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A review on physico-chemical properties of soil

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Abstract
The soil is the most important constituent to fulfilment of all the basic needs of human beings. Soil is an important component of our farming. 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. This knowledge will help to the people who are interested to work in agricultural field.

Keywords: Soil composition, physico-chemical parameters, Soil pollution

Introduction
All agricultural productions and development of forest depends upon physico-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 [13]. 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 function are monitored as indicators of sustainability.

2. Physico-Chemical Properties in Soil Quality
2.1 pH
The most significant property of soil is its pH level, Its effects on 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.

2.2 Texture
Soil texture is a qualitative classification tool used in both the field and laboratory to determine the classes for agricultural soils based on their physical texture. Soil in different regions shows different texture, the texture of the soil is mostly depends upon the size of particles. Soil texture shows its effect on aeration and root penetration. It also effect on the nutritional status of soil. Soil texture can be expressed significantly by its electrical conductivity.

2.3 Moisture
Water content or moisture content is the quantity of water contained in a material, such as soil called soil moisture, Moisture is one of the most important properties of soil.

Absorption of the nutrient by soil is largely depends on moisture content of the soil moisture of soil also shows its effect on the texture of soil.

2.4 Soil temperature

Soil temperature depends on the ratio of the energy absorbed to that lost. Soil has a temperature range between -20 to 60 °C. The temperature of the soil is the most important property because it shows its effect on the chemical, physical and biological processes related to growth of plants. Soil temperature changes with season, time of day, and local conditions of climate.

2.5 Electrical conductivity

Electrical conductivity is also a very important property of the soil, it is used to check the quality of the soil. It is a measure of ions present in solution [13]. The electrical conductivity of a soil solution increases with the increased concentration of ions. Electrical conductivity is a very quick, simple and inexpensive method to check health of soils. It is a measure of ions present in solution. The electrical conductivity of a soil solution increases with the increased concentration of ions.

2.6 Nitrogen

Nitrogen is the most critical element obtained by plants from the soil and is a bottleneck in plant growth [14]. About 80% of the atmosphere is nitrogen gas. Nitrogen gas diffuses into water where it can be "fixed" (converted) by blue-green algae to ammonia for algal use. Nitrogen can also enter lakes and streams as inorganic nitrogen and ammonia. Because nitrogen can enter aquatic systems in many forms, there is an abundant supply of available nitrogen in these systems.

2.7 Phosphorus

Phosphorus is a most important element present in every living cell [13]. It is one of the most important micronutrient essential for plant growth. Phosphorus most often limits nutrients remains present in plant nuclei and act as an energy storage.

2.8 Potassium

Potassium plays an important role in different physiological processes of plants, it is one of the important element for the development of the plant [15]. It is involved in many plant metabolism reactions, ranging from lignin and cellulose used for the formation of cellular structural components, for regulation of photosynthesis and production of plant sugars that are used for various plant metabolic needs.

2.9 Soil organic matter

It is also a valuable property of soil. If the soil is poor in organic matter, then it enhances the process of soil erosion **[13]**. If the soil organic matter is present in soil, then this soil is useful for the agricultural practices. Organic matter may be added in the soil in the form of animal manures, compost, etc. The presence of the higher content of organic matter in the soil can be another possible reason for lowering of the pH. Soil organic matter content has decreased from surface to subsoil due to levelling.

3. Review of past Work

A. Anita Joshi Raj, V Umayoru Bhagan [1] analysed the fluoride concentration and some other important physicochemical parameters of 51 surface soil samples and 51 underground water samples of ten fluorotic areas of Agastheeswaram Union, South India. In all the fluorotic areas the surface soil samples were having fluoride levels greater than the underground water samples. The fluoride concentration in the soil was ranging between 2 to 3.5 ppm and in the water samples it was ranging between 1.3 to 2.7 ppm. Both the levels were found to be above the permissible limit. Other parameters such as pH, alkalinity, total hardness, calcium, magnesium, chloride, salinity and sodium were also measured. Alkalinity and pH were found to be higher than the permissible limit in all the soil and water samples at various seasons. Finally, it was predicted that leaching of minerals from the soil is responsible for the high fluoride content in water samples and this in turn is responsible for the prevalence of fluorosis in the study area.

Saroj Mahajan and Dilip Billore [2] Carried out work on the study of physicochemical parameters like pH, specific conductivity, chloride, total alkalinity, calcium, magnesium nitrate, sulphate, phosphate sodium and potassium from July 2008 to June 2009. During the study year fluctuation was observed in several parameters. Investigation results showed that the soli alkaline throughout the study year. The productivity of an ecosystem depends upon the quality of soil. Some parameters were above permissible limit and some below the permissible limit which affects the quality and productivity of pond soil.

Anu, Upadhyaya S.K, Bajpai Avinash [3], studied that Soil gets polluted due to dumping of waste. Solid waste is garbage, refuse, sludge, and other discarded materials (including solids, liquids and contained gases) resulting from industrial, commercial, mining, and agricultural operations, and from community operations. The soil samples were taken from Shahpura Lake of Bhopal to assess the soil quality. During the study period physic-chemical parameters viz pH, Moisture content, Bulk Density, Chloride of soil was assessed as per the standard methods. High chloride value indicates pollution of soil sediment due to urbanization, industrialization and modernization in agricultural system results in extensive use of chemical fertilizers and pesticides.

Osakwe, SA. [4] Studied that the physicochemical properties of soils from natural flood disaster affected areas of the Isoko Region of Delta State, Nigeria, were investigated. The results indicated that there was an overall reduction in soil pH (5.425± 0.313), phosphorus (7.47±6.34mgkg-1), and nitrate (0.34±0.07mgkg-1) contents as well as exchangeable calcium 1.97±0.31mgkg-1 potassium (0.09±0.01mgkg-1), and effective cation exchange capacity (5.076±1.532 (cmolkg-1) and related parameters with 3.87±0.21, 77.57±5.83 and 7.99±2.72 for Base Exchange Capacity, Base Saturation and Soil Buffering capacity respectively. There was, however increased in the values of exchangeable magnesium (1.50±0.25mgkg-1), exchangeable sodium (0.28±0.004mgkg-1) and also the exchangeable acidity with the values 0.43+0.08 and 0.42±1.02mgkg-1 for Hydrogen and Aluminium respectively. There was no appreciable change in the values of Total Organic Carbon (0.40±0.096%), Total Nitrogen (0.025±0.035%) and Sulphate (0.10±0.02mgkg-1). The overall results indicate that the flood increased soil acidity and decreased the ability of the soils to adsorb metals, but did not have an appreciable effect on the biodegradable and compostable materials. Government should be proactive and devise measures to prevent further flood disaster in the country.

Kiran G. Chaudhari [5] studied that the physicochemical study of soil is based on various parameters like total Organic

Carbon, Nitrogen (N), Phosphorus (P2O5), Potassium (K_2O), pH and Conductivity. This study leads us to the conclusion of the nutrient's quantity present in the soil of Bhusawal, District Jalgaon (Maharashtra). Results show that all the eight selected places of Bhusawal have medium or high mineral content. In order to study the effect of phosphate fertilizer, phosphorus, and application of nitrogen to increase percentage yield of crops. This information will help farmers to solve the problems related to soil nutrients, amount of which fertilizers to be used to increase the yield of crops.

Rajesh P. Ganorkar and P.G.Chinchmalatpure [6] carried out work on soils with physical properties, chemical properties and micronutrients of soils have been done. Soil samples were collected from six different locations covering Rajura Bazar, in Warud Tahsil in Amravati District (Maharashtra) India. The soil parameters like soil moisture, pH, EC, Carbon, Calcium carbonate, TDS, Magnesium, Calcium, Nitrogen, Copper, Potassium and Phosphorous content, were analyzed in the month of February 2013. The values of pH indicated that all samples of the soils are alkaline, all samples were containing moderate amounts of available micronutrients**.**

Joel O.F, Amajuoyi C.A [7] studied some selected physicochemical parameters and heavy metals in a drilling cutting dump site. Test results indicated that some of the heavy metals like copper, iron and calcium showed a high level of contamination in most of the plots under the study area. Iron had a value as high as 880mg/kg, copper 84mg/kg and calcium 12560 mg/kg. These values were above target values as specified by the regulatory body, Department of Petroleum Resources (DPR). Moreover, the oil and grease indicated a high level of contamination, with a concentration of up to 840 mg/kg in one of the plots. This was evident in lack of plant growth noticed in the study area as a result of depletion of NPK values below to specify the value by USDA Standards for plant growth. The highest level of contamination of some of the physicochemical parameters and heavy metals as seen in this project underscores the need for due diligence in managing drilling cutting discharges from drilling activities.

Abdulmajeed Mlitan, Abdullah Abofalga, and Abdelaziz Swalem [8] investigated the effect of treated wastewater on soil chemical and physical properties. A field experiment was conducted in the Misurata region in central Libya with water treatments of wastewater. The Soil physicochemical parameters such as pH, water content, total soluble salts, Cadmium, Zinc, Lead, Copper and Iron of soil added treat industrial waste water. The results reveal that the some sampling sites were affected by industrial waste water pollution. Soil water content ranged from 7.68 to 19.56%. Total soluble salts ranged from 272.6 to 300 ppm and soil pH ranged from 7.7 to 8.0. and showed no appreciable differences within localities. The all tested metals increased from first location to the third location except Iron. The irrigation system had a significant effect on Total soluble salts and microbial flora. Isolated microbial flora consists of 4 fungal genera belonging to, Aspergillus, Penicillium, Rizopus and Fusarium. The latter and one of the Aspergillus spices (Aspergillus sp3) may consider one of the resistance fungi in industrial waste water due to its large colony numbers isolated from the water contaminated metals area.

Sanjoli Mobar, Pallavi Kaushik and Pradeep Bhatnagar [9] carried out work on impacted and non-impacted soil of two areas i.e. Sanganer and Durgapura respectively, of Jaipur district. The soil quality was analysed by estimation of physicochemical parameters such as pH, electrical conductivity (EC), water holding capacity, texture analysis, organic carbon, organic matter, total hardness, sodium, potassium concentration, sodium adsorption ratio (SAR), cation exchange capacity (CEC) using standard protocols. The results showed a significant difference between pH, EC, Water holding capacity, total hardness, SAR, CEC of both the soil, inferring the impact of industrial effluent on the quality of soil. Thus, to protect the deterioration soil quality, control of such industrial pollution assumes greater significance which can be assured by planned industrialization.

Prakash L. Patel, Nirmal P. Patel, Prakash H. Patel, Anita Gharekhan [10] correlated the chemical parameters of agricultural soil of different villages of Kutch district of Gujarat state in Western India**.** Their primary focus was to study mung bean crop based on randomly selected 30 medium black soil samples. Under the Soil Health Card Program of Government of Gujarat, soil samples were collected by authorized locally trained farmers and brought for analysis to Soil Test Laboratory, Bhuj. Standard Methods were used for the soil quality analysis. The objective of this work is to study and evaluate relation between soil properties and macro-nutrients (P, K, C and S) by using *c*orrelation analysis. Present study concludes that the statistical method 'correlation analysis' can provide a scientific basis for controlling and monitoring the agriculture soil fertility management.

A.M. Shivanna and G. Nagendrappa [11] carried out work on the soil fertility status of selected command areas of three lakes- Eachanur, V. Mallenahalli and Halkurke in Tiptur Taluk. The variables tested included pH, EC, OC, N, P, and K. The study revealed that the pH of the soil samples ranged from 7.07 to 7.87 and was on slightly alkaline side but within the limit of 6.5-8.5 which is optimum for crops. EC values ranged from 0.26dSm-1 to 0.485dSm-1 and were within the limit of 0.8dSm-1 indicating low salinity status of the soils. OC content ranged from 0.50% to 0.67% and all the samples were of medium rating. Available nitrogen ranged from 54.825kg/ha to 85.72kg/ha; available phosphorous ranged from 5.33kg/ha to 10.79kg/ha and samples were nitrogen and phosphorous deficient. Potassium ranged from 156.18kg/ha to 434.38kg/ha and samples were of medium rating except one sample of high rating with respect to potassium.

Conclusion

Maintenance or enhancement of soil quality is a more important criterion for analysis and sustainability of soil ecosystems [16]. 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. The selection of a standard set of specific soil properties as indicators of soil quality can be complex and may vary among soil systems.

From the study of reviewing papers it is concluded that study of soil quality can be carried out by different parameters. 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.

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