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EFFECTS OF PHYSICAL PROPERTIES AND MICROBES ON FARM SOIL

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ABSTRACT

Both agricultural outputs and forest produced rely on the physio-chemical parameters of the soil used to them. As per International Food Policy Research Institute,2010, in most developing countries, the economy is primarily based on agricultural production. The soil best evaluation consists of an analysis of parameters and techniques which results on soil to function successfully as an element of a legitimate ecosystem. it might also additionally consist of a potential for water retention, carbon sequestration, plant productivity, waste remediation, and different functions, This review paper tracks the evolution of the concept of soil quality, examines the use of soil chemical and physical characteristics as soil quality determinants, and poses obstacles and opportunities for forest soil scientists to play a critical role in evaluating and promoting sustainable land management in making the soil quality definition a measure of sustainability. sustainable management of agricultural resources such as soil offers the long-term benefits expected for both environmental protection and economic growth.Physical properties in

soil quality contains, pH, texture, moisture, soil temperature, electrical conductivity, nitrogen, phosphorus, potassium, soil organic matter.

Keywords: Physico- chemical, microbiological, parameters, soil pollution, Inorganic fertilizer, soil composition, Soil Quality

INTRODUCTION

Soil Microbiology

The soil is full of microscopic life (bacteria, fungi, algae, protozoa and viruses) and macroscopic life, Many environmental factors depend on the numbers and types of microorganisms present in the soil: quantity and form of available nutrients, humidity available, degree of aeration, pH , temperature, etc. Microorganisms also influence aboveground ecosystems by contributing to plant nutrition, plant health, soil structure and soil fertility. Inorganic fertilizer is a synthetic fertilizer containing all that is applied to the soil to provide one or more plant nutrients that are necessary for plant development. The soil microorganisms are sensitive to changes in the surrounding soil it has been shown that the microbial population changes after fertilization. By providing nutrients, fertilizers can directly stimulate the growth of microbial species as a whole and can influence the composition of individual microbial communities in the soil and surrounding water bodies, thus influencing the terrestrial and aquatic climate. The impact of industrial wastes and chemical contaminants on soil has been extensively because of environmental pollution caused by excessive soil erosion and the associated transport of sediment, chemical fertilizer and pesticide to the surface and ground water and social problems throughout the world.

Both agricultural outputs and forest production are dependent on the soil's physico-chemical parameters. According to the International Food Policy Research Institute (2010), agriculture is the primary source of revenue in the majority of developing countries. Due to public interest in the quality of products derived from it and the various activities involved in their processing, the need for soil testing is increased on a daily basis **[1]**.

The soil best assessment process entails an examination of the criteria and techniques that contribute to the soil's ability to act effectively as a component of a legitimate ecosystem. Soil quality may also include the capacity for water retention, carbon sequestration, plant productivity, waste remediation, and other functions, or it may be more strictly defined. For instance, a forest plantation manager may define soil quality as a territory's capacity to produce biomass. This article discusses the evolution of the concept of soil quality, the use of soil chemical and physical characteristics as determinants of soil quality, and the challenges and opportunities for forest soil scientists to play a critical role in assessing and supporting sustainable land management by making the soil quality description a measure of sustainability. The overarching strategy is to track particular processes or properties that indicate a shift in the direction of ecosystem function as measures of sustainability **[1]**.

As a result, sustainable management of agricultural resources such as soil enables both environmental sustainability and economic development to occur over the long term **[2]**. As a result, Ethiopia has recently developed an interest in assessing the quality of soil resources.

Soil Microbiology

Soil is the interface between geology and biology on the earth's crust, the ground surface that supports plant and animal life as well as microbial life. The soil is densely packed with microscopic life (bacteria, fungi, algae, protozoa, and viruses) and macrolife (earthworms, nematodes, mites, and insects, as well as plant root systems). Numerous environmental factors are dependent on the amount and type of microorganisms present in the soil, including the quantity and type of nutrients available, the available humidity, the degree of aeration, the pH, and the temperature. Soil bacteria and fungi are critical components of distinct biochemical processes and are responsible for organic compound recycling. Soil microorganisms also have an impact on aboveground ecosystems by influencing plant nutrition, health, soil structure, and fertility **[4]**.

Microbiome research has significant implications for understanding and manipulating ecosystem processes such as nutrient cycling, organic matter turnover, and the development or inhibition of soil pathogens. Additionally, this area of research provides an excellent opportunity to better understand the impact of soil microbes on the productivity of natural plant communities and agroecosystems. Though numerous studies in natural ecosystems have focused on the soil microbiome, few studies in agricultural ecosystems have focused on plant rhizosphere and endosphere microbes. Agriculture dominates the landscape in large parts of Nebraska, making the analysis of agricultural crop-growing soils important for science [McPherson *et al.,* 2018]. McPherson *et al*., (2018), attempted to standardize the protocols for describing the microbes found in agricultural environments, determining how plant roots change the microbial communities in the rhizosphere and endosphere, and ultimately understanding the roles these microbes play in soil health and plant productivity **[5]**.

Effect of fire of soil:

Soil fire has a significant effect on forests farm soil. These fires increase the water repellent properties of forest soil, resulting in increased infiltration and soil erosion. Additionally, fires have an effect on the colour, pH, bulk density, and texture of the soil.

Chemical changes in the soil as a result of forest fires are more important. Since changes in the nutrient cycle and soil organic matter will affect the ecosystem's productivity. Forest fires had a range of effects on SOM, from full combustion to a rise in quantity. Additionally, the impact of forest fires on nitrogen is variable. The majority of studies have shown an increase in the total amount of nitrogen available to plants (NH_4+) but a decrease in the amount of total nitrogen. This decrease in nitrogen is due to volatilization. In addition to nitrogen, other nutrients are less affected. This unexpected flush of nitrogen in the soil is accompanied by rapid growth of herbaceous plants and a large increase in plant nitrogen storage. There are very few reports on the micronutrient effects of forest fires.

The biological properties of the soil are also significantly altered. This is because microorganisms and invertebrates are extremely sensitive to high temperatures. Fire reduces both the number and diversity of soil-dwelling invertebrates and microorganisms. However, invertebrates that live in soil are less affected than microorganisms due to their high mobility and burrowing habits **[6]**.

Effect of Charcoal application

The following benefits accrue from the use of charcoal as a soil conditioner for sustainable agriculture in the humid tropics:

1. Increased nutrient content and retention capacity result in increased nutrient supply to plants and decreased nutrient loss by leaching. We hypothesise that two mechanisms are at work here: (1) nutrients are physically trapped in the fine pores of amorphous carbonised products, and (2) gradual biological oxidation results in the formation of carboxylic units on the edges of the charcoal's condensed aromatic backbone, raising the CEC.

2. Converting labile plant organic matter to stable carbon pools will help mitigate CO_2

emissions into the atmosphere during land clearing and increase carbon sequestered in the soil. There is compelling evidence that charcoal mineralizes very slowly in the soil environment.

3. Charcoal can be easily generated from fallow vegetation and/or organic wastes by small-scale farmers and those on a low income. Charcoal processing is a well-known technique with readily available equipment and services.

Using charcoal to improve soil fertility while increasing carbon sequestration in the soil is a relatively new technology. However, the demonstrated beneficial effects of charcoal additives on soil properties and productivity could prompt additional research to determine the feasibility of developing a slash-and-char technique as an alternative to conventional slash-and-burn or slash-and-mulch systems. Under this context, the charcoal will be extracted from the same field to which it is applied, and therefore the slash-and-char technique would not risk more forest destruction. Future research should concentrate on evaluating charcoal amendments in experimental plots and in field settings, as well as on developing a deeper understanding of the chemical and physical properties of charcoal surfaces. Finally, an assessment of charcoal's agronomic efficacy and economic viability as a soil conditioning in field conditions is needed **[7]**.

Soil washing:

Soil washing is a technique that is especially useful for reclaiming metal-contaminated soils. The majority of projects use cost-effective and well-established physical separation technologies in the mineral processing industry. Soil washing can be a cost-effective and environmentally friendly alternative to solidification/stabilization and landfilling. The soil washing technology has a number of advantages: (1) the processes aim to permanently remove metals from soils and, in some cases, allow for metal recycling; (2) the amount of polluted soil is significantly reduced; (3) the treated soil can be returned to the site; and (4) the process cycle is usually short to medium-term in comparison to other metal extraction methods. However, the soil washing process's effectiveness is contingent upon the following: (1) an exhaustive soil characterization; (2) an examination of metal speciation and fractionation; and (3) an appreciation of the relationship between the soil matrix and metals. The combination of the sequential extraction method and the SEM–EDX provides an extremely useful analytical tool for deciphering the chemistry of metals in soils and predicting the efficacy of soil washing treatment.

Soil washing may be used in combination with or in place of other treatment technologies. Although the soil washing method is widely used in Europe, it has not been widely used in the United States and Canada. Soil washing has been successfully implemented in Europe, in part as a result of regulatory measures that severely limit landfill options. Soil washing is often used to reduce the amount of soils and contaminants disposed of in landfills. In Europe, soil washing is mostly done in fixed facilities, while in the United States and Canada, mobile soil washing plants tend to be more prevalent **[8]**.

Lime, fertilizer and manure applications

Lime, fertiliser, and manuring influencing the soil organic matter status and physical properties are critical for agricultural sustainability. Their impacts are intricate, and several interactions are possible. Liming can result in the dispersion of clay colloids and the formation of surface crusts in the short term. As the pH of clay colloids is boosted, the surface electrostatic repulsion increases and repulsive forces between particles become dominant. However, as lime rates rise, the Ca2+ concentration and ionic strength of the soil solution increase, compressing the electrical double layer and reviving flocculation. Both lime and hydroxy-Al polymers produced by precipitation of exchangeable Al will act as cementious agents, connecting soil particles together as one and enhancing soil structure when present in adequate quantities.

Fertilizers are added to soils to keep or increase crop yields. Long-term, increased crop yields and organic matter returns associated with daily fertiliser application result in a higher soil organic matter content and biological activity than occurs in the absence of fertiliser application. As a result, it has been stated that long-term fertiliser formulations increase water stable aggregation, porosity, infiltration capability, and hydraulic conductivity while decreasing bulk density in a number of cases. Additionally, fertiliser additions may have physico-chemical effects on soil aggregation. Phosphatic fertilisers and phosphoric acid can promote aggregation by forming Al or Ca phosphate binding agents, while when NH^{4+} accumulates in high concentrations in the soil dispersion of clay colloids can be favored.

Organic manure additions result in an increase in the organic matter content of the soil. Numerous studies have shown that this results in increased water holding ability, porosity, infiltration capacity, hydraulic conductivity, and water stable aggregation, while simultaneously decreasing bulk density and surface crusting. The problems associated with large manure applications include dispersion caused by accumulated K^+, Na^+, and NH^{4+} in the soil and decomposer fungi producing water-repellant substances **[9]**.

CONCLUSION

Agricultural land management has a major impact on soil properties. Microbial soil species are the most sensitive and rapid indicators of land use changes, while soil enzyme activities are sensitive biological indicators of soil management practices impacts. The application of various methods revealed substantial variations in microbial properties and soil microbial indexes between different agricultural management approaches, as these were closely correlated with soil organic matter content. The effects of different above-mentioned applications resulted in specific microbial soil properties, organic management practices resulted in an improvement in the consistency of the soil biology, aggregate stability, and organic matter content.

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REFERENCES

[1] Tale KS, Ingole S: A Review on Role of Physico-Chemical Properties in Soil Quality, Chem Sci Rev Lett. 2015; 4(13):57-66.

[2] Ashenafi A, Abayneh E, Sheleme B: Characterizing soils of DelboWegene watershed, Wolaita Zone, Southern Ethiopia for planning appropriate land Management. J Soil Sci Environ Manage. 2010, 1: 184-199.

[3] Kekane SS, Chavan RP, Shinde DN, *et al.*: "A review on physico-chemical properties of soil", International Journal of Chemical Studies 2015; 3(4): 29-32.

[4] Ogunmwonyi I. N, Igbinosa O. E, Aiyegoro O.A and Odjadjare E. E. 2008. Microbial analysis of different top soil samples of selected site in Obafemi Awolowo University, Nigeria. Scientific Research and Essay Vol. 3 (3):120-124.

[5] McPherson, M.R., Wang, P., Marsh, E.L., Mitchell, R.B., Schachtman, D.P. 2018. Isolation and Analysis of Microbial Communities in Soil, Rhizosphere, and

Roots in Perennial Grass Experiments. *J. Vis. Exp.* (137), e57932, doi:10.3791/57932.

[6] Verma S, Jayakumar S. Impact of forest fire on physical, chemical and biological properties of soil: A review. proceedings of the International Academy of Ecology and Environmental Sciences. 2012 Sep 1; 2(3): 168.

[7] Glaser B, Lehmann J, Zech W. Ameliorating physical and chemical properties of highly weathered soils in the tropics with charcoal–a review. Biology and fertility of soils. 2002 Jun; 35(4): 219-30.

[8] Dermont G, Bergeron M, Mercier G, Richer-Laflèche M. Soil washing for metal removal: a review of physical/chemical technologies and field applications. Journal of hazardous materials. 2008 Mar 21;152(1):1-31.

[9] Haynes RJ, Naidu R. Influence of lime, fertilizer and manure applications on soil organic matter content and soil physical conditions: a review. Nutrient cycling in agroecosystems. 1998 Jun; 51(2): 123-37.