https://doi.org/10.33472/AFJBS.5.4.2023.128-134

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Analysis of Parameters of Agricultural Soil along Horizontal Direction at Different Depths

Meenu

Assistant Professor (Chemistry), K.L.P. College, Rewari, Haryana, India

(E-mail: ghai.meenu@ymail.com)

Article Info Volume 5, Issue 4, 2023

Received:16 Sep 2023

Accepted :28 Oct 2023

Published: 15 Nov 2023

doi:10.48047/AFJBS.5.4.2023.128-134

Abstract

Soil management is must for better crop production. The study involves analysis of eight quality parameters of soil such as pH, EC, available N, P, K, OC, C/N ratio and fluoride in the soil samples. Soil samples were collected from different locations of an agricultural field in the horizontal direction. Samples were collected at two different depths. Parameters are compared at two depths. Correlation analysis among studied parameters has been done in MS-Excel. Sampling and methods of analysis have been done as per standard methods given by APHA, IS and USDA.

Key words: pH, EC, N, P, K, OC, C/N, Fluoride, Correlation

Introduction

Soil health is necessary for the crop production. Soil is a valuable pool of water and nutrients for the crops. Soil quality can be managed by efficient use of nutrients and managing pH level of soil. Time to time analysis of soil is the way to manage soil quality. Uptake of nutrients from soil by the plants is influenced by the pH of soil. Acidity of the soil has to be adjusted to the level so as to avoid the exposure of crops to the toxic metals and availability of nutrients to maximum extent [1]. A study reflects the organic matter, pH, available phosphorous and water storage as the most common soil quality indicators. Soil quality assessment should be done so as to specify threats to soil, functions and ecosystem services [2]. Another study reveals improper soil management is responsible for low yield of an oil plant *Camellia oleifera.* Responsible parameters were found to be low levels of available Phosphorous, available Potassium, available Boron and microbiological activity [3]. A study explains the N, P and K being the major nutrients for most of the crops, plant growth and yield. Ideal pH value of soil ranges from 5 to 7.5 for most of the crops [4]. Soil quality should be continuously assessed

because of its complex and dynamic nature and is being changed by natural and anthropogenic disturbances [5]. Increased organic matter in soil aides in protection of enzymes of soil naturally [6]. Evaluations of soil quality are means to study modifications caused by soil management [7].

Study area

The samples of soil were collected from the agricultural field of village Salarpur, tehsil Tijara, and district Alwar, Rajasthan, India. The studied area has latitude as 27.98 and longitude as 76.85.

Material and Methods

The samples of soil were taken from 5 locations separated from each other by ten meters in an agricultural field along horizontal direction. From each location two soil samples were taken at 0-1 cm depth and from 1-5 cm depth. Total ten samples of agricultural soil were collected. The sampling was done as per standards given by APHA. Another study had already been done from the agricultural field but along vertical direction [8]. The standard methods are followed for analysis, as per IS (Indian Standards), USDA (United States Department of Agriculture) and APHA (American Public Health Association). pH was measured by Electrometric method, EC by Conductivity meter, Available Nitrogen by Kjeldahl method, Available Phosphorous by Colorimetric method, Available Potassium by Flame photometer, Organic Carbon by Titrimetric method, Carbon Nitrogen Ratio by Calculation method and Fluoride by Ion selective electrode method.

Results and discussions

Values and concentrations of studied parameters have been detailed in Table 1. Correlation analysis among parameters at 0-1 cm and 1-5 cm depth has been shown in Table 2.

pH ranges from 7.86 to 8.05 with average value 7.94 at 0-1cm while at 1 to 5 cm the pH range is from 7.76 to 8.17 and average value is 8.034. Soils at all of the locations are alkaline.

Electrical conductivity at 0 to 1 cm has been found to be in the range of 0.231 to 0.416 mS/cm with average value 0.3084 mS/cm. EC at 1 to 5 cm is from 0.209 to 0.366 mS/cm with average value 0.2812 mS/cm.

Available Nitrogen varies from 163.1 to 182.29 kg/hec with average concentration 175.892 kg/hec at 0-1 cm. Concentration of N at 1-5 cm 163.1 to 188.68 kg/hec with average concentration 172.692 kg/hec.

Available Phosphorous range at 0-1 cm depth is from 31.58 to 34.53 kg/hec and average concentration 33.244 kg/hec. At 1-5 cm the range of P is from 28.74 to 36.17 kg/hec with average value 32.632 kg/hec.

Available potassium range in 0-1 cm depth has been found to be 171.32 to 193.16 kg/hec with average concentration 183.192 kg/hec. At 1-5 cm depth concentration of K is found to be 167.96 to 195.4 kg/hec with average concentration 180.504 kg/hec.

Organic Carbon has been found to be in the range of 0.24 to 0.36% with average value 0.312% at 0-1 cm. OC at 1-5 cm is found to be 0.25 to 0.38 % with average value 0.302%.

C/N ratio at 0-1 cm ranges from32.88 to 44.44 with average value 39.574. At 1-5 cm has been found to be in range 34.2 to 45.24 with average of 39.03.

Fluoride concentration at 0-1 cm is in the range of 0.39 to 53 mg/kg with average value of 0.472 mg/kg. At 1-5 cm it has been found to be in the range of 0.42 to 0.47 mg/kg with average value 0.444 mg/kg.

Table 1 Values of various physicochemical parameters of soil along horizontal direction of an agricultural field

Parameters	**HS-depth (cm)**	**L--1**	**L-2**	**L-3**	**L-4**	**L-5**	**Average**	**Std. Dev.**
pH	0 to 1	8.03	7.86	7.86	7.9	8.05	7.94	0.09301
	1 to 5	7.96	8.13	8.15	7.76	8.17	8.034	0.17444
EC	0 to 1	0.261	0.231	0.416	0.343	0.291	0.3084	0.073
	1 to 5	0.302	0.313	0.366	0.216	0.209	0.2812	0.06727
Av. N	0 to 1	179.09	175.89	182.29	179.09	163.1	175.892	7.5004
	1 to 5	166.3	172.69	188.68	163.1	172.69	172.692	9.85495
Av.P	0 to 1	32.13	34.1	34.53	33.88	31.58	33.244	1.30393
	1 to 5	32.9	36.17	35.41	28.74	29.94	32.632	3.2673
Av.K	0 to 1	181.96	182.52	193.16	187	171.32	183.192	8.01211
	1 to 5	167.96	185.88	195.4	173.56	179.72	180.504	10.6885
OC	0 to 1	0.31	0.35	0.36	0.3	0.24	0.312	0.04764
	1 to 5	0.27	0.32	0.38	0.25	0.29	0.302	0.0507
C/N ratio	0 to 1	38.75	44.3	44.44	37.5	32.88	39.574	4.89395
	1 to 5	36.49	41.56	45.24	34.2	37.66	39.03	4.37671
Fluoride	0 to 1	0.48	0.39	0.51	0.45	0.53	0.472	0.05495
	1 to 5	0.42	0.43	0.47	0.46	0.44	0.444	0.02074

Units: pH and C/N Ratio -unit less, EC = mS/cm, Available Nitrogen = kg/hec., Available Phosphorus == kg/hec., Available Potassium = kg/hec., Organic Carbon = %, Fluoride = mg/kg

Abbreviations: HS=Horizontal soil, L=Location, EC= Electrical conductivity, Av.N=Available, Nitrogen, P=Phosphorous, K=Potassium, OC=Organic Carbon, C/N= Carbon/Nitrogen ratio

Comparative study of various parameters with depth has been shown with the help of column charts from Fig.1 to Fig.8.

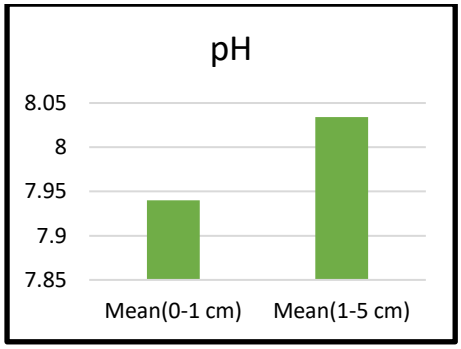

Fig.1

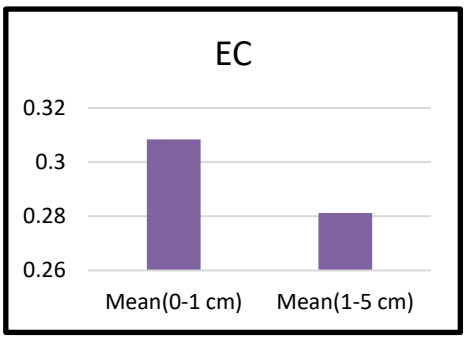

Fig.2

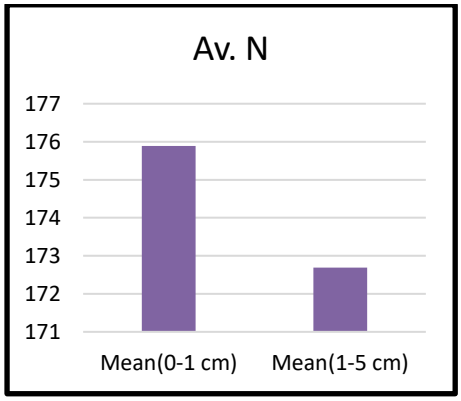

Fig.3

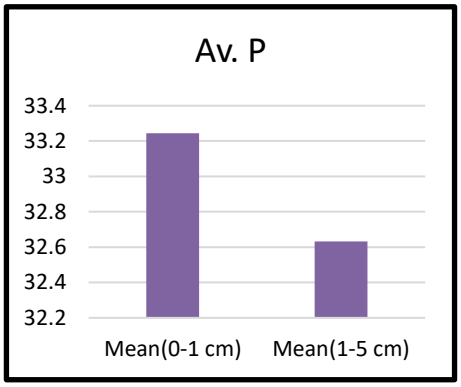

Fig.4

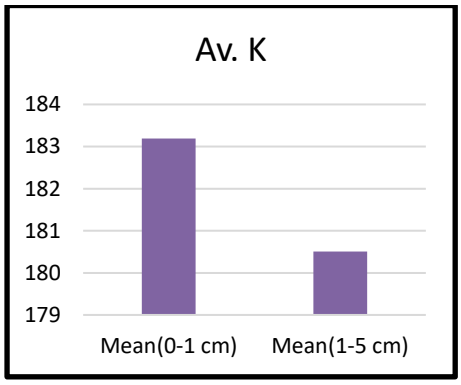

Fig.5

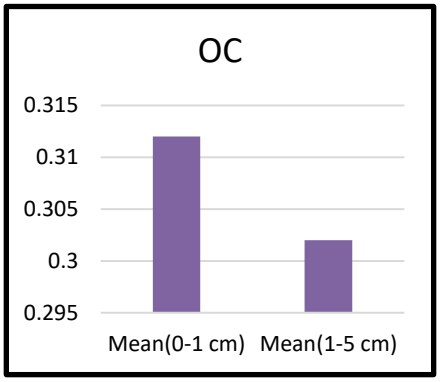

Fig.6

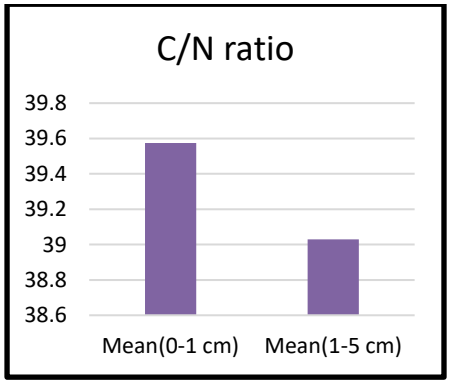

Fig.7

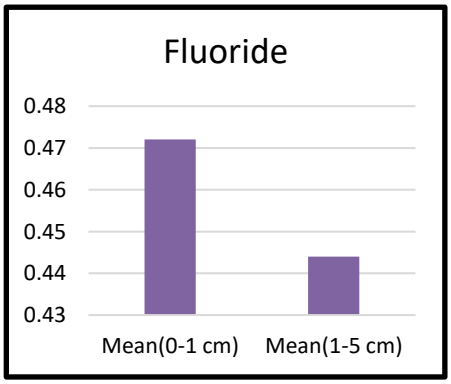

Fig.8

Fig.1 to Fig.8 Column charts showing comparative study of mean values of physicochemical parameters of agricultural soil at 0-1cm and 1-5cm depth

Table 2 Correlation study of physicochemical parameters at depth of 0-1cm and 1-5 cm of soil

	pH(0-1cm)	*pH(1-5cm)*	*EC(0-1cm)*	*EC(1-5cm)*	*Av.N (0-1cm)*	*Av.N (1-5cm)*	*Av.P (0-1cm)*	*Av.P (1-5cm)*	*Av.K (0-1cm)*	*Av.K (1-5cm)*	*OC (0-1cm)*	*OC (1-5cm)*	*C/N ratio (0-1cm)*	*C/N ratio (1-5cm)*	*Fluoride (0-1cm)*	*Fluoride (1-5cm)*
pH (0-1cm)	1															
pH (1-5cm)	0.035	1														
EC (0-1cm)	-0.37	-0.065	1													
EC (1-5cm)	-0.51	0.413	0.238	1												
Av.N (0-1cm)	**-0.63**	-0.403	0.397	**0.656**	1											
Av.N (1-5cm)	-0.4	**0.721**	**0.588**	**0.697**	0.173	1										
Av.P (0-1cm)	**-0.99**	-0.095	0.462	**0.547**	**0.715**	0.42	1									
Av.P(1-5cm)	-0.51	**0.589**	-0.08	**0.912**	0.414	**0.621**	0.487	1								
Av.K (0-1cm)	**-0.78**	-0.264	**0.65**	**0.653**	**0.931**	0.414	**0.857**	0.402	1							
Av.K (1-5cm)	-0.64	**0.666**	0.498	**0.585**	0.134	**0.914**	**0.621**	**0.617**	0.418	1						
OC (0-1cm)	**-0.82**	0.086	0.227	**0.875**	**0.828**	0.477	**0.84**	**0.815**	**0.828**	**0.532**	1					
OC (1-5cm)	-0.52	**0.728**	0.468	**0.79**	0.252	**0.976**	**0.523**	**0.764**	0.461	**0.937**	**0.619**	1				
C/N ratio (0-1cm)	**-0.82**	0.216	0.169	**0.884**	**0.732**	**0.534**	**0.824**	**0.877**	**0.752**	**0.611**	**0.988**	**0.684**	1			
C/N ratio (1-5cm)	-0.54	**0.749**	0.352	**0.822**	0.257	**0.938**	**0.534**	**0.839**	0.436	**0.922**	**0.666**	**0.99**	**0.741**	1		
Fluoride (0-1cm)	0.563	0.257	**0.516**	-0.13	-0.33	0.354	-0.49	-0.35	-0.2	0.056	-0.498	0.151	-0.513	0.03638	1	
Fluoride (1-5cm)	-0.54	-0.102	**0.932**	0.091	0.309	**0.508**	**0.601**	-0.13	0.612	**0.57**	0.218	0.419	0.182	0.31733	0.29836	1

= Strong positive correlation = Moderate positive correlation = Strong negative correlation

Conclusion

Study concludes that along horizontal direction in the given agricultural land of the studied area, the overall pH (mean value) increases slightly with depth i.e. soil becomes more alkaline. With the rise in alkalinity overall values i.e. mean values of other parameters such as EC, Available Nitrogen, Phosphorous, Potassium, Organic Carbon, Carbon Nitrogen ratio and Fluorides decrease slightly with depth. In the other similar study [8] along vertical direction of the agricultural field, all of the given parameters such as mean values of pH, EC, available N, P, OC, C/N ratio and fluorides increase with depth, whereas mean concentration of available K decreases with depth. Location-3 (L-3) out of all has been found to have maximum values of EC, Av.N, P, K, OC, C/N ratio and Fluoride at both depths. It may be due to concentration of fertilizer at this particular location.

There is not only slight difference between values of parameters along horizontal and vertical direction [8]. Also the concentrations of available N, P, K and C/N ratio show large standard deviations which is also true for the other similar study along vertical direction of the same agricultural field [8].

Correlation analysis of the present study reveals that at 0-1 cm depth Available N, available P and available K are strongly linearly correlated with each other. At 1-5 cm depth Available N and K are moderately correlated with available P whereas available N and K are strongly correlated with each other. Available N, P and K at 0-1cm depth are strongly linearly correlated with organic carbon and carbon nitrogen ratio at 0-1 cm depth. Similar strong correlation has been observed between available N, P and K at 1-5cm depth and OC and C/N ratio at 1-5cm depth. Available P at 1-5 cm is even strongly correlated with OC and C/N ratio at both of the depths. OC at both of the depths has strong linear correlation with C/N ratio at respective depths. C/N ratio at 0-1 cm is also linearly correlated with C/N ratio at 1-5 cm. pH at 0-1 cm depth is negatively correlated to all of the rest of parameters except Fluorides at 0-1 cm depth. Whereas pH at 1-5 cm depth is strongly correlated to Available N, OC and C/N ratio and N and moderately correlated to P and K at the same depth. EC at 0-1 cm is positively correlated with Fluorides whereas EC at 1-5 cm is not correlated with Fluorides. EC at 1-5 cm is mostly positively correlated to all of the parameters except Fluorides.

Correlation analysis is helpful to make predictions so that fertilizers may be used more efficiently.

References

1. www.agrivi.com, Ines Hajdu, The Importance of Soil Analysis in Agriculture, Agronomy, Blog, *AGRIVI*

2. Bünemann, E.K., Bongiorno, G., Bai, Z., Rachel E. Creamer, R.E., Deyn, G. D., Goede, R. D., Fleskens, L., Geissen, V., Kuyper, T. W., Mäder, P., Pulleman, M., Sukkel, W., Groenigen, J. W. V. and Brussaard, L., 2018, Soil quality – A critical review, *Soil Biology and Biochemistry*, 120, 105-125.

3. Liu, J., Lichao Wu, L., Chen, D., Li, M. and Wei, C., 2017, Soil quality assessment of different *Camellia oleifera* stands in mid-subtropical China, *Applied Soil Ecology*, 113, 29-35.

4. Bhatia, S., Nair, R. S. and Mishra, V.P., 2021, Nutrient Analysis of Soil Samples Treated with Agrochemicals, *International Conference on Computational Intelligence and Knowledge Economy (ICCIKE)*, March 17–18, 2021, Amity University Dubai, UAE.

5. Maurya, S., Abraham, J.S., Somasundaram, S., Toteja, R., Gupta, R. and Makhija, S., 2020, Indicators for assessment of soil quality: a mini-review, *Environmental Monotoring and Assessment*, 192, 604. https://doi.org/10.1007/s10661-020-08556-z
6. Fazekasova, D., 2012, Evaluation of Soil Quality Parameters Development in Terms of Sustainable Land Use, *Sustainable Development-Authoritative and Leading Edge Content for Environmental Management*, IntechOpen.
7. Gholamhosseinian, A., Bashtian, M. H. and Sepehr, A., 2022, Soil Quality: Concepts, Importance, Indicators, and Measurement, *Soils in Urban Ecosystems*, 161-187, Springer, Singapore. https://doi.org/10.1007/978-981-16-8914-7_8
8. Meenu, 2022, Study of soil quality parameters along vertical direction of an agricultural field and variation with depth, *IJFANS*, 11(11), 2808-2819.