BIO 403- LECTURE-2

TITLE: PHYSICAL PRPERTIES OF SOIL

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Summary

In this lecture class we are going to continue on the physical properties of soil and we are discussing soil structure and soil density.

Soil structure

Soil structure describes the way and manner soil particles are being arranged. And this determines the nature of the systems in terms of pores and channels. The arrangement and grouping of soil particles is being referred to as soil aggregates or soil peds. This soil aggregates greatly influences movements, heat transfer, aeration and porosity in the soil. Soil structure is characterized by shape, size and distinctness of the aggregates or peds. The four principal structure of soil that will be considered in this course are Spheroidal, platy, prism like, block like.

(1) Spheroidal soil structure

They are granular in shape and they are always separated from each other in a loosely packed arrangement. They range from less than 1mm to greater than 10mm in diameter. This type of soils are common in surface soils with high organic contents especially those that has been highly invaded by earthworms. They are also common in grasslands.

(2) Plate like structure

This kind of soil are characterized by thin horizontal peds arranged in plate form and can be found in surface and subsurface horizon of soils. Platy structure may be inherited from soil parent materials, and in some cases compaction of clay soils by heavy machinery can create plate like soil structure.

(3) Prism like structure

Prism like structure are characterized by vertically oriented prism or pillar like peds and they have diameter up tom150mm or more. They are commonly found in subsurface grounds on arid and semi-arid regions.

(4) Block like

They are in cube form and they are irregularly arranged. They can be from 5mm to 50mm. Block like soil structure promote good aeration, root penetration and drainage.

Soil Density

In measuring soil density there are three aspect of measurements and calculations you must note. (1) Soil particle density (2) Soil bulk density (3) Soil pore size

Soil particle density: This is defined as the mass per unit volume of soil solids. Particle density is essentially the same as the specific gravity of a solid substance. The chemical composition and crystal structures of a mineral determines its particle density. Soil density is not affected by pore space, and therefore is not related to particle size or to the arrangement of particles. Soil texture and depth affects soil density. Changes in soil density for a given soil are easily measured and can alert soil managers to changes in soil quality and ecosystem function for example, increase in soil density indicate a poorer environment for root growth, reduced aeration, and undesirable changes in hydrologic function, such as reduced water infiltration.

Formula for calculating soil particle density

$$\text{Soil particle density} = \frac{\text{Mass of dry soil}}{\text{Total volume of the soil}}$$

Soil bulk density: This is defined as the mass of a unit volume of soil. The volumes in this case involves the solid particles of the soil and the pores. Soil bulk density is affected by soil texture and depth in soil profile.

Soil pore size

One of the main reason of calculating soil bulk density is to enable us calculate pore space. For soils with the same particle density the lower the density, the higher the percent pore space (total porosity).

Formula for calculating percentage pore space

$$\text{Percentage pore space} = 100 - \left(\text{Soil bulk density} \times \frac{100)}{DP}\right.$$

Soil pores occur in a wide variety of sizes and shapes that largely determine what role the pore can play in soil. Pores can be grouped by size into macropores, mesopores and miropores. Continuous cropping of soils originally high in organic matter, often results in a reduction of macropore spaces.