IJFANS INTERNATIONAL JOURNAL OF FOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 01, 2023

INVESTIGATION ON CERTAIN PARAMETERS OF SOIL FROM THREE WATER BODIES OF BARPETA DISTRICT, ASSAM

Abdul Gafur[1], Santoshkumar Abujam[2]
[1]Department of Botany, Hatsingimari College, Hatsingimari, South Salmara Mankachar, Assam.
[2]Department of Zoology, Pravabati College, Mayang Imphal, Imphal West, Manipur.
*Corresponding author: abdulgafur3066@gmail.com

Abstract

A rapid estimation of certain soil quality parameters were undertaken in 3 different wetlands of Barpeta districts, Assam from the month of March, 2018 to February, 2019. The sampling and analysis were performed following the standard methods and recommended protocols for each of the parameters. It reveals that the highest pH soil of 6.56 was recorded in Manash *beel* and the lowest of 5.32 in Kapla *beel*; the highest organic carbon (3.32 %) and lowest (1.68%) were found in Kapla; the higher soil available nitrogen 1218.56 ppm was recorded in Kapla while the lowest value of 314.12 ppm was found in Manash. The highest values for soil available phosphorus 58.93 ppm was recorded in the Kapla *beel* and its lowest 5.83 ppm in Manash; the highest soil available potassium (199.38 ppm) was recorded in Kapla and its lowest (44.26 ppm) in Manash. The results obtained from the soil quality revealed that there was distinct slight variation among the studied wetlands.

Key words: Beels, Seasonal variation, Soil, wetland, Assam.

INTRODUCTION

Soil is one of the most important abiotic factors of the wetland ecosystem. The growth of plants usually depends on the supply of nutrients, water supply and anchorage. It is the net result of the influence of climate and vegetation on the parent materials of the earth surface. The soil is composed of particles which are variable in size, shape and chemical composition. The various physical and chemical properties of soils are responsible for the growth of plants in different soil types. The different characteristics of soils vary from place to place. In soil, physical, chemical and biological actions occur constantly and are closely interrelated. The physical form of the soil plays an important role in influencing the nature of biological and chemical reactions as soil is closely connected in maintaining the productivity of any water body and water quality and also a vital factor for metabolic processes of biological species living in the water bodies.

Many studies on physico-chemical, soil and biological aspects of water of wetlands were done made throughout the world, including different parts of lndia. Important contributions were made by Tiwari and Ranga (2006), Gilles (2005). Other important contributions include those by Sankaranarayanan and Pananpunnyil (1979) studied on organic carbon, nitrogen and phosphorus in sediments of Cochin back water; Reddy *et al*. (1989) studied the nitrogen fixation at the plant root sediment interfaces. Brady (1990) reported organic matters of soil which play an important role in the soil

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 01, 2023

environment; Venterink *et al.* (2002) studied on impact drying and re-wetting on N, P, K dynamics; Chaturvedi and Sankar (2008) reported a comparative account of sediment in upper and downstream wetlands of river Banganga, Uttaranchal; Bera *et al*. (2008) studied the sediment quality of the Deepor beel, Assam. Recently, Abujam *et al*. (2021) studied on spatial variation of the soil and water qualities in the mountain lakes of Arunachal Pradesh. Considering the importance and current scenario, the present study has taken up to measure the seasonal variation of the soil quality from the 3 different beels of Barpeta, Assam.

MATERIALS AND METHODS

An investigation was carried out on the certain physico-chemical characteristics of soils from different wetlands viz., Kapla, Amguri and Manash and these are located to the Barpeta district, Assam during 2018-2019.The Kapla *beel* (Fig. 1) of the district lies between $26^{0}20^{//}28^{/}$ to $26^{0}20^{//}28^{/}$ N latitude and $90^{0}12^{//}47^{/}$ to $91^{0}15^{//}23^{/}$E longitude, that covers an area of 91 ha of land and the depth is about 5 to 10 meters. The Amguri *beel* (Fig. 2)lies between 26^{O} $21^{//}01^{/}$ to $26^{O}20^{//}50^{/}$ N latitude and $90^{O}56^{//}13^{/}$ to $90^{O}64^{//}11^{/}$ E longitude. The beel is an Ox-bow type of lake which originates from Baki River near Kalgachia revenue village. The total area of the beel is 58 ha and average depth is 4-7 meters. Manash beel (Fig. 3) lies between 26^{O} $36^{//}35^{/}$ to $26^{0}38^{//}30^{/}$ N latitude and $91^{0}12^{//}58^{/}$ E to $91^{0}50^{//}16^{/}$ E longitude. It is also Ox –bow type and originated directly from Palla river near Pallarpar revenue village. This is covering an area of 50 ha and average depth is 3 to 5 meters.

The composite soil samples were collected from the different sitesof the selected wetlands and mixed to get the representative sample. The collected samples were packed properly in polythene bags and marked in each sample and were carried to the laboratory for further analysis.From the dried samples, stones and other foreign materials were removed and the samples were crushed in a mortar to break up aggregates or lumps. The crushed samples were then passed through a 2 mm sieve as this mesh size allows all the nutritionally important factors to pass through it.

Soil p^{H} is measured as per method of Schofield and Taylor (1955); organic carbon was determined by Wet Digestion method (Walkley and Blacks titration method, 1934); Available nitrogen (N_2) was determined by alkaline potassium Permanganate ($KMno_4$) method, (Subbiah and Asija, 1956); Available Phosphorus (P)was determined by Oslen's ($NaHco_3$) method (Oslen *et al*; 1954); Available Potassium (K) was determined by neutral NH_4oAc extraction process as per method of Schollenberger and Simon (1945).

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 01, 2023

Fig.1: A panoramic view of Kapla *beel*

Fig. 2: A panoramic view of Amguri *beel*

Fig. 3: A panoramic view of Manash *beel*

The findings of the various parameters of physico–chemical properties of soil of the wetlands of the experimental sites have been presented in the **Table (1,2,3)** and

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 01, 2023

the average values along with standard deviation and their correlation matrix of all parameters were summarized in the **Table (4, 5, 6, 7).**

P^H: During the present study in the Kapla *beel* in different seasons, the maximum p^H (6.43) was recorded during winter season and minimum p^H (5.32) during monsoon season. In Amguri beel, the maximum p^H (6.53) was recorded during winter season, and minimum p^H (5.47) during monsoon season. Similarly, in Manash beel, the maximum p^H (6.56) was recorded during winter season and minimum p^H (5.43) during monsoon season. The mean values of p^H of the soil of the wetland in the experimental sites were recordedto be (5.83±0.42) in Kapla *beel*; (5.86±0.46) in the Amguri *beel* and (5.83±0.51) respectively.

During the study period in the Kapla *beel* for different seasons soil p^H showed negative correlation with organic carbon, nitrogen, phosphorous and potassium. In the Amguri beel for different seasons, soil P^H showed negative correlation only with organic carbon and positive correlation with nitrogen, phosphorous and potassium. Similarly, in Manash *beel* for different seasons, soil p^Hshowed negative correlation with organic carbon, phosphorus and potassium and positive correlation with nitrogen.

p^H of the soils of the wetlands were recorded to vary from 5.32 to 6.43 in Kapla beel; from 5.47 to 6.53 in Amguri beel and from 5.43 to 6.56 in the Manash beel. The maximum P^H was found in winter season and minimum in monsoon season. Thus variability of P^H indicates that the soil of the wetland is favorable for macrophytic growth due to the presence of available nutrients, sufficient aeration etc. The average soil pH was found to be slightly acidic in most of the lakes probably due to high rainfall as rainwater is known to be slightly acidic. However, the present findings are in contrast to the observations of Das and Bindi (2014) in the soils of Jaisamand lake area and Deb *et al*. (2013) in South Sikkim.

Organic carbon (OC): During the present study in the Kapla beel in different seasons the maximum organic carbon (3.32) was recorded during monsoon season and minimum organic carbon (1.68) during winter season. In Amguri *beel* in different seasons, the maximum organic carbon (2.59) was recorded during post-monsoon season and minimum organic carbon (1.83) during the winter season. Likewise, in Manash beel the maximum organic carbon (2.63) was found during monsoon season and the minimum organic carbon (1.98) was recorded during winter season. The mean values of the soil organic carbon of the wetlands in the study sites were recorded to be (2.44±0.78) in Kapla *beel*, (2.25±0.31) in Amguri *beel* and (2.26±0.28) in Manash beel respectively.

In the Kapla beel for different season, the soil organic carbon showed significantly positive correlation with potassium, nitrogen and phosphorus. In Amguri beel the soil organic carbon showed positive correlation with nitrogen and potassium and negative correlation with phosphorus. Similarly, in case of Manash beel soil organic carbon showed significantly positive correlation potassium and negative correlation with nitrogen.

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 01, 2023

The organic carbon is an important factor for the proper growth of wetland macrophytes in the study sites. In the present study maximum organic carbon was found in monsoon season and minimum in the winter due to decomposition of death and decay of wetland plants.In the present study, maximum organic carbon was recorded in monsoon season and minimum in the winter season due to decomposition of the death and decay of wetland plants.

Soil available Nitrogen: In the present study, in the Kapla beel in different seasons, the available nitrogen (1218.56 ppm) was recorded to be maximum during monsoon season, in 2014 and minimum of soil available nitrogen (945.37 ppm) was recorded during pre-monsoon season. In case of Amguri beel the available soil nitrogen (528.78 ppm) was recorded during post-monsoon season and minimum of soil available nitrogen (343.75 ppm) was recorded during monsoon season, in 2014. Similarly, in Manash beel the maximum available soil nitrogen (637.38 ppm) was recorded during pre-monsoon season and minimum of soil available nitrogen (314.12 ppm) was recorded during monsoon season. The mean values of soil available nitrogen in the wetlands of the study sites were recorded to be (1053.61±123.20) in Kapla beel, (451.01±79.10) in Amguri beel and (486.66±141.35) in Manash beel respectively.

Again in study in the Kapla *beel* the soil available nitrogen showed significantly positive correlation with potassium and simple positive correlation with phosphorus. In Amguri beel for different seasons, the soil available nitrogen showed positive correlation with phosphorus and potassium. Similarly, in Manash beel for different seasons the soil available nitrogen showed significantly negative correlation with phosphorus and potassium.

Soil available phosphorus: The present investigation shows the maximum soil available phosphorus (58.93 ppm) in the Kapla *beel* during post-monsoon season and minimum soil available phosphorus (27.57 ppm) in the pre-monsson season. In Amguri *beel* the maximum available phosphorus (37.92 ppm) was recorded during pre monsoon season and minimum available phosphorus (13.64 ppm) during monsoon season. Likewise, in Manash *beel* the maximum available phosphorus (10.21 ppm) was recorded in monsoon season and minimum soil available phosphorus (5.83 ppm) was recorded during pre-monsoon season. The mean values of the soil available phosphorus in the wetlands of the study sites were recorded to be (41.24±13.54) in Kapla *beel*; (28.33±10.46) Amguri *beel* and (7.49±2.00) in Manash *beel* respectively.

In the present investigation in Kapla *beel* the soil available phosphorus showed positive correlation with potassium; In the Amguri beel the soil available phosphorus showed positive correlation with potassium, and in Manash *beel* soil available phosphorus showed positive correlation with potassium.

Soil available potassium: In the present study in Kapla beel the maximum soil available potassium (199.38 ppm) was recorded during monsoon season 4 and minimum soil potassium (98.27 ppm) was recorded during the pre-monsoon season In

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 01, 2023

Amguri beel the maximum available potassium (162.84 ppm) was recorded during the post-monsoon season and minimum available potassium (126.35 ppm) during the monsoon season. Similarly, in Manash *beel* the maximum potassium (62.38 ppm) was recorded during post -monsoon season and minimum potassium (44.26 ppm) during the pre-monsoon season. The mean values of soil available potassium in the wetlands of the experimental sites recorded to be (144.73±47.26) in Kapla *beel*; (143.00±15122) Amguri *beel* and (51.93± 7.79) in the Manash *beel* respectively.

Conclusion: The available N, P, K content of the soil of the wetland of the study sites were found more in monsoon season and post- monsoon season in all the wetlands due to heavy organic matter decomposition and the accumulation of chemical fertilizers containing N.P.K from the surrounding agricultural fields. The p^H, OC, available NPK of the soils is variable from sites to sites which also influence the productivity of wetland macrophytes. Nitrogen, phosphorous and potassium are the main soil nutrients for normal germination, growth and maturity of plants. The availability of nitrogen depends on the varying degree of soil microbial decomposition (Gairola and Soni, 2010). The study found fluctuations in the available nitrogen, phosphorus, potassium and organic carbon content in the lakes of different altitude. Phosphorous act as a limiting or co-limiting factor of ecosystem productivity (Harpole *et al*., 2011) and low P availability can constrain N_2 fixation (Vitousek *et al*., 2010).

Table 1: Physico-chemical properties of soil of the Kapla *beel*.

Name of the Wetland	Parameters	Monsoon	Post-Monsoon	Winter	Pre-Monsoon
Kapla beel	P^H	5.32	5.59	6.43	5.84
	Organic Carbon (%)	3.32	2.88	1.68	1.88
	Soil Available Nitrogen (ppm)	1218.56	1075.25	975.26	945.37
	Soil Available Phosphorus(ppm)	43.86	58.93	34.62	27.57
	Soil Available Potassium (ppm)	199.38	168.24	113.04	98.27

Table 2: Physico –chemical properties of soil of the Amguri *beel*

Name of the Wetland	Parameters	Monsoon	Post-Monsoon	Winter	Pre-Monsoon
Amguri beel	P^H	5.47	5.67	6.53	5.78
	Organic Carbon (%)	2.27	2.59	1.83	2.31

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 01, 2023

	Soil Available Nitrogen (ppm)	343.75	528.78	485.56	445.97
	Soil Available Phosphorus (ppm)	13.64	28.94	32.83	37.92
	Soil Available Potassium (ppm)	126.35	162.84	144.52	138.32

Table 3: Physico–chemical properties of soil of the wetland of Manash *beel*.

Name of the Wetland	Parameters	Monsoon	Post-Monsoon	Winter	Pre-Monsoon
Manash beel	P^H	5.43	5.51	6.56	5.85
	Organic Carbon (%)	2.63	2.33	1.9 8	2.11
	Soil Available Nitrogen (ppm)	314.12	437.52	557.62	637.38
	Soil Available Phosphorus(ppm)	10.21	7.79	6.16	5.83
	Soil Available Potassium (ppm)	48.25	62.38	52.83	44.26

Table 4: Average values of physico-chemical parameters of soil of the wetlands

Sl. No.	Parameters	Kapla beel	Amguri beel	Manash beel
1	p^H	5.83±0.42	5.86±0.46	5.83±0.51
2	Organic Carbon (%)	2.44±0.78	2.25±0.31	2.26±0.28
3	Available Nitrogen (ppm)	1053.61±123.20	451.01±79.10	486.66±141.35
4	Available Phosphorus(ppm)	41.24±13.54	28.33±10.46	7.49±2.00
5	Available Potassium (ppm)	144.73±47.26	143.00±15.22	51.93±7.79

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 01, 2023

Table 5: Correlation matrix for physico-chemical properties of soil in Kapla beel

	pH	Organic Carbon (%)	Nitrogen (ppm)	Phosphorus (ppm)	Potassium (ppm)
pH	1				
Organic Carbon (%)	-0.908	1			
Nitrogen (ppm)	-0.785	0.945	1		
Phosphorus (ppm)	-0.503	0.712	0.562	1	
Potassium (ppm)	-0.789	0.972(*)	0.975(*)	0.731	1

* Indicateas significant at the 0.05 % level.
** Indicates significant at the 0.01% level.

Table 6: Correlation matrix for Physico-chemical properties of soil in Amguri *beel*

	pH	Organic Carbon (%)	Nitrogen (ppm)	Phosphorus (ppm)	Potassium (ppm)
pH	1				
Organic Carbon (%)	-0.822	1			
Nitrogen (ppm)	0.460	0.127	1		
Phosphorus (ppm)	0.541	-0.142	0.697	1	
Potassium (ppm)	0.195	0.383	0.943	0.458	1

* Indicates significant at the 0.05 % level.
** Indicates significant at the 0.01% level.

Table 7: Correlation matrix for Physico-chemical properties of soil in Manash beel

	pH	Organic Carbon (%)	Nitrogen (ppm)	Phosphorus (ppm)	Potassium (ppm)
pH	1				
Organic Carbon	-0.860	1			

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 01, 2023

(%)					
Nitrogen (ppm)	0.639	-0.910	1		
Phosphorus (ppm)	-0.708	0.966(*)	-0.977(*)	1	
Potassium (ppm)	-0.114	0.040	-0.294	0.100	1

* Indicates significant at 0.05% level.
** Indicates significant at the 0.01% level.

REFERENCES

1. Abujam, S.K., Bushi, D., Jongkey, K., Nimasow, O. D., Nimasow, G. and Das, D. N. (2021). Spatial variation of the soil and water qualities in the Mountain lakes at different altitude of Arunachal Pradesh, India. *Ecology, Environment & Conservation*, 27, S219-S225.
2. Bera,S. K., Dixit, S., Basumatary, S. K and Gogoi, R. (2008). Evidence of biological degradation in sediments of Depor *beel* Ramsar site, Assam as inferred by degraded polynomorphs and fungal remains. *Current Science*, 95(2): 178-180.
3. Brady, N. C. (1990). The nature and properties of soils. Mac Millan publishing, New York.
4. Chaturvedi, R. R and Sankar, K. K (2008). Hydro-Geo chemistry of Banganga river wetland, Haridwar, Uttranchal. *Indian Journal of Environmental Sciences*, 12(1):49-56.
5. Das, B. and Bindi (2014). Physical and Chemical Analysis of Soil Collected from Jaisamand. Universal Journal of EnvironmentalResearch and Technology, 4(5): 260-264.
6. Deb, P., Debnath, P. and Pattanaaik, S. K. (2013). Physicochemical properties and water holding capacity of cultivated soils along altitudinal gradient in south Sikkim, India. *Indian Journal of Agricultural Research*, 48 (2): 120-126.
7. Gairola, S. U. and Soni, P. (2010). Role of soil physical properties in ecological succession of restored mine land - A case study. *International Journal of Environmental Science*, 1(4): 475-480.
8. Gilles, J. G. (2005). Nitrogen study of fertilizers of pollution.*Nature*, 433:791.
9. Harpole, W. S., Ngai, J. T., Cleland, E. E., Seabloom, E. W., Borer, E. T., Bracken, M. E. S., Elser, J. J., Gruner, D.S., Hillebrand, H., Shurin, J. B. and Smith, J. E. (2011). Nutrient co-limitation of primary producer communities. *Ecology Letters*, 14: 852-862.
10. Olsen, S. R., Cole, C. V. and Watanable, F. S. (1954). Estimation of Available Phosphorous in soils by extraction with sodium Bicarbonate. USDA Circular No. 939, US Government Printing Office, Washington DC.
11. Reddy, K. R. Patrick, J. K. W. H. and Lindau, C. W.(1989). Nitrification-denitrification at the plant root –sediment interfaces in wetlands *Limnology and Oceanography*, 34(6):1004-1013.

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 12, Iss 01, 2023

12. Sankarranarayanan, V. N. and Pananpunnayil, S. U. (1979). Studies on organic carbon, nitrogen and phosphorus in sediments of Cochin back water.*Indian Journalof Marine Science*, 8:27-30.
13. Schofield, R. K. and Taylor, A.W. (1955). The measurement of soil pH. *Soil Science Society of America Journal*, 19(2): 146-167.
14. Schollenberger, C. J. and Simon, R. H. (1945). Determination of exchange capacity and Exchangeable bases in soil-Ammonium Acetate method. Soil Science, 59(1): 13-24.
15. Subbiah, B. V. and Asija, G. L. (1956).A rapid procedure for estimation of available nitrogen in soil.*Current Science*, 25:259.
16. Tiwari, M. and Ranga, M. M. (2006). Aquatic sediments analysis with reference to environmental degradation index of khanpurpond, Ajmer. *Pollution Research*, 25(2):453-454.
17. Venterink, H. O. Davidsson, T, E. Kichl, K. and Leonrdson, L. (2002). Impact of drying and re- wetting on N, P, and K dynamics. *Plant and Soil*, 243:119-130.
18. Vitousek, P. M., Porder, S., Houlton, B. Z. and Chadwick, O. A. (2010). Terrestrial phosphorus limitation:mechanisms, implications, and nitrogen-phosphorus interactions. *Ecological Application*, 20: 5-15.
19. Walkey, A. J. and Black, I. A. (1934). Estimation of soil organic carbon by the chromic acid titration method.SoilScience, 37: 29-38