Review Article

A Review on Role of Physico-Chemical Properties in Soil Quality

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Abstract

Fundamental needs of human beings food, clothes and shelter fulfill through the medium of soil. Soil is an important part of our agriculture. An eminent position in global cultivation of wheat, rice, jawar, pulses, sugarcane and vegetables and fruits etc. is occupied by Indian agriculture. An understanding of physical and chemical condition of any soil is essential for proper implementation of the other management practices. Therefore the physico-chemical study of soil is very important because both physical and chemical properties which affect 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 create awareness among the farmers about economic productivity.

Keywords: Soil composition, Role of Physico-chemical properties, Soil pollution, Precautionary measures

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Introduction

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[50]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[65]. Any parts of earth surface that support vegetation also bears a covering of soil. Vegetation distribution and development largely depends on the soil condition(38].

Soil formation is a constructive as well as destructive process[59]. 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[74] 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 composition. The soil is a natural body of mineral and organic material differentiated into horizons[35] The mineral composition of soil, the organic matter within it and the environment, all are determined by the chemical properties of soil[35]. 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[61]. Chemistry of soil covers chemical reaction process in the soil pertaining to plant and animal growth and human development[6].

Understanding of soil chemical reaction and processes is essential for developing innovative resource management strategies, and understanding and regulating the behavior of the terrestrial ecosystem at regional and global scale[66].

The modern concept of soil quality is the ability to sustain plant and animal productivity, to increase water and air quality and to contribute plant and animal health[19]. The soil health and quality has consistently evolved with an increase in the understanding of soil and soil quality attributes[14]. It is controlled by physical, chemical and biological component of a soil and their interaction[53].

Soil is important everyone either directly or indirectly. It is natural body on which agriculture product grow and it is fragile ecosystem[70]. It is one of the most important natural resource of a country and knowledge about its characteristics is essential for developing optimum land use plan for maximizing agricultural production[40]. Agriculture refers to an art of raising plants from the soil and is one of the most economical factors from human beings[78]. But the intensive use of agrochemicals may lead to soil degradation, residues of agrochemicals in crop or ground water includes negative effects on the health of agricultural workers, especially in intensive commercial horticulture, particularly in vegetable production[24].

Soil fertility is an important factor, which determine the growth of plant. It is depends on the concentration of N,P,K organic and inorganic materials, micronutrients and water. In general soil chemical fertility and in particular lack of nutrient inputs is a major factor in soil degradation[28].

The deficiency of nutrients has become major constraint to productivity, stability and sustainability of soils[8]. A soil aggregate status usually deteriorates rapidly if soil is repeatedly cropped with annuals that supply little organic matter to the soil, require extensive cultivation and provide minimal vegetative cover[27]. There are various ways of addition and losses of nutrients as take place in soil. These nutrient cycling make the balance of organic and inorganic soil constituents. In recent years organic and inorganic fertilizers and pesticides are being widely used by farmers in agriculture to increase the yield and production of cultivable plants. The yield and quality of crop depends upon the fertilizers and presence of micronutrients. The soil condition is of great importance because it is a universal medium for plant growth, which supllies essentials nutrients to the plants[49]. But due to excess use of fertilizers, the physico-chemical status in soil is being changed[37]. The increasing use of chemical fertilizers to the soil, it is difficult to control the side effect of the chemicals to the soil, plant animals and human beings[49].

Soil farming factors intraction results into the properties of soil. Physico chemical characteristics of different soils vary in space and time due to variation in topography, climate, physical weathering processes, vegetation cover, microbial activities, and several other biotic and abiotic variables[58].

Different factors create different type of soil. The properties of soil along with its type have a great importance in agriculture[2]. Soil physico chemical properties deteriorates to the change in land use especially from agriculture and forest[74]. The change in physico chemical properties of soil leads to infertile or barren soil that does not support normal growth of vegetation for years[33].

The industrialization and development in agriculture are necessary to meet the basic requirement of people, at the same time it is necessary to preserve the environment[36]. For the high crop yield the farmers used the pesticides and fertilizers in excess amount causes serious environmental problems and also consider their possible impact on soil health. Nitrogen, phosphorus and potassium ratio is an important indicator in crop production that identifies balanced and unbalanced fertilization. Hence, balanced fertilizer application are important for high crop yield[34]. The food productivity and environmental quality is dependent on the physico-chemical properties of soil, so it is very important to know the basic knowledge about the physico-chemical properties of soil.

Role of Physico-Chemical Properties in Soil Quality

pH

pH is a most important physical properties of soil.It having great effects on solute concentration and absorption in soil[3]. 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[52]. 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[41]. It is a good indicator of balance of available nutrients in the soil[39]. 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[18]. It also help in maintaining the soil fertility and to quantify the amendments used for amelioration[15]. 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[23]. Williams, has studied effect of pH on nutrient balance and observed that high pH of soil can affect the micronutrients content present in soil[80]. At low pH values solubility of micronutrients is high while at high pH solubility and availability of micronutrient to plant is declined[10]. 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[41]. 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[21]. Soil infiltration problem also associated with high pH. Most soil of the Vidharbha region of Maharashtra were neutral to moderately alkaline in reaction(pH 7.15 to 8.03) [25].

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[42]. 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[31]. Soil texture also affects the nutrient supply of the soil[26]. 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[57]. Sandy soil contains low organic matter. Al-Omran reported that sandy textured soil increased the squash crop productivity by addition of clay deposits[4]. Sandy loam texture have little resistance to root penetration and also less suitable for deep rooted crops[50]. According to Carter sandy soil increases crop yield and also reduces hydrophobicity by addition of clay content[13]. 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[46]. 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[57]. 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[43]. Loamy topsoil over clayey subsoil, these soil could be highly susceptible to sever soil degradation should erosion reduce the depth of the topsoil[50]. Variability in soil texture can directly or indirectly influence many other soil functions and soil threats such as soil erosion[1].

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[82]. 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[81]. Good water holding capacity shows the good physical condition of soil[72]. Knowledge of the soil water holding capacity is essential to the evaluation of regional soil water balance[76]. Thakare et al reported maximum water holding capacity of red and black soils[75]. The sandy soil can quickly be recharged with soil moisture but it enable to hold as much water as the soils with heavier textures[31]. Decomposition of organic matter is

mainly depending on the soil moisture. If water becomes too low, a plant becomes stressed. Water is present in more in soil; it is not available to plants due to high degree of salinity. According to Snober Bhat the average percent soil moisture of Chandur Bazar taluka of Amaravati district were recorded in between 7.886 to 8.85%(9).Wlile Oseni et al observed moisture content 13.81-26.27% from rain forest and plantation in Ondo state, Nigeria[51].

Soil Temperature

Temperature of the soil is an important property because it 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[32]. A rise in temperature of soil accelerates chemical reaction, reduces solubility of gases and decrease pH of soil[67]. 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[48]. Soil temperature varies in response to exchange processes that take place primarily through the soil surface[67]. According to Bahuguna et al 2011 the temperature of Uttarakhand, India soil samples varied from 38^0 C to 43^0 C.[7]

Eletrical Conductivity

Eletrical 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. Eletrical 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 alkli and alkaline bases[20]. 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[73]. Eletrical conductivity is used to estimate the soluble salt concentration in soil and is commonly used as a measure of salinity[79] It has generally been associated with determining soil salinity, it also can serve as measure of soluble nutrients[71]. Putman and Alt also reported that soil removal by leveling changes the concentration of salts in root zone[60]. 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 severaly injurious to crops.[18].

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 NO3 and NH4[74]. 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[68]. 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(32). Soil nitrogen is also directly related with soil organic carbon[69]. Nitrogen influences the quality of plants fruit and it increases the fruits protein content. Supply of nitrogen either through organic and inorganic sources also plays an important role for higher winter sorghum productivity in addition to the moisture conservation[56]. 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[16]. Manure treated soil was compared with inorganic fertilizer treated soil in which inorganic fertilizer treated soil showed higher nitrogen content[54]. Saha et al also observed in the terrain soil of West Bengal, that the availability of nitrogen and its different forms decreased with increase in soil depth[64]. Nitrogen plays a beneficial as well as harmful effect on soil. Soil acidification is the major problem faced by farmers because due to the excessive use of inorganic nitrogen fertilizers in agriculture. The available nitrogen was measured by Jain and Singh 2014 from Madhya Pradesh, India its value ranges from 172 ±2.1 to 193.3Kgha^{-1} for red, and brown soil and197±4.9 to 215±21Kgha^{-1} for black soil, 183±19Kgha^{-1} nitrogen investigate in yellow soil[31].

Phosphorus

Phosphorus is a part of every living cell in plant. It is one of the most important micronutrient essential for plant growth. Phosphorus is most often limiting nutrients remains present in plant nuclei and act as a energy storage. It helps in transfer of energy[32]. Phosphorus is an essential element because of the large amount of phosphorus required by plants growth. It is also an essential part of the process of photosynthesis, involved in the formation of all oils, sugars, starches, etc.[68]. Phosphorus is abundant in the fruits of plants and seeds and also plays an important role in plant processes. Similar like that, Wagh and Sayyed said that phosphorus is necessary for seed germination and essential for flowering and fruits formation,its deficiency symptoms are purple stem and leaves, poor yield of fruit[78]. It is necessary for maintaining a balance between the other plant nutrients and ensuring the normal growth of the crop[79]. Wagh et al reported that phosphorus is one of the key macronutrient required for plant growth and metabolism. The most of the activity of plant such as growth, respiration and reproduction depends upon phosphorus levels of the soil in which plant grows[79]. The available phosphorus content of the soil was higher in topographic position as compared to soils occurring on lower topographic position[68]. The soil with high organic matter content have better supplies of organic phosphate for plant uptake than have the soils with low organic content[45]. Adequate phosphorus availability for plants stimulates early plant growth and hastens maturity[73]. The soil with minimum leaching are known to contain high amount of phosphorus as compared to the soil with maximum leaching[6]. All the soil samples had available phosphorus values more than 10 mg/kg considered suitable for crop production[22].

Potassium

Potassium is not an integral part of any major plant component but it plays a key role in a vast array of physiological process vital to plant growth from protein synthesis to maintenance of plant water balance[74]. It is involved in many plant metabolism reactions, ranging from lignin and cellulose used for formation of cellular structural components, to regulation of photosynthesis and production of plant sugars that are used for various plant metabolic need[73]. Potassium is found in its mineral form and affect plants division, carbohydrate formation, translocation of sugar, various enzyme action and resistance to certain plant disease[32]. The high content of available potassium on surface soil may be attributed to the application of potassium fertilizers and manures addition[44]. Potassium fixation occurs when soil dry and the potassium is bonded between layers of clay[79]. It decreases with an increase in depth of soil[12]. Soil that have adequate potassium allow plants to develop rapidly and outgrow plant disease, insect damage and protect against winter freeze damage[73]. In the nitrogen levels balancing potassium plays an important role. Potassium is observed by plants in larger amounts than any other mineral element except nitrogen and in some cases, calcium[68]. Water loss is from plants control by potassium and it an important role in improve the plant growth. Increase in potassium availability in Kaolinitic soil increased the grain yield of winter sorghum as reported by Pal[55]. According to Muhar et al 25% samples were categorized as low (< 125 kg ha -1), 67.5% medium (125 to 300 kg ha -1) and 2.5% high (>300 K2O kg ha -1)[47].

Soil Organic Matter-

Soil organic matter is an important property of soil. If the soil is poor in organic matter then it enhances the process of soil erosion. If the soil organic matter is present in soil then this soil is usefull for the agricultural practices. Organic matter may be added in the soil in the form of animal manures, compost, etc. The presence of higher content of organic matter in the soil can be another plausible reason for lowering of the pH[30]. Soil organic matter content has decreased from surface to subsoil due to leveling[29]. The decomposition rate of organic matter has a tendency to increase as weather warm and to furnish maximum plant growth conditions[63]. Organic matter commonly increases water content at field capacity, increases available water content in sandy soil and increases both air and water flows rates through fine textured soil[62]. Soil organic matter supplies essential nutrients and has unexcelled capacity to hold water and absorb cations[5]. It also function as a source of food for soil microbes and thereby helps enhance and control their activity[11]. The content of organic matter in a soil can be maintained the structure of soil. It affects the available water capacity and infiltration rate. It is a source of nitrogen and other essential nutrients for crops that’s why it enhances the usefulness of soil for agricultural purposes.

Conclusion

Conventional agriculture has been largely dependent on intensive chemical inputs which plays an important role in improving food productivity to meet human demands. In recent years, most of the farmers are using the excess amount of fertilizers and pesticides. Due to excess use of chemicals soil quality decreases. Small crop also affected due to large use of fertilizers and pesticides. So it becomes essential to analysis of soil parameter[49]. Above information help to farmers for use integrated nutrient management practice to maintain optimum concentration of all the essential nutrients for plants.

Organic agriculture dose not use synthetic fertilizers and pesticides and attempt to close nutrient cycle on their farms, protect environmental quality and enhance beneficial biological interaction and processes[77]. But farmers preference to the inorganic fertilizers as compare to organic because the nutrients are more readily available form and rapidly released after application.

To obtain high yield many farmers are using artificial and inorganic fertilizers. The nutrients from these fertilizers are not taken up directly by the plants and hence they may remain in the soil for several years, due to this the soil quality will be changed[37]. Like as a fertilizers, there is a wide range of chemicals used as pesticides. But the most harmful are those which either do not degrade or degrade very slowly in nature. These hazardous chemicals that enter our food chain begin to increase their concentration at successive trophic levels in the food chain. The environmental problems associated with fertilizers application, a number of problems arise from the use of pesticides. These include persistence in the environment, toxicity in soil, vegetation and water supplies and its application for human health. The persistence and toxicity of many pesticide compounds dependant on a number of soil characteristics. It also help to the farmers about the proper supply of nutrients for healthy growth and to increase the yield of crop.

In most of cases, some lawns greener than others, some gardens produce larger vegetables than others, some farms produce larger yields than others, why this happened? Because of the physical and chemical properties of the soil is different. That's why examination of the soil will provide information that can be used to determine what essential nutrients are needed and how much fertilizer should be applied.

The intensive agriculture has a number of disadvantages in the long run. Thus, it needs a new approach in sustainable agriculture through the application of biofertilizers and biopesticides. In recent years, use of biofertilizers has become a hope for most countries, as far as economical and environmental view points are concerned. Like as biofertilizers, pest control by biological processes appears to be very useful tool in recent years. Some of the organisms used in biopesticides to target arthropods.

At present, the majority of our land resources are degraded. Therefore, it is important to maintain the soil health for food security and increasing agricultural production.

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] Akpoveta OV,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.

[4] Al-Omran AM,Sheta AS,Falatah AM,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.
[5] 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,African J.of Env.Sci.and Tech. 2014,8(1),41-47.
[6] 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.
[7] Bahuguna A,Lily MK,Munjal A,Singh RN,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.
[8] Bell RW and Dell B, Micronutrients for Sustainable Food, Feed,Fibre and Bioenergy Production.First edition, IFA, Paris, France, 2008.
[9] Bhat SH,Darzi AB,Dar MS,Ganaie MM,Bakhshi SH,Correlation of soil physico-chemical factors with VAM fungi distribution under different agroecological conditions,Int.J.of Pharma and Bio Sci. 2011,2(2),98-107.
[10] Brady C N, Weil RR,Nature and properties of soils, 2002,13th Ed. Prentice Hall.
[11] Brady NC,. The Nature and Properties of Soils, 11th ed., McMillan: New York, 1996, 621.
[12] Campbell RE and Rouss JO, TerracingEconomics of Iowa Soils, J. Soil and Water Cons. 1961, 41(1), 49-52.
[13] Carter DJ,Gilkes RJ,Walker E, Claying of water repellent soils:effects on hydrophobicity, organic matter and nutrients uptake,In:Proceedings of World Congress of Soil Science,Montpellier,France, 1998,21,747.
[14] Chaudhary PR, Ahire DV,Ahire VD,Correlation between Physico-chemical properties and available nutrients in sandy loam soils of Haridwar,Journal of chemical,biological and physical science, 2012,2(3),1493-1500.
[15] Daji JA, A text book of soil Science, Media promoters and publishers, 1996,Bombay.
[16] Defoer T, Budelman A, Toulimin C and Carter SE, Managing soil fertility in the tropics, 2000,Royal Tropical Institute, Kit Press, UK.
[17] De-Neve S,Van De Steene J,Hartman R,Hofman G,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,Rasayan J.Chem. 2012, 5(1),74-85.
[19] Doran JW and Zeiss MR, Appl. Soil Ecology, 2000,15, 3-11.
[20] Dutta M and Ram M,Status of micronutrient in some soil series of Tripura, J.Ind.Soc.Soil Sci. 1993,41(4),776-777.
[21] Elango L, Ramachandran S and Chowdhary YSN, Ground water quality in coastal regions of south Madras,Indian Journal of Environmental Health,1992, 34, 318 -325.
[22] FAO, A Framwork for Land Evaluation, 1976, FAO Bulletin 32, FAO/UNESCO, France.
[23] Foth HD and Ellis BG, Soil Fertility, 1997, 2nd Ed. CRC Press, Boca Raton, Florida.
[24] Fotio D, Monkiedje A, Maniepi NJS, Nguefack J and. Amvam ZPH, Evaluation des re'sidus pesticide de leurs effets sur la qualite' des re' coltes du sol en zone pe' riurbaine de Yaounde´ a cultures maraıˆche` res'. Proceedings, Journe´e, Poˆ le de Compe´tence en partenariat grand –Sud Cameroun (PCP).Re'sume's d'ope' rations de recherché participative mene'es en 2004,Yaounde, Cameroun.
[25] Gabhane VV,Jadhao VO, Nagdeve MB, Land evaluation for land use planning of a micro watershed in Vidarbha region of Maharashtra, J. Indian Soc. Soil Sci. 2006, 54,307-315.
[26] Gupta OP and Shukla RP, The composition and dynamics of associated plant communities of sal plantations, Trop. Ecol. 1991, 32(2), 296-309.
[27] Harris RF, Chesters G and Allen ON, Dynamics of soil aggregation, Adv. Agron. 1966,18,107-169.
[28] Hartemink E, Land use change in the tropics and its effect on soil fertility,2010, 19th World Congress of Soil Science, Soil Solutions for a Changing World 1 – 6 August 2010, Brisbane, Australia.Published on DVD.
[29] 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.
[30] Hodes SC, Soil fertility basics: N.C. certified crop advisor training, Soil Science Extension, North Carolina State University, 1996, 75.

[31] Jain P and Singh D, Analysis the Physico-Chemical and Microbial Diversity of Different Variety of Soil Collected From Madhya Pradesh, India, Scholarly Journal of Agricultural Science, 2014,4(2),103-108.
[32] Jain SA, Jagtap MS,Patel KP,Physico-Chemical Characterization of farmland Soil used in some villages of Lunawada Taluka, Dist : Mahisagar (Gujarat) India,Int.J. of Sci.and Res.Publi., 2014, 4(3),1-5.
[33] Jha AK and Singh JS, Soil characteristics and vegetation development of an age series of mine spoil in a dry tropical environment. Vegetatio ,1991,97, 63 – 76.
[34] John MS,Mohammad Y,Ullahshah H,J.Bat., 2010,42(3), 1909-1922.
[35] Joffe JS, 1949. Pedology: PedologyPubl., New Brunswick, N. J.
[36] Joshi N and Kumar A,Physico-chemical analysis of soil and industrial effluents of Sanganer region of Jaipur Rajsthan,Res.J.of Agric.Sci. 2011,2(2),354-356.
[37] Kamble PN, Kurhe AR, Pondhe GM, Gaikwad VB,Baath E,Soil Nutrient Analysis And Their Relationship With Special Reference To Ph In Pravaranagar Area, District Ahmednagar, Maharashtra.India, Inter. J. Of Sci. & Tech. Res. 2013, 2(3), 216-218.
[38] Kardol P, Bezemer TM,Vanderputten WH, Temporal variation in plant-soil feedback controls succession, - Ecology Letters, 2006,9, 1080-1088.
[39] Kinyangi J, 2007, Soil Health and Soil Quality: A Review.
[40] Kumar P,Kumar A,Dhyani BP,Kumar P,Shahi UP,Singh SP,Kumar R,KumarY,Kumar A,Raizada S, Soil fertility status in some soils of Muzaffarnagar District of Uttar Pradesh, India, along with Ganga canal command area.African J.of Agric.Res. 2013,8(14),1209-1217.
[41] Kumar S, Iyer A,Agarwal S, Cotton Yield In Relation To Physicochemical Properties Of Cultivated Soil Of Rajkot Region.Int.J.of Adv.Engi.Tech. 2011,2(3),52-55.
[42] Marx ES, Hart J and StevensRG,1999, Soil Testing Interpretation Guide, Oregon State University, Corvallis.
[43] Matike DME, Ekosse GIE and Ngole VM, Physico-chemical properties of clayey soils used traditionally for cosmetics in Eastern Cape, South Africa. Int. J. Phy. Sci., 2010,6(33), 7557 – 7566.
[44] Miles RJ and Hammer RD, One hundred years of Sanborn field soil baseline data.Univ. Missouri, USA. 1989,100-108.
[45] Miller RW and Donahuer RL, Soils in our environment, 2001, Seventh edition. Prentice Hall, Inc. Upper Saddle River, New Jersey.
[46] Moody PW and Cong PT, Soil Constraint and Management Package (SCAMP): Guidelines for sustainable management of tropical upland soils, 2008,Australian Centre for International Agricultural Research, Canberra ACT2601, Australia.
[47] Muhar GR,Datta NP, Shankara SN,Dever F,Lecy VK, Donahue RR, Soil testing in India,1963, USDA Mission to India.
[48] Naranjo NM, Meima J A, Haarstrick A and Hempel DC, Modeling and experimental investigation of environmental influences on the acetate and methane formation in solid waste. Waste Management, 2004,24, 763–773.
[49] Narkhede SR, Bhirud SR,Patil NS and Choudhary RR, Physico-Chemical Analysis Of Soil Collected From Chorwad, Tehsil – Bhusawal, Dist. Jalgaon (M.S.) - Int. J. Chem. Sci., 2011, 9(4), 1973-1978.
[50] Nwachokor MA, Uzu FO and Molindo WA, Variations in Physicochemical Properties and Productivity Implications for Four Soils in the Derived Savannah of Southern Nigeria,American-Eurasian Journal of Agronomy, 2009,2 (3), 124-129.
[51] Oseni OA, Ekperigin MM, Akindahunsi AA and Oboh G, studies of physicochemical and microbiological propertiesof soil from rainforest and plantation on Ondo state , Nigeria, African Journal of Agriculture research, 2009,2(11),605-609.
[52] Pandeeswari N and Kalaiarasu S, Studies On The Physico-Chemical Properties Of The Soil Samples Collected From Different Locations Of Tsunami Affected Soils Of Cuddalore District Of Tamil Nadu. Int. J. Current Res. 2012, 4(7),143-145.
[53] Papendick and Parr, Amer. Journal of Alternative Agric., 1992,7 (1, 2), 2.
[54] Parham JA, Deng SP, Raun WR and Johnson GV, Biol. Fertil. Soils. 2002,35,328-337.
[55] Pal SK, Agropedology, 1998,8,94-100.

[56] Patil SL, Sheelavantar MN, Nalatwadmath SK, Surkod VS,Mana Mohan S and Lamani VK, Correlation Analysis Among Soil Moisture, Soil Physico-Chemical Propertise, Nutrient Uptake And Yield Of Winter Sorghum.Ind.J.Agric.Res. 2005,39(3),177-185.
[57] Patnaik L,Raut D, Behera L, Nayak A,Misha S,Swain S, Physico-Chemical and Heavy Metal Characterization of Soil from Industrial belt of Cuttack, Orissa.Asian J. Exp.Biol.Sci. 2013,4(2),219-225.
[58] Paudel S and Sah JP, Physiochemical characteristics of soil in tropical sal (Shorea robusta Gaertn.) forests in eastern Nepal. Himalayan J. Sci. 2003, 1(2),107-110.
[59] Pujar KG, Hiremath SC,Pujar AS,Pujeri US and Yadawe M S, Analysis of Physico-Chemical and Heavy Metal Concentration in Soil of BijapurTaluka, Karnataka Sci. Revs. Chem. Commun. 2012, 2(1), 76-79.
[60] Putman J and Alt K, Erosion Control: How does it changes farm income. J. Soil and Water Cons. 1987, 42 (4), 265-268.
[61] Rai MM,Principal of soil science.Macmillan India Publication. 2002,38-91.
[62] Ramulu SUS, Reuse of municipal sewage and sludge in agriculture,2001, Scientific publishers Jodhpur, India 86.
[63] Russell EJ, Soil conditions and plant growth,1950,Biotech Books, New Delhi, India.
[64] Saha AN et al, Agropedology, 2000,10, 132-138.
[65] Schlesinger WH, Reynolds JF,Cunningham GL, Huenneke LF, Jarrell WM, Virginia RA,Whitford WG, Biological feedbacks in global desertification. - Science, 1990,247, 1043-1048.
[66] Schnitzer M, Binding of humic substances by soil colloids. In: Huang P.M., M. Schnitzer (Eds.), Interactions of soil minerals with natural organics and microbes, 1986,pp. 77E 1. Special Publication No.17, Soil Science Society of America, Madison, WI.
[67] Shirbhate N and Malode SN, Municipal Solid WasteManagement: A Survey And Physicochemical Analysis Of Contaminated Soil From Sukali Compost And Landfill Depot, Batkuli Road, Amravati.G.J.B.B., 2012,1 (2) , 215-219.
[68] Singh DP and Rathore MS,Available nutrient status and their relationship with soil properties of Aravalli mountain ranges and Malwa Plateau of Pratapgarh, Rajsthan, India.African J. of Agric.Res. 2013,8(41),5096-5103.
[69] Singh RV and Negi GCS,Physicochemical characteristics of soil in Nanda Devi Biosphere Reserve (Valeriana Jatamansi Jones) in different forest.Biotech.Int. 2013,6(1),1-8.
[70] Sinha AK and Shrivastav,2000,Earth Resource and Environmental issues, 1st edition. ABD publisher Jaipur, India 2000.
[71] Smith JL and Doran JW, Measurment and use of pH and electrical conductivity for soil quality analysis. Soil Sci. Am.Spe.Publication 49, 1996,SSSA,Madison,WI.
[72] Soffe RE, 1995, In: The agricultural Notebook, 19 Black well Science ,Oxford.
[73] Solanki HA and Chavda NH, Physicochemical analysis with reference to seasonal changes in soilsofVictoria park reserve forest, Bhavnagar (Gujarat).Life sciences Leaflets,2012,8,62-68.
[74] Sumithra S, Ankalaiah C, Rao D and Yamuna RT, A case study on physico – chemical characteristics of soil around industrial and agricultural area of yerraguntla, kadapa district, A. P, india. Int. J. Geo. Earth and Environ. Sci. 2013,3(2), 28-34.
[75] Thakre YG, Choudhary MD and Raut RD, Physicochemical Characterization of Red and Black Soils of Wardha Region. Int. J. Chem. and Phys. Sci. 2012,1(2), 60-66.
[76] Vanderlinden K,Juan V, Giráldez and Marc VM,Vadose ZJ, Soil Water-Holding Capacity Assessment in Terms of the Average Annual Water Balance in Southern Spain, 2005, 4, 317-328.
[77] Vandermer J, Ann. Rev. Ecol. Sys., 1995,26, 201-224.
[78] Wagh GS and Sayyed MRG, Assessment of Macro and Micronutrients in Soils from Panvel Area, Maharashtra, India. Uni.J.of Env.Res.and Tech., 2013, 3(1),72-78.
[79] Wagh GS, Chavhan DM and Sayyed MRG, Physicochemical Analysis of Soils from Eastern Part of Pune City.Uni.J.of Env.Res.and Tech., 2013,3(1),93-99.
[80] Williams DA, Specialty fertilizers and Micronutrients do they Pay?" Proceeding 2006 Western Alfalfa and Forage Conference sponsored by cooperative extension services of AZ, CA, CO, ID, MT, NV, NM, OR, UT,

WA, WY. Published by US cooperative extension, agronomy research and extension center plant science department. University of California, Davis, 1990, 95, 616.
[81] Williams PT, Waste Treatment and Disposal. 2nd ed. John Wiley & Sons Ltd, England, ISBN 0-470-84912-6, 2005,171-244.
[82] Yennawar VB, Bhosle AB and Khadke PA, Soil Analysis And Its Environmental Impact On Nanded City, Maharastra. Research Front, 2013,1(1),65-70.

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