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PHYSICO-CHEMICAL ANALYSIS IN SOIL OF SAMPLE BLOCK, ROHTAK (HARYANA), INDIA

BINDU, NAVEENA DINODIA AND SEEMA KUMARI*

Department of Botany, Baba Mastnath University, Asthal Bohr, Rohtak 124 021, Haryana, India

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ABSTRACT

Soil is the main constituent to the fulfillment of all basic needs of plants, agriculture and human beings. Soil is occupied by Indian agriculture for proper implementation and management practices. Physico-chemical study is very significant due to soil productivity which is based on various parameters like pH, electrical conductivity, texture, moisture, temperature, soil organic matter, available nitrogen, Phosphorous ,Potassium, were studied in soils of Sampla block of Rohtak, District, Haryana, India. This block includes 22 villages namely Atail, Bhainsru Kalan, Bhainsru Khurd, Chulliana, Dataur, Gandhara, Garhi Sampla, Gijji, Hassangarh, Ismaila11, Ismaila 9b, Karaur, Kheri Sadh, Kisranti, Kultana, Morkheri, Nayabans, Nonand, Pakasma, Samchana, Sampla ,Kheri Sampla. The soil samples were collected from agricultural land and analysed by Soil kit method in the present study.

KEYWORD: Soil composition, Physico –chemical, Soil contaminations, Soil samples.

INTRODUCTION

Soil is a priceless, unique and a great valuable resource that could be described as the "soul of infinite life"(Chepuri, 2023). Soil is the main element of survival for all living things includes: plant, animal and microbes. Soil quality may include capacity of the water retention ,carbon sequestration, plant productivity, waste remediation and other function or, it may be defined narrowly. This report traces the N development of the concept of land quality explores the use of soil chemical and physical attributes as determines of soil quality. For farming soil scientist to play a major role in the assessment and advancement of sustainable soil management in making the concept of soil quality as indicator of sustainability. After doing all these things the specific process or properties that changes in the dependent to each other by combined actions of physical and chemical attributes (Sunil *et al*., 2023). Soil is provide main material for plant growth and fertility (Mureva and Ward, 2017). Crop producing capacity and productivity is mainly influenced by soil, soil fertility, management practices, soil properties and climate (Lal, 2011). The performance of soil functions are mainly identified or indicated by the soil properties (Ma, *et al.,* 2020). Soil directly and indirectly influences the growth of plants by providing water or nutrients and the decomposition or transformation by microorganisms (Wu *et al.,* 2018), (Lange *et al.,* 2015; Wu *et al*., 2019). The quality and health of soil determine agricultural sustainability, environmental quality, the plant, animal and human health. Soil samples that determine their physical, chemical, and biological properties, are tested under soil analysis (Chepuri *et al.,* 2023).Soil physicochemical properties may also play major roles in the maintenance of plant diversity due to continuous of nutrient supplies for their proper growth and development (Gong, *et al*., 2019). Several studies have examined soil nutrients, pH and soil water to be the main abiotic factors that affect plant diversity (Yan *et al*., 2015; Damgaard *et al*., 2013). For vegetation development the nitrogen and phosphorus are most limiting soil nutrients (Liu *et al*., 2021; Yang, *et al*., 2021). Nitrogen (N), potassium (K), and Phosphorus (P) are very essential for plant growth and also for the strengthening of reproductive parts, activation of enzymes, and

carbohydrate metabolism. Nitrogen is a common limiting nutrient in nature and agriculture. Nitrogen (N) plays an important role in crop plants. It is involved in various critical processes, such as growth, leaf area-expansion and biomass-yield production. Globally increasing nitrogen (N) deposition is recognized as an important regulator of soil microbial communities. However, how N enrichment affects soil microbial diversity, richness and community structure remains unclear at the global scale (Wang *et al.*, 2023). Nitrogen is required for all organisms to live and grow because it is the essential component of DNA, RNA, and protein. Application of nitrogen increases greenness of plants, CO_2 assimilation rate, crop quality-yield and improve resistance to environmental stresses such as limited water availability and saline soil conditions (Chen *et al*., 2010).

Potassium (K) plays a significant role in various vital processes within the plants. K is one of the 17 chemical elements required for plant growth and development. It is present dissolved in the soil water, adsorbed onto particles of clay and organic matter and held within the layers of clay particles. K is found in four forms in the soil: Ionic form (0.1"0.2%), exchangeable form (1–2 %), are utilized by the plants and available for the immediate requirement by plants and non-exchangeable form (1–10 %), unavailable form (90–98 %) non-labile one and they maintain the supply for longer-term.

Phosphorus (P) is a necessary macronutrient for plant growth and metabolism, but P applied to the soil can be easily fixed by metal cations (Al, Fe, and Ca) or absorbed onto mineral surfaces, leading to low P availability. The excess P may result in a wide range of environmental problems, such as water eutrophication, soil biodiversity reduction, and the degradation of ecosystem functions.

Soil pH is an important soil chemical property which controls many soil properties and it is affected by climate, soil buffering system, plants, etc. (Hong, *et al*., 2019). Soil acidity is measured as pH (the concentration of H^+ ions) with a logarithmic scale running from pH 1 (very acid), through pH 7 (neutral) to pH 14 (very alkaline). The range found when soil sampling is likely to be between pH 4.5-8.5.In topsoil pH values are more affected by precipitation and evaporation. Abundant amount of rainfall causes the leaching of calcium and magnesium ions which lowers soil pH (Zhao *et al.,* 2018b) and where rainfall is relatively lower, serious soil salinization occurs in sandy soil as a result of evaporation exceeding precipitation, which lead to higher soil pH values (Zhao *et al.,* 2018a). Soil pH is vital in determining the variation of microorganisms' community structure and diversity (Tripathi *et al.,* 2018)

Keeping in view of importance of soil's physical and chemical properties, the present study of Physico-chemical properties of soil collected from various locations of block of Sampla district Rohtak, Haryana.

MATERIALS AND METHODOLOGY

Site specification and sampling

Area of study is Sampla Block of Rohtak district which is situated in south east of Haryana state. It is surrounded by Sonipat district in North, Jhajjar district in south, Delhi in East, Bhiwani district in west, Charkhi dadri district in south west. Sampla is 48 km of capital of India and 245 km of capital of Haryana Chandigarh And is situated between 28° 46' 34.1652'' N latitude and 76° 46' 23.1924'' E longitude respectively. The temperature of the sampla is varies from 2 °C to 44 °C. Rainfall is annual rainfall about (237-250 mm) mainly in month of July -August. The climate is semi arid with extreme temperature conditions in summer and winter. Winter temperature is 8.7 °C to 20.7 °C and 35 °C to 44°C in summer. Average humidity is about 18%. The winter span is Dec to Feb. The topography is consist of flat and levelled plain, in some villages land is interrupted with cluster of sand dunes (Morkheri, Kisrenti, village).

Soil samples: The study area included all the 22 villages of the Sampla Block of Rohtak Distt. in Haryana based on the quality of the soil obtained from all corners as well as the center of each region on a 2-feet depth The collection of soil Samples was done from in these villages in the month of Mar'22. Soils samples will be collected from different regions of Meham Block Rohtak district, surface 10-15 cm (top soil). Soil samples were sieved to 4 mm and kept at 4 ºC until analysis (maximum storage time 4 weeks).

METHODOLOGY

Major reagents used for soil testing method For soil pH test method distilled water and pH reagents, organic carbon test organic-A and organic-B compounds, testing available nitrogen test Nitro-1 and Nitro-2 , testing phosphorus in soil Phos-1,

Fig. 1. Kit used for testing

Phos-2 and Phos-3 were used.

Experimental Methodology

Soil Preparation Take about 100gm of soil and Grind it with the help of mortar and pestle and after that sieve it.

Soil pH test method With the help of a spatula 20 grams of sieved soil sample were put in the test tube. Add 50 ml distilled water to it with the help of a measuring cylinder and stir it well. Filter this mixture through filter paper and funnel. Then add 2-3 drops of pH reagent until the color is produced. Now color is matched with the pH chart.

Soil organic carbon test method Put 20 g of soil sample in the test tube with the help of a spatula. Add 10 ml organic-A in the test tube with the help of a measuring cylinder then also adds 10 ml organic-B in the same test tube and mix it well. After 15-20 min filter this mixture into the test tube. Now the color appears to match the organic carbon chart.

Testing of available nitrogen in the soil Put 20 g of soil sample in the test tube with the help of a spatula. Add 5 ml Nitro-1with the help of a measuring cylinder and mixed it well. Filter the mixture with filter paper and a funnel. Now add 2-3 drops of Nitro-2 and mixed it until the color produces then matched the color with the nitro chart.

Testing of available phosphorous in the soil Put 2milli Phos-2 in the test tube with the help of a dropper now add a pinch of Phos-3 so in this way, phos-4 are prepared. With the help of a spatula put 20 g of soil sample in the test tube. Add 5 ml Phos-1 with the help of a measuring cylinder and mix it for 1 min. Now filter the mixture in the test tube. Then add 1 ml Phos-4 to the filtered mixture until the blue color is produce. Appeared color matched with the Phosphorous color chart.

Testing of available potash in the soil Put 2 ml distilled water in the test tube, add a pinch of potas-2 with the help of a spatula in the same test tube mixed it well so the Potas-3 is prepared. Put 20 g of soil sample in the test tube. Add 5 ml Potah-1 with the help of a measuring cylinder. Filter the mixture the add 2-3 drop of Potash-3 until the color produced matches the appearing color with the potash color chart.

With the help of all these method, we can find the available physiochemical parameter in soil.

RESULTS AND DISCUSSION

Soil pH test method with chart of soil kit: The most significant property of soil is its pH level, its effects all other parameters of soil therefore, pH is considered while analysing any kind of soil. If the pH is less than 6 then it is said to be an acidic soil, the pH range from 6-8.5 it's a normal soil and greater than 8.5 then it is said to be alkaline soil. pH test of soil samples was done to measure the pH range value. After testing different pH value was shown that show in the given below Table 1.

Soil organic carbon test method: The organic matter is an important of the soil that contributes to the soil fertility. Soil organic carbon is the basis of soil fertility. It release nutrient for plant growth, increasing soil organic carbon improves soil health and fertility Organic carbon ranges from 0.52 to 0.72 %. Medium proportion of organic carbon. Soil sample was tested for organic carbon the result was seen in the below given Table 1.

Testing of available nitrogen present Nitrogen is the most crucial element obtained by plants from the

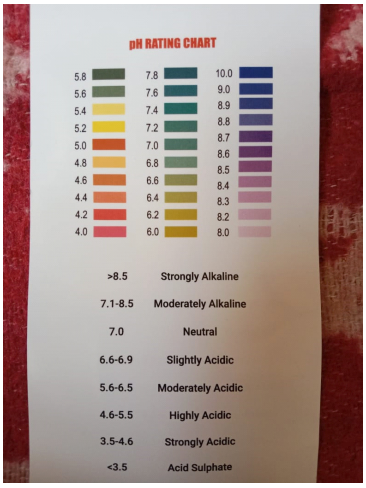

Fig. 2. pH rating chart

soil and is a bottleneck in plant growth, about 80% of the atmosphere is nitrogen gas. Nitrogen gas dissolved into water where it can be fixed convert by blue- green algae to ammonia for algal use. Nitrogen can also enter lakes and streams as inorganic nitrogen and ammonia nitrogen is found in all soils which are required by all living creatures. In plants, nitrogen is the nutrient required in the largest amounts. Result of nitrogen in soil was given in below Table 1.

Testing of available phosphorous in soil. Phosphorous is a mineral that naturally occurs in many foods and is also available as a supplement. It is a non - metallic element of the nitrogen family. Important element in every living cell. It helps in energy storage and transfer in study area phosphorous ranges 15.11 to 54.13 kg/ha. Result of phosphorous in soil was given in below Table 1.

Testing of available potash in soil Potassium plays a major role in different physiological processes of vegetation. Potassium is major nutrient for the production of for the greenery. It is agitator in nature. Potassium is one of the most important elements for the development of greenery plant. Potassium is a key plan element although it is soluble in water, little is lost from undisturbed soils because as it is released from dead plants and animal excrements, it quickly become strongly

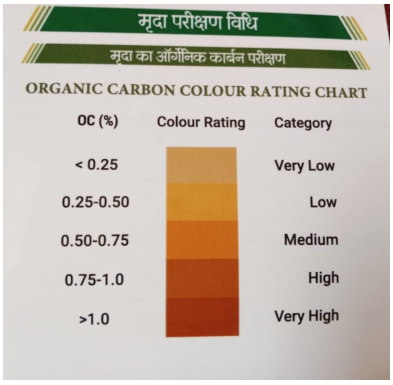

Fig. 3. Organic carbon color rating chart

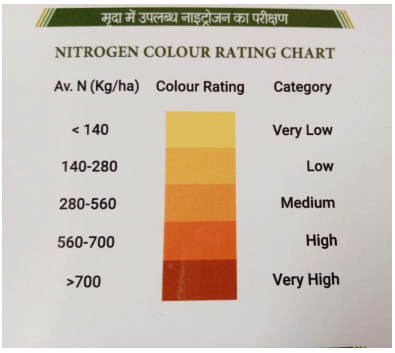

Fig. 4. Nitrogen colour rating chart

Table 1. Results of physicochemical properties of Sampla Block

Sr. No.	Village	Block	pH	Nitrogen	Phosphorus	Potash	Organic carbon (%)
1	Atail	Sampla	5.8	140-280	10-25	> 560	0.75-1.0
2	Bhainsru Kalan	Sampla	7.4	140-280	< 5	280-560	0.75-1.0
3	Bhainsru Khurd	Sampla	8.3	< 140	5-10	120-280	0.25-0.50
4	Chulliana	Sampla	6.8	< 140	< 5	60-120	0.50-0.75
5	Dataur	Sampla	8.0	< 140	5-10	> 560	0.25-0.50
6	Gandhara	Sampla	5.6	141-280	< 5	201-250	>1.0
7	Garhi Sampla	Sampla	6.8	141-280	18-25	201-250	0.50-0.75
8	Gijji	Sampla	8.7	140-280	10-25	280-560	0.75-1.0
9	Hassangarh	Sampla	8.0	< 140	10-25	> 560	< 0.25
10	Ismaila11B	Sampla	8.0	< 140	18-25	> 560	< 0.25
11	Ismaila 9B	Sampla	8.1	< 140	18-25	> 560	< 0.25
12	Karaur	Sampla	6.4	< 140	26-35	201-250	>1.0
13	Kheri Sadh	Sampla	8.4	< 140	18-25	280-560	< 0.25
14	Kisranti	Sampla	6.8	140-280	10-25	280-560	0.50-0.75
15	Kultana	Sampla	6.6	141-280	11-17	201-250	>1.3
16	Morkheri	Sampla	8.4	140-280	10-25	280-560	>1.0
17	Nayabans	Sampla	6.8	< 140	18-25	201-250	>1.0
18	Nonand	Sampla	5.6	141-280	< 5	251-300	>1.3
19	Pakasma	Sampla	7.0	< 140	< 5	201-250	0.75-1.0
20	Samchana	Sampla	7.4	141-280	< 5	201-250	1.1-1.3
21	Sampla	Sampla	7.2	280-560	< 5	120-280	>1.0
22	Kheri Sampla	Sampla	5.8	141-280	6-10	151-200	1.1-1.3

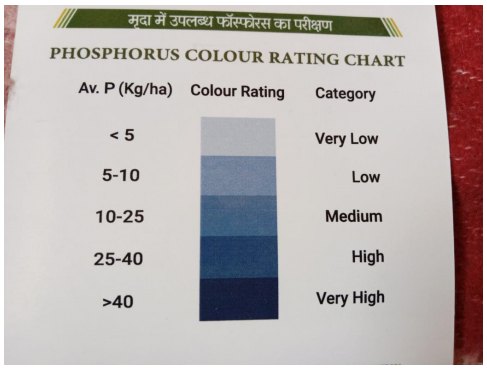

Fig. 5. Phosphorus color rating chart

bound to clay particles, and it is retained ready to be absorbed by the roots of other plants. It is agitator in nature. Potassium is one of the most important elements for the development of greenery plant. Potassium is a key plant element although it is soluble in water, little is lost from undisturbed soils because as it is released from dead plants and animal excrements, it quickly become strongly bound to clay particles, and it is retained ready to be absorbed by the roots of other plants. Result of potash in soil in Table 1

DISCUSSION

The study area soils showed highest pH was of Ismaila and lowest of Atail. Highest EC was of Morkheri and lowest of highest OC was found in Hassangarh and lowest was of Atail. Highest nitrogen content was found in Nonand and lowest was in Kraur. Highest Phosphorus was found in Dataur and lowest was in Attail. Highest pottasium was in Kultana and lowest was found in Attail. Highest Sulphur content was found in Pakasma and lowest was found in bhaisru khurd. Highest Zinc was found in Pakasma and lowest was found in Kisransi. Highest iron was found in Bhainsru kalan and lowest was found in Naya Bans. Highest magnesium content was found in Pakasma and lowest was found in Naya Bans. Highest copper was found in Kisranti. A total of 22 samples were examined using the methods described above, and the results are showcase in the table above. Most of the parameters are quite higher or lower than acceptable limits. Therefore, it is very important to put a total ban on the human activities which are responsible for soil quality deterioration. The result of this study covers the effects of soil compaction on soil physical and chemical properties like soil pH, EC, soil organic content at different depths.

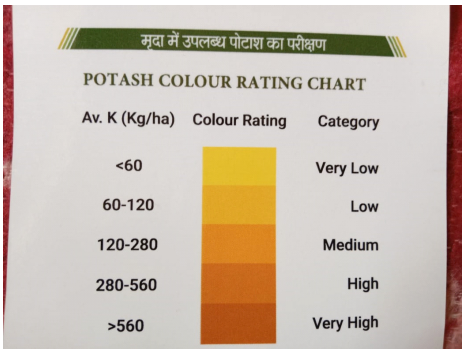

Fig. 6. Potash color rating chart

REFERENCES

Chen, W., Hou, Z., Wu, L., Liang, Y. and Wei, C. 2010. Effects of salinity and nitrogen on cotton growth in arid environment. *Plant Soil.* 326:61-73.

Damgaard, C., Ejrnaes, R. and Stevens, C.J. 2013. Intra-specific spatial aggregation in acidic grasslands: Effects of acidification and nitrogen deposition on spatial patterns of plant communities. *J. Veg. Sci.* 24: 25-32. [Google Scholar] [CrossRef]

Gong, Y., Ling, H., Lv, G., Chen, Y., Guo, Z. and Cao, J. 2019. Disentangling the influence of aridity and salinity on community functional and phylogenetic diversity in local dryland vegetation. *Sci. Total Environ.* 653: 409-422. [Google Scholar] [CrossRef] [PubMed]

Hong, S., Gan, P. and Chen, A. 2019. Environmental controls on soil pH in planted forest and its response to nitrogen deposition. *Environmental Research.* 172: 159-165.

Lal, R. 2011. Soil degradation as a reason for inadequate human nutrition. *Food Sec.* 3(2):137-147.

Lange, M., Eisenhauer, N., Sierra, C.A., Bessler, H., Engels, C., Griffiths, R., Mellado-Vázquez, P.G., Malik, A.A., Roy, J. and Scheu, S. 2015. Plant diversity increases soil microbial activity and soil carbon storage. *Nat. Commun.* 6: 6707. [Google Scholar] [CrossRef] [PubMed]

Liu, X., Tan, N., Zhou, G., Zhang, D., Zhang, Q., Liu, S., Chu, G. and Liu, J. 2021 Plant diversity and species turnover co-regulate soil nitrogen and phosphorus availability in Dinghushan forests, southern China. *Plant Soil.* 464: 257-272. [Google Scholar] [CrossRef]

Ma, T., Deng, X., Chen, L. and Xiang, W. 2020. The soil properties and their effects on plant diversity in different degrees of rocky desertification. *Sci. Total Environ.* 736: 139667. [Google Scholar] [CrossRef] [PubMed]

Mani Teja Chepuri, Ram Bharose, Tarence Thomas and Neha Toppo, 2023. Assessment of Physico-chemical Properties on Soil from Different Blocks of

Komaram Bheem, Asifabad District, Telangana, India

Mureva, A. and Ward, D. 2017. Soil microbial biomass and functional diversity in shrub-encroached grasslands along a precipitation gradient. *Pedobiologia.* 63: 37-45. [Google ScholLer)

Sunil, Vikas Kumar Bharti, Arun Kumar and Om Prakash, Prashant, 2023. Physico-Chemical Analysis Of Soil. *International Journal of Creative Research Thoughts IJCRT*. 11(2): 2320-2882.

Tripathi, B.M., Stegen, J.C., Kim, M., Dong, K., Adams, J.M. and Lee, Y.K. 2018. Soil pH mediates the balance between stochastic and deterministic assembly of bacteria. *ISME Journal.* 12(4):1072-1083

Wang, Xudong, Jiguang Feng, Gukailin Ao, Wenkuan Qin, Mengguang Han, Yawen Shen, Mengli Liu, Ying Chen, and Biao Zhu, 2023. Globally nitrogen addition alters soil microbial community structure, but has minor effects on soil microbial diversity and richness. *Soil Biology and Biochemistry.* 179.

Wu, H., Xiang, W., Ouyang, S., Forrester, D.I., Zhou, B., Chen, L., Ge, T., Lei, P., Chen, L. and Zeng, Y. 2019. Linkage between tree species richness and soil microbial diversity improves phosphorus bioavailability. *Funct. Ecol.* 33: 1549-1560. [Google Scholar]

Wu, S.H., Huang, B.H., Huang, C.L., Li, G. and Liao, P.C. 2018. The Aboveground Vegetation Type and Underground Soil Property Mediate the Divergence of Soil Microbiomes and the Biological Interactions. *Microb. Ecol.* 75:434-446. [Google Scholar] [PubMed]

Yan, N., Marschner, P., Cao, W., Zuo, C. and Qin, W. 2015. Influence of salinity and water content on soil microorganisms. *Int. Soil Water Conserv. Res.* 3: 316-323. [Google Scholar] [CrossRef][Green Version]

Yang, X., Long, Y., Sarkar, B., Li, Y., Lü, G., Ali, A., Yang, J. and Cao, Y.E. 2021. Influence of soil microorganisms and physico-chemical properties on plant diversity in an arid desert of Western China. *J. For. Res.* 32: 2645-2659. [Google Scholar].

Zhao, Z.H., Liu, G.H., Liu, Q.S., Huang, C. and Li, H. 2018a. Studies on the spatio-temporal variability of river water quality and its relationships with soil and precipitation: a case study of the Mun River Basin in Thailand. *International Journal of Environmental Research and Public Health.* 15:19.

Zhao, Z.H., Liu, G.H., Liu, Q.S., Huang, C., Li, H. and Wu, C.S. 2018b. Distribution characteristics and seasonal variation of soil nutrients in the Mun River Basin. *Thailand International Journal of Environmental Research and Public Health.* 15: 1818.