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Research Article

Fertility Status of Some Selected Soils of Tripura

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Abstract

The evaluation of the fertility status of an agricultural field is an essential parameter in terms of sustainable productivity of crops. Macro and micro nutrient elements govern the fertility of soils and control the growth, development and yield of crops. This Study was conducted to assess the soil fertility of some selected land classes of Tripura. For this purpose 50 surface soil samples were collected from all the districts of Tripura covering different land classes. The data shows that these soils were acidic in nature, medium in available Nitrogen content, low in available phosphorous and medium in available potassium. The concentrations of available Zn in all the soil samples analyzed were low which could be as a result of the strongly acidic nature of the soils in the study area. We therefore recommend that agricultural lime be applied on the soil so as to raise the soil pH to required level of 5.5 – 7.8 for crop productivity.

Keywords: *Soil fertility; Available N; P; K; Tripura.*

Introduction

Soil fertility is one of the important factors in controlling yields of the crops. Soil characterization in relation to evaluation of fertility status of the soils of an area or region is an important aspect in context of sustainable agricultural production. Because of imbalanced and inadequate fertilizer use coupled with low efficiency of other inputs, the response (production) efficiency of chemical fertilizer nutrients has declined tremendously under intensive agriculture in recent years (Meena, *et al.*,, 2006). The physico-chemical properties such as pH, electrical, organic carbon are important in deciding availability of essential nutrients in soil and thereby for crop production. The supply of essential nutrients from soil can be augmented by proper management of these properties. Crop nourishment in any region depends remarkably on soil nutrient availability and on their profile similarities. All these problems make it necessary to closely analyze the physico-chemical status of agricultural soils, if they are managed for benefits of the individual farmers and of mankind. For this purpose soil survey was carried out which have given an account of anatomy as well as physiology of soil mantle. It is not only helpful to choose correct fertilizer doses but also keep farmers informed about inherent qualities and deficiencies. The productive and health of plants is the function of adequate supply of plant nutrients and the amount of these nutrients required by plants differs among plant species, yield potential, soil properties, environment and management. (John, *et al.*, 2012).Determining the concentration of plant nutrient availability in soil is significantly important if agricultural land is to remain conducive in crop production sustainably in an acceptable level by farmers (Brady & Weil, 2004).

Tripura is a land of hills and dales. About 70% of the area of the state is covered by hills and hillocks which are locally known as '*tilla*'. The

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remaining 30% are plain land and locally called as '*lunga*'. There are about 10 rivers originating from the highest hill rage 'Betling Sib' and they flow towards western direction through narrow valleys to Bangladesh. This picturesquely beautiful state in the lap of hill is surrounded by Bangladesh in the west, south and north. Its North-Eastern and Western boundaries are separated by Assam and Mizoram states, respectively. The state lies within the latitudes 22°56/ N -24°32/N and between the longitudes 90°10/ E – 92°21/ E. Of the total area of 10, 49,169 hectares, 6, 06,150 hectares, i.e., near about 60% of land are under forest area. Notwithstanding small arable land resource, the agriculture remains to be main source of livelihood to the people of mountainous regions. The major food crops of the region are cereals, pulses, oilseeds and potato (Anonymous, 1998). Rice is the main crop followed by maize in this region. Due to intensive cultivation practices and inadequate use of chemical fertilizers, the fertility and productivity of agricultural soil is deflecting. Various techniques are employed in assessing soil fertility including soil testing which is widely used in the world (Havlin, *et al*.,, 2010). The testing of soils provide information on the availability of plant nutrients which form the basis for fertilizer recommendations that increase crop yield and maintained the fertility of soil for a longer period (Khadka., *et al*.,2016).Therefore, an attempt is made to assess the fertility status of soil of Tripura covering different land classes.

Materials and Methods

50 representative soil samples were collected randomly from 0-15 cm depth from all the districts of Tripura. Five soil samples have been collected from each district covering different land classes. The Collected soil samples were dried, pounded in wooden mortar and passed through 2 mm sieve. Each sample was thoroughly mixed to make it homogenous and preserved in properly labeled polythene bags for a laboratory analysis. The pH of the soil was determined using glass electrode pH Meter (Jackson, 1973). The organic carbon and available N (0.32% alkaline KMnO4), Available P (0.5 M NaHCO3), Potassium 1 N Neutral Ammonium Acetate extractable) were evaluated using the adopted methods by (page, *et al*., 1982) and the available micro nutrient (Zn) were determined by DTPA extractable methods (Lindsay & Norvel, 1978).

Results and Discussion

The results of the collected soil samples was presented in Table: 1. It showed that the soil pH of selected locations ranged from 4.01 to 6.21 with an average of 4.68 in table (4.1). The lowest pH value was found in Hrishyamukh whereas, the highest pH value of 6.21 was found in Melaghar area. The soils of these are strongly acidic to slightly acidic in nature. Similar finding was reported by Mitra, *et al*., (2006).

The organic carbon content varied from 0.28 to 3.55 % with lowest and highest in Manubazar and Rangamati respectively with a mean value of 1.325%. Such low organic carbon content of the Manubazar soils suggest that the soils of the region are relatively infertile.

The available N , P_2O_5 and K_2O contents in soil of 50 sites / locations were recorded low to medium ; low to high and low to medium respectively. The highest available nitrogen content was found in Kalyanpur (311.00 kg ha^{-1}) whereas the lowest value of available nitrogen (43.70 kg ha^{-1}) was found in Damchera. Similarly, the available phosphorus content of the soils ranged from 10.44 kg ha^{-1} to 68.76 kg ha^{-1} . The highest available phosphorus was found in Tuichindrai while the lowest one was found in Bagbasa region . Again, the available potassium content of the soil also varied between 298 kg ha^{-1} in Salema region to 78.44 kg ha^{-1} in Ranguati . The average value of N, P_2O_5 and K_2O of the fifty different soil samples were 186.96;25.08 and 142.54 kg ha^{-1}respectively.

The DTPA – extractable cationic Zn contents were also analyzed in soils of 50 locations and recorded that as soils under investigation were found deficient in most locations based on the critical limits in soils. The DTPA extractable Zn content of the soils varied from

0.42 mg kg^{-1} in Mohanpur to 2.10 mg kg^{-1} in Jirania.

Table: 1 Results of soil sample

Sl. No	Place of the Soil	Depth (cm)	pH (1:2.5)	Org. C (%)	Av. N (kg ha^{-1})	Av. P_2O_5 (kg ha^{-1})	Av. K_2O (kg ha^{-1})	Zn (mg kg^{-1})
1	Kamalghat	0 - 15	4.80	0.95	277.00	32.64	148.04	0.71
2	Mohanpur	0 - 15	4.10	0.59	177.00	23.74	130.90	0.42
3	Hezamara	0 - 15	4.02	1.89	251.00	28.71	152.54	1.98
4	Kalyanpur	0 - 15	4.33	2.01	311.00	28.05	105.63	1.66
5	Hawaibari	0 - 15	5.30	0.68	287.00	47.64	129.82	1.48
6	Teliamura	0 - 15	5.40	0.55	172.00	29.48	97.00	1.28
7	Mandwai	0 - 15	5.20	0.61	124.00	27.05	112.63	1.19
8	Jirania	0 - 15	5.10	0.30	193.00	29.00	143.55	2.10
9	Simna	0 - 15	5.90	0.90	247.00	32.64	151.72	1.47
10	Tulabagan	0 - 15	4.58	1.76	231.00	27.84	145.71	1.30
11	Tuichindrai	0 - 15	4.68	1.94	111.20	68.76	187.92	1.58
12	Pulinpur	0 - 15	4.51	1.91	150.74	55.60	155.64	1.57
13	Bishalghar	0 - 15	6.10	2.18	171.89	31.20	202.64	1.61
14	Melaghar	0 - 15	6.21	2.01	166.00	37.80	139.96	1.68
15	Ramkrishnapur	0 - 15	6.10	1.70	159.00	37.60	173.48	0.51
16	Boxanagar	0 - 15	5.21	1.29	237.20	32.30	238.38	0.57
17	Salema	0 -15	4.40	1.98	126.03	18.30	294	0.81
18	Kulai	0 -15	4.28	1.16	193.56	18.05	258.00	1.25
19	Manikbhandar	0 -15	4.51	1.99	128.00	26.30	237.62	1.01
20	Dumacherra	0 -15	4.42	1.87	46.46	21.00	298.00	0.95
21	West Kathalcherra	0 - 15	5.19	1.05	220.00	26.13	159.00	1.22
22	Mainama	0 - 15	5.11	0.88	116.00	23.87	115.00	0.71
23	Labancherra	0 - 15	4.81	2.98	98.70	12.45	169.00	0.95
24	Rangamati	0 - 15	4.52	3.55	152.80	18.72	265.10	1.05
25	Debbari	0 - 15	4.16	2.98	176.87	23.50	221.78	1.44
26	Mirza	0 - 15	4.29	3.26	142.13	17.00	235.00	1.56
27	Palatana	0 - 15	5.03	1.83	76.52	27.56	148.00	1.66
28	Jatanbari	0 - 15	4.77	1.62	251.00	20.20	87.45	1.31
29	Bagma	0 - 15	4.82	1.41	201.00	19.50	95.00	0.98
30	Rajnagar	0 - 15	4.22	1.83	226.00	20.20	102.73	0.71
31	Bagabasa	0 - 15	4.61	1.31	261.00	10.44	88.12	1.74
32	Tepania	0 - 15	4.40	1.42	249.00	16.70	91.78	0.90
33	Kalshi	0 - 15	4.92	1.41	198.00	26.50	109.10	0.89
34	Barpathri	0 - 15	4.78	1.42	198.50	14.80	125.40	0.98
35	Rajnagar	0 - 15	4.82	0.91	198.00	16.00	122.00	1.54
36	Hrishyamukh	0 - 15	4.01	0.42	161.00	13.20	96.80	1.33
37	Manu Bazar	0 - 15	4.76	0.28	285.00	19.00	87.50	1.55
38	Betaga	0 - 15	4.21	0.56	297.00	19.88	103.56	1.75
39	Madhabnagar	0 - 15	5.07	0.32	256.00	33.10	108.72	1.63
40	Vanghmun	0 - 15	4.33	1.03	176.00	14.00	123.86	1.59
41	Jubrajnagar	0 - 15	4.21	1.02	306.64	18.00	98.90	1.41
42	Kadamtala	0 - 15	4.40	1.59	210.10	11.00	100.29	1.39
43	Kanchanpur	0 - 15	4.09	1.52	149.00	18.70	101.54	1.51
44	Manuvalley	0 - 15	4.01	0.51	165.70	12.00	98.75	0.97

45	Fatikroy	0 - 15	4.16	0.49	178.90	26.70	102.36	0.69
46	Kanchanbari	0 - 15	4.56	0.78	110.30	21.00	122.89	1.15
47	Gokulnagar	0 - 15	4.29	0.31	152.80	29.80	87.56	0.82
48	Rangauti	0 - 15	4.21	0.28	165.00	25.00	78.44	0.91
49	Machmara	0 - 15	4.33	0.49	110.84	24.89	91.00	0.84
50	Chandipur	0 - 15	4.16	0.52	98.50	20.79	87.50	1.08

Table 2: Characterization of soil testing values for different nutrients

Sl.No	Parameters	Status of Available soil nutrients		
		Low	Medium	High
1.	Organic Carbon (%)	< 0.5	0.5-0.75	> 0.75
2.	Available Nitrogen (kg/ha^{-1})	< 280	280-560	> 560
3.	Available Phosphorus (kg/ha^{-1})	< 10	10-25	> 25
4.	Available Potash(kg/ha^{-1})	< 120	120-280	> 280

Conclusion

Based on the results obtained from the study, we concluded that soils of the study area are strongly acidic, normal salt content safe for crop production. The organic carbon status of the soil is medium and the available N amount exhibited low to medium status in the soil while available P and K levels in the soils were in medium categories. The concentrations of available Zn in all the soil samples analyzed were low which could be as a result of the strongly acidic nature of the soils in the study area. We therefore recommend that agricultural lime be applied on the soil so as to raise the soil pH to required level of 5.5 – 7.8 for crop productivity. Nitrogen and organic fertilizers are required to be applied on the soil to increase crop yield sustainably.

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