PDF - EFFECT OF NATURAL SOIL FERTILITY ON Lycopersicon esculentum (TOMATO) - researchcub.infoABSTRACT

A naturally fertile soil is that which have been allowed to undergo varying physical, chemical and biological decomposition as a result of the activities of the various micro-organisms (protozoa, bacteria, viruses) on the leaves and other plants materials that had fallen on the soil for a very long period say twenty (20) to thirty (30) years. These materials are being eaten up by soil macro-fauna: earthworm, termites, ants and then subjected to decomposition by soil micro-flora: bacteria, viruses and actinomycetes thereby resulting in the mixing of the organic and mineral matter with both micro-flora and fauna playing vital roles and the net result is a naturally fertile soil.

Soil natural fertility has a dominant role and influence on the growing of crops because it is the medium through which the desirable characteristics (disease resistant, good flowering and vegetative growth, early maturity and high yield) of the crop plant will be obtained without any interference from an external factor by way of fertilizer application or organic manure. Desired quantity and quality (high fruit production with good flavor, aroma and texture) are achieved if varieties of crops are grown with naturally fertile soils.

OBJECTIVE:

The main objective of this experiment was to demonstrate that different soils: Elaeis guinensis,Tectona grandis and Irvingia gabonesis that had been under varying microbial activities for a long period have varying mineral constituents, hence varying effects on the growth pattern, fruit yield and quality of Lycopersicon esculentum (Tomato). CHAPTER 1

INTRODUCTION

1.1What is Soil?

Metaphorically, soil is life. This is because it is that medium by which cultivated plants take up numerous nutrients in the balanced form to produce food for consumption by organisms notably animals which are dominated by man.

Soil can also be referred to as a natural body consisting of layers (soil horizons) of mineral constituents of variable thickness, which differ from the parent materials in their morphological, physical, chemical and mineralogical characteristics. It is composed of particles of broken rocks which have been altered by chemical and environmental processes that include weathering and erosion. Soil differs from its parent rock due to the interaction

between the lithosphere, hydrosphere, atmosphere and biosphere.

The formation of soil (Pedogenesis) is the combined effect of physical, chemical, biological and anthropogenic processes on soil parent material. Soil genesis involves processes that develop layers or horizons in the soil profile. These processes involve addition, losses, transformations and translocation of materials that compose the soil.

ADDITION: When materials are brought from outside sources to the developing soil profile. A very common example is the impact of organic matter from foreign plant leaves. The soil is already going through the processes of development and some external materials are added to the developing soil.

LOSSES: Materials are lost from the soil profile through leaching to ground water, erosion of surface materials or other forms of removal from the surface. Other sources of losses include evaporation and evapo transpiration.

TRANSFORMATION: Involves weathering of many primary minerals and altering same to form various kinds of silicate clays. Here, the soil constituents are changed (modified) in chemical and physical properties while others may be synthesized from the precursor material. Decomposition and recombination of the decomposed materials from primary minerals may also lead to new minerals which may be additional types of silicate clays and hydrous oxides of Aluminum and iron.

TRANSLOCATION: This involves the movement of materials laterally within the horizon or vertically from one horizon to another horizon. Water, either rising up by capillary action or moving down by the effect of gravity is a typical translocation agent. Materials like fine clay particles, dissolved salts and dissolved organic substances may be moved within the soil profile. Other translocation agents are soil organisms-earthworm, which may incorporate surface organic litter into the A or B horizon and the transportation of materials in the B and C horizon to the surface by mound-building termites or the burrowing actions of rodents.

It should be noted that the alteration and movement of materials within the soil causes the formation of distinctive soil horizons.

Broadly, soil is formed by the interaction of five major factors which are climate, parent materials, topography or relief and organisms (plants and animals).These were incorporated by Hans Jenny in 1941, in a state factor equation: S or s= F (c,o,r,p,t)

Key: S = soil; s = any soil property; c= climatic factor, 0= organism or biotic factor; r = relief or topography factor; p = parent material, and t= time factor.

For climate, the effects of precipitation and temperature are considered in soil formation. Organism or biotic factors are essentially vegetation, and it is the summation of plant litter reaching the soil. Topography or relief factors include shape and slope of the landscape, the aspect of the slope and the height of the water table. Parent materials are the weathered and unweathered materials from which the soil is formed. Time is the period taken for the materials to be deposited and exposed at the surface. that is period of soil formation.

The relative influence of each factor varies from place to place, but the combination of all the five factors normally determines the kind of soil that develops in any given place. In most cases, one of the factors has a dominating effect in describing a particular soil. Soil scientists usually refer such set of soils as:

Lithosequence: If parent materials dominate;

Climosequence- If climatic factors dominate;

Biosequence- If organisms (vegetation and animals) dominate;

Toposequence- If topography or relief dominates;

Chronosequence- If a longer period is taken before soil is formed.

Diagram showing the climate, parent material, organisms and topography interacting with time to form soil. (Source E.A. Fitzpatrick 2006).

In this presentation, the effect of organisms (Particularly vegetation) and organic matter to bring about natural fertility of soil will be looked at.

1.2 ROLE OF NATURAL VEGETATION: The role of natural vegetation is determining soil properties and by extension its fertility can be linked to its use to reduce natural soil erosion thereby slowing down soil mineral removal, hence sustaining fertility of the soil.

Organic acids produced from certain types of plant leaf litters bring iron and aluminum into solution by complexation reactions and accelerate the downward movement of these ions and accumulate them in the B-horizon. This helps to prevent soil acidity.

Again when the properties of the soil under grassland and that in the forest regions are compared, the organic matter added to soil in the grassland is from the deep fibrous root system whereas in the forest zone the organic matter comes from the tree leaves falling on the forest floor. As a result, the soil in the grassland has a thicker A-horizon with a deeper distribution of organic matter whereas the soil of the forest has a thin A-horizon.

1.3 ROLE OF ANIMALS: Large animals like gophers, moles and prairie dogs bore into the lower soil horizon and bring materials to the surface through their tunnels which are open to the surface thereby encouraging movement of water and air into the surface layers. In localized areas, they enhance the mixing of the lower and the upper horizons by creating and later refilling underground tunnels, thereby creating profile features known as “Crotovinas” by their burrowing activities.

Earthworms and other smaller animals bring about considerable soil mixing as they burrow through the soil significantly affecting soil formation. Earthworms ingest soil particles and organic residues enhancing the availability of plant nutrients in the materials that pass through their bodies. They aerate and stir the soil and increase the stability of the soil aggregates. Ants and termites as they build various mounds also transport soil materials from one horizon to the other. This mixing activity of animals is called “Pedoturbation”.

1.4 ROLE OF ORGANIC MATTER: Organic matter content of the soil undergoes several and varying decompositions for a very long period of time to release the desired nutrient for plant uptake through the roots. These organic matter is seriously acted upon by microscopic organisms notably bacteria (nitrosomonas, nitrobacter, thiobacilli etc).

Therefore, natural soil fertility is the ability of the soil to make available all the required and essential nutrients for uptake and use by plants in producing carbohydrate through the process of photosynthesis without any external influence by way of addition of fertilizers.

Generally, a fertile soil has the following properties:

It is rich in nutrients necessary for basic plant nutrition-N, P,K and other basic nutrients.

It contains sufficient minerals (trace elements) for plant nutrition including Boron, Chlorine, Cobalt, Copper, Iron, Manganese, Magnesium, Molybdenum, Sulphur and Zinc.

It contains soil organic matter that improves soil structure and soil moisture retention.

The pH of the soil is in the range 6.0 to 6.8 for most plants although some prefer acid or alkaline condition.

There is a range of micro organisms that support plant growth.

It often contains large amount of topsoil.

It must be noted at this point that in land uses for agriculture, or fertile soil typically arises

from the use of soil conservation practices.

1.5 SOIL FERTILIZATION:

The major elements that is most lacking in the soil is Nitrogen Peroxide. Phosphorus oxide (P_2O_5) and potassium bicarbonate are also needed in very large amount. This deficits are often remedied by the use of inorganic fertilizers but criticisms have been leveled against the use of inorganic fertilizers because the water-soluble Nitrogen does not provide for the long term needs of the plant and also creates water pollution.

1.6 SOIL DEPLETION: Soil depletion occurs when the components which contribute to fertility are removed or are not replaced; and the conditions which support fertility of soil are not maintained. This leads to poor crop yields. In agriculture, depletion can be due to excessively intense cultivation and inadequate soil management.

Major widespread occurrences of soil depletion emanate from the combined effects of growing population densities, large scale industrial logging, slash-and-burn agriculture, ranching and total nutrient removal.

Top soil depletion is when the nutrients- rich organic top soil that takes hundreds to thousands of years to build up under natural conditions is eroded or depleted of its original organic material. Depletion of the top soil may occur through a variety of effects including over tillage-which damages soil structure; the over use of inputs such as synthetic fertilizers and herbicides which leave residues and buildups that inhibit activities of soil microorganisms.

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