COOPERATIVE EXTENSION SERVICE ♦ MARYLAND INSTITUTE FOR AGRICULTURE AND NATURAL RESOURCES

SOILS
UP FROM THE SOIL
SOIL STRUCTURE

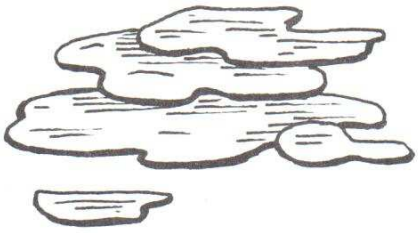
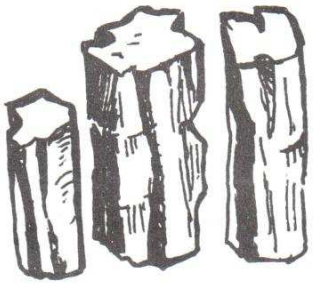
4-H 317

In the lesson on soil texture, you learned that the mineral part of the soil is made up of particles which vary considerably in size. You also learned that the relative proportion of the various-sized particles in a soil is referred to as soil "texture". In this lesson, you will learn that the manner in which soil particles adhere to one another in clumps or in aggregates is referred to as soil structure.

In general, soils with good structure are more productive than those with poor structure. In soils with poor structure, the particles can become packed together very tightly, making it very difficult for plant roots to penetrate the soil. A crust on the surface of cultivated soil is one example of poor structure. Young plants often find it difficult to force their way through hard crusts.

Poor structure, which often occurs in soil with reduced organic matter content, may also reduce the aeration of soils. As a result, the infiltration of water is reduced, the soil becomes compacted, and relatively little pore space remains for moisture, air and roots. A soil in good physical shape is relatively easy to cultivate.

In addition to the small crumb-like granules or aggregates which may form, larger groupings of the granules may take shapes which resemble blocks, columns or irregular layers. Below are some examples of what the various forms look like.

TYPE		DESCRIPTION
PLATY		Flat, thin plates lying horizontally in soil.
PRISMATIC		Vertical columns in soil may be several centimeters long and about 4 to 8 cm (1 1/2 to 3 inches) in diameter.

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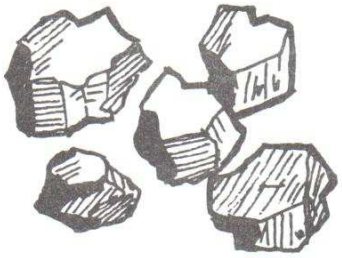
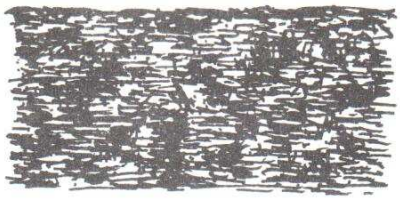
TYPE		DESCRIPTION
BLOCKY		Angular blocks about 1 to 5 cm (1/2 to 2 inches) in diameter.
GRANULAR OR CRUMB		Resembles crumbs or grains. Usually less than .5 cm (about 1/4 inch) in diameter.
GRAVEL OR SAND		Soil particles do not stick together. Single grains.
HEAVY SOIL		Soil in very large clods. No visible structure. Hard to break apart.

When a soil has good physical structure, it is said to have good soil tilth. Soils which have good soil tilth cultivate easily and remain in good condition after heavy rains. Seeding is easy, and the hard crusts which can prevent seedlings from emerging do not form readily. Drainage and aeration is improved and soil erosion is reduced.

Soil tilth can best be improved by growing crops which require a minimum amount of tillage (plowing, cultivating, etc.). Good tilth depends upon the soil particles being cemented together by organic matter. Thus, over a period of time, a sod crop would improve soil tilth much more than a row crop, such as corn or soybeans. The sod crop is plowed up only occassionally, but row crops require frequent plowing and cultivating which destroy soil organic matter. Each culture has its own associated soil organic matter level. The most practical way to build up soil organic matter and to improve soil tilth is to grow as large a crop as possible each year with a minimum stirring of the soil.

Experiment

To demonstrate the effect of various crops on soil tilth, take two soil samples from adjacent fields--one from a pasture which has been in sod for many years, and another from a field which has been plowed often in the last few years and is currently growing a cultivated crop. Check a soil map of the field to be sure that both areas have the same soil type. You can usually get a soil map from your local Soil Conservation Service office.

Take about .5 liters (about 1 pint) of soil from each field. The soil sample should be taken from the top 5 to 8 cm (2 to 3 inches) in the sod, and from the top 15 to 20 cm (6 to 8 inches) in the plowed field.

Spread the samples on a piece of newspaper and allow to air dry. Break up any clumps so that the largest aggregates are no more than .5 cm (1/4 inch) in diameter. Either by sieve or by hand, separate out about 7.5 mL (1 teaspoon) of aggregates from each sample. Place these in two old teacups. Pour enough water down the inside of each cup to barely cover the aggregates. Do not pour the water directly onto the aggregates.

From which field do the soil aggregates remain intact? From which field do the aggregates slake down or decompose? From which field are the soil aggregates the most stable? Why? _____

If the materials are available, a better comparison of the two kinds of soil aggregates could be performed as follows:

1. Obtain two glass or plastic cylinders about 2.5 to 5 cm (1 to 2 inches) in diameter and about 20 to 25 cm (8 to 10 inches) long.
2. Fasten a doubled layer of cheesecloth or other loosely woven fabric over one end of each cylinder with a rubber band.
3. Pour 8 to 10 cm (3 to 4 inches) of each kind of soil aggregates into separate tubes.
4. Suspend the tubes of soil over separate jars.
5. Carefully add enough water to each tube so that about 2.5 to 5 cm (1 to 2 inches) of water covers the soil. *Be sure to pour the same amount of water into each tube.*
6. Which soil allows the most water to pass through, and pass through the most rapidly? This soil would absorb the most water and be the least susceptible to erosion.

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