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Study of Physico-Chemical Parameters of Farmland Soil of Crop Cultivation Areas of Rajasthan

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Abstract: *In this research, an endeavour has been made to study physicochemical parameters as an attempt to provide an index of nutrient availability with an updated understanding of factors that influence the production economic of soil. High yield of crops require an abundant supply of nutrient elements. Soil is the important for fulfillment of all basic needs of human beings. Soil is an important factor in farming and cultivation. An eminent position in global cultivation of wheat, rice, jawar, pulses, sugarcane, vegetables and fruits etc. is occupied by Indian agriculture and reason of physical, chemical condition of whatever land is indispensable for proper implementation of the other management practices. Thus the physico-chemical study of territory is very significant because both physical and chemical properties which bear upon the soil productivity. This, physico-chemical study of soil is based on various parameters like pH, electrical conductivity, texture, moisture, temperature, soil organic matter, available nitrogen, phosphorus and potassium.*

Keywords: Physico-Chemical Parameters

I. INTRODUCTION

All agricultural production depends upon physic-chemical parameters of the soil used for it. Straight off a day's need of soil testing is increased due to interest of the public in the calibre of products obtained from it and different practices carried for their output. The soil quality analysis includes an analysis of parameters and processes which effects on soil to operate efficiently as a component of a sound ecosystem. Soil quality may include a capacity for water retention, carbon sequestration, plant productivity, waste remediation, and other functions, or it may be defined more narrowly. For instance, a forest plantation manager may define soil quality as the capacity of a territory to produce biomass. This report traces the development of the concept of land quality, explores the use of soil chemical and physical attributes as determinants of soil quality, and present challenges and opportunities for forest soil scientists to play a relevant role in assessment and advancement of sustainable forest management in making the concept of soil quality as an indicator of sustainability. The overall attack is that specific process or properties that suggest changes in direction of ecosystem.

Soil is one of the most important resources of the nature. All living things depends on plants, and plants grow in soil for day to day need. Soils are medium in which crop grow to food and cloth. Soil is not only important for agriculture but also have more useful for living organisms. Soil as a component of the terrestrial ecosystem fulfills many function including those that are essential for sustaining plant growth(1) .The importance of soil as a reservoir of nutrients and moisture for the production of forage and plant species has been recognized since the beginning of the forest management as a science. Any parts of earth surface that support vegetation also bears a covering of soil. Vegetation distribution and development largely depends on the soil condition(2).

Soil formation is a constructive as well as destructive process. Soil is composed of particles of broken rock that have been altered by chemical and mechanical processes that weathering and erosion. Soil has a complex function which is beneficial to human and other living organism. Soil is not merely a group of mineral particles. It has also a biological system of living organism as well as some other components. The climate and other factor largely affect the soil formation. Soil, as most people think, is not a dead inert matter of minerals. But a healthy soil is indeed alive and dynamic consisting of microorganisms. The top-most layer of soil is comparatively richer in nutrients and supports maximum bio-farms. The profile character varies distinctly from place to place, particularly with respect to their depth, colour and

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composition. The soil is a natural body of mineral and organic material differentiated into horizons. The mineral composition of soil, the organic matter within it and the environment, all are determined by the chemical properties of soil(3). It also of variable depth, which differs from the parent material below in morphology, physical properties and constitution, chemical properties and composition and biological characteristics.

1.1 pH

pH is a most important physical properties of soil.It having great effects on solute concentration and absorption in soil. Soil pH is an important consideration for farmers and gardeners for several reason, including the fact that many plants and soil life forms prefer either alkaline or acidic condition. If the pH is less than 6 then it is said to be a acidic soil, the pH range from6-8.5 it's a normal soil and greater than 8.5 then it is said to be alkaline soil. According to Sumit Kumar et al the pH of cotton soils was found to be in the range of 7.5-8.4. It is a good indicator of balance of available nutrients in the soil. pH is an important parameter as it help in ensuring availability of plants nutrients eg. Fe, Mn, Zn and Cu are more available in acidic than alkaline soils[4]. It also help in maintaining the soil fertility and to quantify the amendments used for amelioration[5]]. pH is a good sign to maintain equilibrium between nutrients in soil. It is also an indicator of plant and other living organism, available nutrients, cation exchange capacity and organic matter content[6]. Williams, has studied effect of pH on nutrient balance and observed that high pH of soil can affect the micronutrients content present in soil. At low pH values solubility of micronutrients is high while at high pH solubility and availability of micronutrient to plant is declined[7]. In general pH of the soil increased with depth. The extremely high and low values of pH often lead to failure of crop due to ionic strength imbalance]. The high pH can be attributed to the leakage and spread of alkaline effluent generated from the cement industry, as it was well know that high sodium content gives rise to high pH in the soil. Soil infiltration problem also associated with high pH.

1.2 Texture

Soil having different textural groups, on basis of the proportion of different sized particles. Soil texture directly influences soil-water relation, aeration and root penetration. It also affect on the nutritional status of soil. Soil texture can be expressed significantly by its electrical conductivity. Clay textured soil is highly conductive while sandy soil are poor conductors. Texture of most of the soil was loamy and clay for black soil, silty clay and loamy for red soil and loamy clay of yellow soil. Soil texture also affects the nutrient supply of the soil. Sandy soils are light soils having low nutrient concentration, low in ability to retain moisture, low in cation exchange capacity and buffer capacity, and rapidly permeable. The main problems to deal with sandy textured soil are maintaining moisture retention capacity and nutrient deficiency. Sandy soil contains low organic matter. Al-Omran reported that sandy textured soil increased the squash crop productivity by addition of clay deposits[8]. Sandy loam texture have little resistance to root penetration and also less suitable for deep rooted crops. According to Carter sandy soil increases crop yield and also reduces hydrophobicity by addition of clay content[9]. Clayey soil are unsuitable for crops that do not tolerate prolonged soil wetness; they have low permeability and this constraint causes them to remain wet for a longer period than soils of lighter texture. Clay contains high organic matter. It can resist water and wind erosion of the soil better. Clay content has high cation exchange capacity and pH buffering capacity. The cosmetic capabilities of clays are being exploited by many beauty spas around the world. In these spas, the colour of the clays greatly determines their use. Loamy topsoil over clayey subsoil, these soil could be highly susceptible to sever soil degradation should erosion reduce the depth of the topsoil. Variability in soil texture can directly or indirectly influence many other soil functions and soil threats such as soil erosion[10].

1.3 Moisture

Moisture is a most important physical property of soil. The absorption of nutrients is depends on the moisture of the soil. The water content of soil is also much related to its texture and structure. The soil moisture commonly depends on void ratio, particle size, clay minerals, organic matter and ground water condition[11]. Wetness depends largely on the porosity of a soil, and for that reason clayey soil, which have a high porosity generally have larger water content than do sandy soils. Good water holding capacity shows the good physical condition of soil. Knowledge of the soil water holding capacity is essential to the evaluation of regional soil water balance. Thakare et al reported maximum water holding

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capacity of red and black soils. The sandy soil can quickly be recharged with soil moisture but it enable to hold as much water as the soils with heavier textures[12].

1.4 Soil Temperature

Temperature of the soil is an property which influences the chemical, physical and biological processes associated with plant growth. Soil temperature fluctuates with season, time of day, and local climatic conditions. The major source of heat is sun and heat generated by the chemical and biological activity of the soil[13]. A rise in temperature of soil accelerates chemical reaction, reduces solubility of gases and decrease pH of soil. It is also plays an important role in germination in seeds. The change of temperature will have an impact on the growth of biomass and the activity of the microorganisms. Soil temperature varies in response to exchange processes that take place primarily through the soil surface[14]. According to Bahuguna et al 2011 the temperature of Uttarakhand, India soil samples varied from 38^0C to 43^0C

1.5 Electrical Conductivity

Electrical conductivity is a very quick, simple and inexpensive method to check health of soils. It is a measure of ions present in solution(15). The electrical conductivity of a soil solution increases with the increased concentration of ions. Electrical conductivity varies with depth and its range of variation was less in upland profile, probably occurred due to slope of land surface, high permeability and high rainfall, responsible to leach out alkali and alkaline bases[16]. It is a measurement that correlate with soil properties that affect soil texture, cation exchange capacity, drainage condition, organic matter level, salinity and subsoil characteristics. Electrical conductivity is used to estimate the soluble salt concentration in soil and is commonly used as a measure of salinity It has generally been associated with determining soil salinity, it also can serve as measure of soluble nutrients. The electrical conductivity of soils varies depending on the amount of moisture held by soil particles. It is useful in monitoring the mineralization of organic matter in soil[17]. The electrical conductivity is less than 1 (dS/cm) it is a normal soil, 1-2(dS/cm) then critical for germination, 2-3(dS/cm) critical for growth of salt sensitive crops and greater than 3(dS/cm) it is severely injurious to crops[18].

1.5 Nitrogen

Nitrogen is a most important fertilizer element. Plants respond quickly to application of nitrogen salts. This element encourages above ground vegetation growth and gives a deep green colour to the leaves. Plants root take up nitrogen in the form of NO_3 and NH_4. It is the most important major nutrient required by plant for proper growth and development and it is a part of all living cells is a necessary part of all proteins, enzymes and metabolic processes involved in the synthesis and transfer of energy. Nitrogen cycle plays an important role in soil system and is influenced by biological processes. It is required for growth of plant and is a constituent of chlorophyll, plant protein and nucleic acid. Soil nitrogen is also directly related with soil organic carbon. Nitrogen influences the quality of plants fruit and it increases the fruits protein content.. The lower value of total nitrogen in organic plots could be as a result of crop uptake, immobilization by microorganism and it loss through volatilization[19].

II. EXPERIMENTAL

2.1 Collection of Soil Samples

Soil samples were collected from Hanumangarh city selecting three different areas . Soil sample without effluent discharges served as control which was collected from adjacent site (1 km away) of industry. Soil samples with effluents were used for determination of physicochemical and biological activities. Soil samples were collected aseptically in sterile poly-bags from targeted sites and transferred to laboratory on same day. These soil samples were air dried and mixed thoroughly and kept overnight the solution was filtered for determination of soil texture.

2.2 Physico-chemical property of soil

The physic-chemical properties of test soil were determined by the standard procedures. Organic matter is oxidized with chromic acid (Potassium Di-chromate, + H_2So_4) . This method is widely used in Indian Laboratories. The K and P analysis by standard method. The electrical conductivity and pH were determined using pHmeter and conductivity meter whereas the temperature of soil is determined using digital thermometer.

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III. RESULTS AND DISCUSSION

Soil samples were analysed for their physico-chemical properties and their results were represented in table 1.

Table 1: Physico-chemical parameters in the soil of Hanumangarh District

S. No	Parameters	Pilibanga Area	Rawatsar area	Nohar Area
1	pH	5.4	6.8	6.1
2	Temperature	41°C	31°C	38°C
3	Conductivity	2.67ds/m	2.12ds/m	1.94ds/m
4	Organic Carbon	0.64	0.78	0.67
5	Nitrogen	0.04	0.07	0.06
6	Phosphorus	38	74	56
7	Potassium	178	503	375

- **pH:** The soil reaction or PH is meant to express the acidity or alkalinity of the soil. The PH is very important property of the soil is it determines the capacity. The PH values fluctuated less than 8.5(table-1) .The limit of PH value for soil Acidic. < 6.5, Normal 6.5-7.8, Alkaline 7.8- 8.5, Alkali > 8.5.
- **Soil Temperature**: The soil temperature varies between 30^{O}c to 41°C. Soil temperature is one of the most important soil properties that effect crop growth. The major source of heat is sun and heat generated by the chemical and biological activity of the soil is negligible.
- **Conductivity**: Total soluble salts are estimated from electrical conductivity (EC) of aqueous soil extracts. Standard value of EC in soil- Normal < 0.8 dsm^{-1}, critical for salt sensitive crops, critical for salt tolerant crops 1.6 -2.5 dsm^{-1}, Injurious to most crops > 2.5 dsm^{-1}. The EC value 2.67to 1.94
- **Organic Carbon**: Higher organic matter of the polluted soil may be due to the discharge of waste water, this increased organic matter enhanced soil enzyme activity.
- Nitrogen:
- **Phosphorus:** Phosphorus was found in the range of low, medium, high (table no.1) . Inorganic phosphorus as orthophosphate plays a dynamic role in aquatic ecosystem. Phosphorus, the most important micro nutrient, is utilized by plant in the form of $H_2PO_4^-$ & HPO_4^{2-} species.
- **Potassium:** Standard value of K as K_2O in soil low < 140 kg K_2O ha^{-1}, medium 140-280 kg K_2O ha^{-1}

IV. CONCLUSION

Maintenance or enhancement of soil quality is a more important criterion for analysis and sustainability of soil ecosystems [20-21]. Nevertheless, the undertaking of establishing a specific criterion for land quality is challenging because functions and subsequent values provided by soil ecosystems are variable and rely on the interplay of soil physical, chemical, and biological properties and cognitive operations which often differ significantly across spatial and temporal scales. Result are in tune with farming practices followed by farmers of this region. Most of the farmer's are using chemical fertilizer, Urea and Nitrogen fertilizer only since last 25 to 30 years which contains concentrated amount of Nitrogen, OC & Phosphorus. On the basis of these results farmers are advised to use integrated nutrient management practice to maintain optimum concentration of all the essential nutrients for plants. Farmers are also advised to add bio-fertilizers containing organic carbon and nitrogen solubilising bacteria.

REFERENCES

[1]. Adhikari K, Guadagnini A, Toth G and Hermann T, Geostatistical analysis of surface soil texture from Zala county in western Hungary, International Symposium on Environment, Energy and Water in Nepal: Recent Researches and Direction for Future, 2009.

[2]. Ahire DV, Chaudhari PR, Ahire VD and Patil AA, Correlations of Electrical Conductivity and Dielectric Constant with Physico-Chemical Properties of Black Soils, Inte. J. Scientific and Res. Publications, 2013, 3(2), 1-16.

[3]. AkpovetaOV,Osakwe SA, Okoh BE, Otuya BO, Physicochemical Characteristics and Levels of Some Heavy Metals in Soils around Metal Scrap Dumps in Some Parts of Delta State, Nigeria, J. Appl. Sci. Environ. Manage, 2010, 14 (4), 57 – 60.

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[4]. Deshmukh KK,Studies On Chemical Characteristics And Classification Of Soils From sangamner Area, Ahmadnagar District, Maharastra,RasayanJ.Chem. 2012, 5(1),74-85.
[5]. Daji JA, A text book of soil Science, Media promoters and publishers, 1996,Bombay.
[6]. Foth HD and Ellis BG, Soil Fertility, 1997, 2nd Ed. CRC Press, Boca Raton, Florida.
[7]. Brady C N, Weil RR,Nature and properties of soils, 2002,13th Ed. Prentice Hall.
[8]. Al-OmranAM,ShetaAS,FalatahAM,Al-Harbi AR,.Effect of drip irrigation on squash (Cucurbita Pepo) yield and water use efficiency in sandy calcareous soils amended with clay deposits, Agri.Water Management, 2005,73,43-55.
[9]. Amos-Tautua, Bamidele M W,Onigbinde AO and ERE D,.Assessment of some heavy metals and physicochemical properties in surface soils of municipal open waste dumpsite in Yenagoa, Nigeria,AfricanJ.ofEnv.Sci.and Tech. 2014,8(1),41-47.
[10]. Adhikari K, Guadagnini A, Toth G and Hermann T, Geostatistical analysis of surface soil texture from Zala county in western Hungary, International Symposium on Environment, Energy and Water in Nepal: Recent Researches and Direction for Future, 2009.
[11]. Helburg GR, Wallen NC and Miller GA, A century of soil development in soil derived from loess in Lowa, Soil Sci. Soc.Amer. J., 1978, 42, 339-343.
[12]. Hodes SC, Soil fertility basics: N.C. certified crop advisor training, Soil Science Extension, North Carolina State University,
[13]. Amos-Tautua, Bamidele M W,Onigbinde AO and ERE D,.Assessment of some heavy metals and physicochemical properties in surface soils of municipal open waste dumpsite in Yenagoa, Nigeria,AfricanJ.ofEnv.Sci.and Tech. 2014,8(1),41-47.
[14]. Ashraf M, Bhat GA, Dar ID, Ali M,.Physico-Chemical Characteristics of the Grassland Soils of Yusmarg Hill Resort (Kashmir, India),Eco.Balkanica, 2012,4(1),31-38.
[15]. Bahuguna A,Lily MK,MunjalA,SinghRN,Dangwal K,A study on the physico-chemical analysis of automobile contaminated soil of Uttarakhand,India,Int.J. of Env.Sci. 2011, 2(2),380-388. 13
[16]. Dutta M and Ram M,Status of micronutrient in some soil series of Tripura, J.Ind.Soc.Soil Sci. 1993,41(4),776-777.
[17]. De-Neve S,Van De SteeneJ,HartmanR,HofmanG,Using time domain reflectometry for monitoring mineralization of nitrogen from soil organic matter,Eu.J.Soil Sci. 2000,51,295-304.
[18]. Deshmukh KK,Studies On Chemical Characteristics And Classification Of Soils From sangamner Area, Ahmadnagar District, Maharastra,RasayanJ.Chem. 2012, 5(1),74-85
[19]. Defoer T, Budelman A, Toulimin C and Carter SE, Managing soil fertility in the tropics, 2000,Royal Tropical Institute, Kit Press, UK
[20]. FAO, A Framwork for Land Evaluation, 1976, FAO Bulletin 32, FAO/UNESCO, France.
[21]. Foth HD and Ellis BG, Soil Fertility, 1997, 2nd Ed. CRC Press, Boca Raton, Florida