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Three Simple Hands-On Soil Exercises Extension Professionals Can Incorporate into Natural Sciences Curriculum

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Abstract: The importance of healthy soil and of conveying the importance of soils starts by conveying a few basic concepts of soil science cannot be overstated. This article provides three hands-on exercises Extension professionals can add to natural resources or Master Gardener education curricula. These natural sciences exercises are easy to prepare for the instructor and accurately reflect behavior of soil in situ. These exercises are designed for classroom use, but they can be used concurrently with field training. These exercises are appropriate for both youth and adult audiences.

Introduction

Soil is defined as the unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants (Soil science glossary terms committee, 2008). Soil is crucial for all life on earth and is playing an increasingly important role as a carbon dioxide sink (Lal, 2004). This article presents three straightforward exercises Extension professionals can incorporate into a natural resources curriculum and present to youth and adult audiences. Specifically, I have used these exercises during 4-H sponsored farm/city programs for 4th and 5th graders as well as Master Gardener certification training. A practical exercise on soil aggregate stability (Wortmann & Brubaker, 2004) can also be included with the following exercises.

Exercise #1: Physical Properties of Clay

Soil properties such as shrink-swell behavior, plasticity, water holding capacity, and chemical adsorption depend on the kind of clay present in soil (Brady and Weil, 2002). The objective of this exercise is to demonstrate the disparate water holding properties of two visually identical clays, montmorillonite and kaolinite.

Materials Required

- Montmorillonite clay, 1b dry

- Kaolinite clay, 1b dry
- Standard kitchen blender
- Tap water
- Tablespoon
- Measuring cup
- Clean, empty glass container (an old pickle jar works great)

Montmorillonite and Kaolinite can be purchased online at ceramic or pottery supply stores. Kaolinite is sometimes sold as "EPK"; montmorillonite is sometimes sold as "bentonite."

Procedure (adapted from Graveel & Fulk-Bringman, 2003)

Invite a participant to assist you with this demonstration. Ask the participant to add approximately 1/3 of a measuring cup of tap water to the blender, and start the blender. Using the kaolinite clay first, have the participant add two heaping tablespoons of dry kaolinite to the water with the blender running. Allow the mix to blend for 3 seconds, turn off the blender, and slowly pour the slurry into an empty glass container. Repeat the procedure using montmorillonite, and note that the montmorillonite does not pour from the blender due to its extreme water holding capacity. Discuss how the different clay properties affect water potential for crop growth.

Exercise #2: Soil Forming Factors

There are several factors that act concurrently to produce soil. These factors are referred to collectively as "soil forming factors," and include parent material, climate, biota, topography, and time. The objective of this exercise is to introduce these five soil-forming factors to the audience.

Materials Required

- A branch from a tree, no longer than 18" (for ease of handling)
- A piece of flagstone or similar flat stone no longer than 18" (for ease of handling)
- Residue from crops, I recommend filling a five-gallon bucket half full

Procedure

Invite three participants to assist you, and have each participant hold up one of the items mentioned above: branch, flagstone, and crop residue. Ask the audience, "are any of these things soil?" The correct answer is "no." Then ask, "will these things become soil?" The answer is "yes, if the soil forming factors are allowed to work." Begin a free discussion on the soil-forming factors and their impact on each of the items, and discuss which might turn to soil more quickly.

Exercise #3: Soil Structure and Soil Quality

The combination of primary soil units (sand, silt, and clay) into secondary units is referred to as "soil structure." Soil structure is related to water and nutrient movement, biological productivity, and nutrient cycling. Soils lacking structure may be prone to runoff and erosion, which may ultimately affect surface water quality. The objective of this exercise is to examine a well-structured soil and poorly structured soil and discuss implications.

Materials Required

- Dark-colored surface soil (no deeper than 4") from a garden or crop field. I recommend using native soil and not potting mixes or store-purchased topsoil. Native soil will show granular structure.

- Light-colored clods of soil (approximately 6-8) at least the size of a fistâ larger is better for this demonstration. I recommend investigating a recently plowed field or visiting a construction site to find hard, impermeable clods.

Procedure

Pass around the dark-colored garden soil to all participants, being sure to have participants put their hands in the soil. I recommend not passing the clods around to all, because they may break open if dropped. Hold up two or three clods to participants. Ask which soil would the participants rather use in a garden, and why. Explain to the participants that the garden soil has structure and that structure is primarily due to microbial activity, which also gives that soil a dark color. Discuss factors that promote structure development in soil, such as using cover crops, avoiding compaction, avoiding working soil when wet, adding organic matter, and maintaining health plants.

References

Brady, N. C., & Weil, R. R. (2002). *The nature and property of soils, 13th Edition.* Upper Saddle River, NJ: Pearson Education.

Glossary of soil science terms committee. (2008). *Glossary of soil science terms 2008*. Madison, WI: SSSA.

Graveel, J., & Fulk-Bringman, S. (2003). Demonstrations in soil science. West Lafayette, IN: Purdue Department of Agronomy.

Lal, R. (2004). Soil carbon sequestration impacts on global climate change and food security. *Science*, 304(5677): 1623 â 1627.

Wortmann, C. S., & Brubaker, S. C. (2004). Soil aggregation: A practical exercise for crop producer education. *Journal of Extension,* 42(6) [On-line] Article 6TOT7. Available at: http://www.joe.org/joe/2004december/tt7.php