66	69.44	63.89	75.0	71.43	66.67	72.92
	High	---	---	---	---	---	---	---	---
Iron		All in high range							
Copper	Low	---	---	---	---	---	---	---	---
	Medium	14.28	7.14	19.44	19.44	2.08	---	---	---
	High	85.71	92.86	80.55	80.55	97.92	100.0	100.0	100.0
Manganese		All in high range							
	Low	19.05	16.66	16.67	19.44	18.75	23.81	18.75	14.58
	Medium	21.43	83.33	66.67	61.11	72.92	71.43	81.25	85.42
	high	59.52	---	16.67	19.44	8.33	4.76	---	---

Table 5 : Per cent categorization of major, secondary & micro nutrients into low, medium and high in different blocks of Sivsagar district

Nutrients	Level (%)	Blocks								
		Sibsagar	Gaurisagar	Amguri	Nazira	Sonari	Lokowa	Sapekhati	Demow	West Abhayapuri
Nitrogen	Low	79.17	87.5	80.56	81.81	90.0	83.33	91.67	85.42	77.78
	Medium	20.83	12.5	19.44	18.19	10.0	16.67	8.33	14.58	22.22
Phosphorus	Low	43.06	43.75	61.11	54.54	40.0	33.33	58.33	35.42	11.11
	Medium	56.94	56.25	38.89	45.46	60.0	66.67	41.66	64.58	88.89
Potassium	Low	27.78	31.25	19.44	27.28	45.0	22.22	21.43	48.96	16.67
	Medium	72.22	68.75	80.56	72.72	55.0	77.78	78.57	51.04	83.33
Sulphur	Low	---	---	---	---	---	---	---	---	---
	Medium	68.06	75.0	72.22	74.24	50.0	100.0	70.24	60.42	44.44
	High	31.94	25.0	27.78	25.75	50.0	----	29.76	39.58	55.56
Zinc	Low	29.17	25.0	44.4	36.36	18.33	----	19.05	58.3	----
	Medium	68.05	72.92	55.56	56.06	76.67	94.44	66.66	41.66	72.22
	High	2.78	2.08	---	7.57	5.0	5.56	14.28	---	27.78
Iron		All in high range								
Copper	Low	---	---	---	---	---	---	---	---	---
	Medium	1.39	4.17	8.33	1.51	---	---	3.57	3.13	---
	High	98.61	95.83	91.67	98.78	100.0	100.0	96.43	96.87	100.0
Manganese		All in high range								
Boron	Low	1.38	25.0	25.0	19.69	25.0	22.22	27.39	50.0	22.22
	Medium	76.39	70.83	61.11	72.72	65.0	77.78	72.43	50.0	77.78
	high	22.22	4.17	13.89	7.57	10.0	---	1.19	---	---

positive significant correlation with EC (r= 0.200**) and negative and significant correlation with available P (r=-0.247**). On the other hand, in Jorhat district, it showed positive correlation with pH, organic carbon (r=0.385**) (Sharma *et al.*, 2008) and also with available N (r=0.213**) and available P (r=0.261**).

Micronutrients :

Available Iron :

Correlation studies reveled that in Sivasagar district, it has positive correlation with EC (r=0.254**) (Vijayakumar *et al*., 2011) whereas, negative correlation with organic carbon (r=-0.277**) and available zinc (r=-0.158**), similar result was shown by Sood *et al.*, 2004; Minakshi *et al*., 2005; Singh *et al*., 2006 and Talukdar *et al*., 2009. But in Golaghat district, it showed negative correlation with EC (r=-0.285**) and available K_2O(r=-0.371**), whereas positive correlation with available N (r=0.169**) and P (r=0.314**). On the other hand, in Jorhat district it showed negative correlation with pH (r=-0.373**) (Rajakumar *et al*., 1996), available P (r=-0.252**), available K (r=-0.583**), but positive correlation with organic carbon (r= 0.442**), similar result was revealed by Talukdar *et al*., 2009; Vijayakumar *et al*., 2011.

Available manganese :

It showed positive and significant correlation with organic carbon (r=0.241**, 0.211**) in Sivasagar and Jorhat district, and result was in agreement with Vijayakumar *et al*., 2011, it also showed positive correlation with available Fe(r=0.192**) and Cu (r=0.197**) (Talukdar *et al*., 2009) in Sivasagar district . Similarly in Golaghat and Jorhat district also it showed positive correlation with available K (r=0.196** and 0.228**) and negative correlation with available Cu (r=- 0.277**) in Golaghat district and Fe (r=-0.197**) in Jorhat district.

Available copper :

It showed positive and significant correlation with organic carbon (r=0.169** and 0.250**, respectively) and available Fe(r=0.269** and 0.328**, respectively) in Sivasagar and Jorhat district. Similar results were reported by Khalifa *et al*. (1996). But in Golaghat district it showed negative correlation with available K (r=-0.184**) and available zinc (r=-0.190**). It has no significant correlation with EC in all these three districts and this result was in accordance with Somasundaram *et al*., 2009.

Available zinc:

With pH it showed negative non-significant correlation in both Sivasagar and Golaghat district and this result is in agreement with Sheeja *et al*. (1994), Sadashiva *et al*. (1995). Whereas, in Jorhat district, it showed negative significant correlation with pH (r=-0.558**) (Kumar *et al*., 2009). Again, it showed positive and significant correlation with organic carbon (r=0.132**) in Sivasagar district and these results were similar to the findings of Perveen *et al*. (1993) and negative and significant correlation with EC (r=-0.193**) and available iron (r=-0.158**) in Sivasagar district.

Available boron:

There was negative non-significant correlation between

Table 6 : Per cent categorization of major, secondary & micro nutrients into low, medium and high in different blocks of Golaghat district

Nutrients	Level (%)	Blocks						
		Kothalguri	Bokakhat	Sorupathar	Podumoni	Morongi	Kakodonga	Dergaon
Nitrogen	Low	35.19	88.09	40.91	14.58	19.69	5.56	16.67
	Medium	64.81	11.90	59.09	85.41	80.30	94.44	83.33
	High	---	----	----	---	---	---	---
Phosphorus	Low	12.96	29.76	10.11	8.33	7.57	22.22	13.33
	Medium	87.04	70.23	89.89	91.67	92.42	77.78	86.67
	High	---	---	---	---	---	---	---
Potassium	Low	---	---	---	---	---	---	---
	Medium	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	High	---	---	---	---	---	---	---
Sulphur	Low	---	---	---	---	---	---	---
	Medium	66.67	65.47	72.72	77.08	77.27	100.0	50.0
	High	33.33	34.52	27.27	22.91	22.72	---	50.0
Zinc	Low	72.22	47.61	45.43	29.16	24.24	33.33	80.0
	Medium	27.78	52.38	54.54	70.83	75.75	66.67	20.0
	High	---	---	---	---	---	---	---
Boron	Low	18.52	95.23	67.67	97.91	75.75	50.0	63.33
	Medium	81.48	4.76	32.32	2.08	24.24	50.0	36.67
	high	---	---	---	---	---	---	---

pH and available B in these three districts and this result was supported by Abid *et al*. (2002). But it has positive correlation with organic carbon (r=0.464**) in Sivasagar district and with available Fe (r= 0.243**) it showed positive correlation in Jorhat district. But in Golaghat district there was no significant correlation with soil properties and other nutrients.

Conclusion:

It is obvious from the above discussuion that zinc is the most deficient nutrient in these three districts followed by boron and soils are adequately supplied with DTPA-extractable Fe, Mn and Cu. pH and organic carbon are the two major factors which affect the availability of nutrients in soils of UBV zone of Assam.

Literature Cited

Abid Niaz, Ibrahim, M., Ahmad, Nisar and Anwar, S.A. (2002). Boron contents of light and medium textured soils and cotton plants. *Internat. J. agric. & Biol.,* **4** (4) : 534-536.

Bray, R.H. and Kurtz, L.T. (1945). Determination of total, organic and available forms of phosphorus. *Soil Sci.,* **59** (1) : 39-45.

Jackson, M.L. (1973). *Soil chemical analysis*. Prentice Hall of Indian Pvt. Limited. NEW DELHI (INDIA).

Khalifa, E.M., El-Desoky, M. A., Gameh, M. A. and Faragallah, M.E. (1996) Status of some micronutrients and their relations to mineral composition of the Nile valley desert interference zone soils, East of Assiut city. *Assiut J. agrci. Sciences* **27**(3): 107-127.

Kumar, R., Sankar, A.K., Singh, K.P., Agarwal, B.K. and Karmakar, S. (2009). Appraisal of available nutrients status in santhal paraganas region of Jharkhand. *J. Indian Soc. Soil Sci.* **57**(3): 366-369.

Lindsay, W.L., and Norvell, W.L. (1978). Development of a DTPA soil test for zinc, iron, manganese and copper. *Soil Science Society of America J.,* **42** (3) : 421-428.

Minakshi, N.S., Tur, Nayyar, V.K., Sharma, P.K. and Sood, A.K. (2005). Spatial distribution of micronutrients in soils of Patiala district - A GIS approach. *J. Indian Soc. Soil Sci.* **53** (3) : 324-329.

Nambiar, K.K.M. and Abrol, I.P. (1989). Long term fertilizer experiments in India: An overview. *Fertilizer News,* **34** (4) : 11-20.

Perveen, S., Tariq, M., Farmanullah, J.K., Khattak and Hamid, A. (1993). Study of micronutrient status of some important sites of N.W.F.P., Pakistan. *Sarhad J. Agric.,* **9**(5) : 467-473.

Rajakumar, G.R., Patil, C.V., Prakash, S.S., Yeledhalli, N.A. and Math, K.K. (1996). Micronutrient distribution in paddy soils in relation to parent material and soil properties. *Karnataka J. agric. Sci.,* **9**(2) : 231-235.

Sadashiva, V., Prabhuraj, D.K. and Murthy, A.S.P. (1995). Status of micronutrients in soils of Kabini Command Area (India). *University of agric. Sci. Bangalore,* **24**(3) : 41-43.

Sharma, P.K., Sood, Anil, Setia, R.K., Tur, N.S., Mehra, Deepak and Singh, Harpinder (2008). Mapping of macronutrients in soils of Amritsar district (Pujab) – A GIS approach. *J. Indian Soc. Soil Sci.,* **56**(1) : 34-41.

Sheeja, S., Kabeerathumma, Pilla, S., N.G. and Nair, M.M. (1994). Availability and distribution of micronutrients in cassava growing soils of Andhra Pradesh. *J. Root Crops,* **20**(2) : 75-80.

Singh, R.D., Kumar, S. and Pande, H. (2006). Micronutrient status of soils under different vegetations in Uttaranchal Hills. *J. Indian Soc. Soil Sci.,* **54** (1) : 115-116.

Somasundaram, J., Singh, R.K., Parandiyal, A.K. and Prasad, S.N. (2009). Micronutrient Status of Soils under Different Land Use Systems in Chambal Ravines. *J. Indian Soc. Soil Sci.,* **57**(3): 307-312.

Sood, A., Setia, R.K., Bansal, R.L., Sharma, P.K. and Nayyar, V.K. (2004). Spatial distribution of micronutrients in soils of Amritsar district using frontier technologies. *In*: *Proceedings of 7th Punjab Science Congress.* February 7-9; held at Guru Nanak Dev. University, Amritsar (PUNJAB) INDIA.

Talashilkar, S.C., Mehta, V.B., Dosani, A.A.K., Dhopavkar, R.D. and Dhekale, J.S. (2006). Influence of soil reaction on soil acidity parameters and fraction of organic matter, nitrogen, phosphorus and potassium in lateritic soils of Konkan. *J. Indian Soc. Soil Sci.,* **54**(2): 174-178.

Talukdar, M.C., Basumatary, A., and Dutta, S.K. (2009). Status of DTPA extractable Micronutrients in soils under rice and sugarcane ecosystems of Golaghat district in Assam. *J. Indian Society of Soil Science,* **57** (3) : 313-316.

Vijayakumar, R., Arokiaraj, A. and Martin, Deva Prasath, P. (2011). Micronutrients and their relationship with soil properties of natural disaster proned coastal soils. *Research J. Chemical Sci.,* **1**(1) : 8-12.

Walkely, A.C. and Black, T.A. (1949). Estimation of soil organic carbon by the chromic and titration Method. *Soil Sci.,* **47** : 29-38.