The Journal of Extension

Volume 42 | Number 6 Article 33

12-1-2004

Soil Aggregation: A Practical Exercise for Crop Producer Education

Charles S. Wortmann
University of Nevada, cwortmann2@unl.edu

S Corey Burbaker
Natural Resource Conservation Service, corey.brubaker@ne.usda.gov

Recommended Citation

Wortmann, C. S., & Burbaker, S. (2004). Soil Aggregation: A Practical Exercise for Crop Producer Education. *The Journal of Extension, 42*(6), Article 33. https://tigerprints.clemson.edu/joe/vol42/iss6/33

This Tools of the Trade is brought to you for free and open access by the Conferences at TigerPrints. It has been accepted for inclusion in The Journal of Extension by an authorized editor of TigerPrints. For more information, please contact kokeefe@clemson.edu.

December 2004 // Volume 42 // Number 6 // Tools of the Trade // 6TOT7

Soil Aggregation: A Practical Exercise for Crop Producer Education

Abstract
The importance of soil physical properties to crop growth is often under-estimated by producers. Simple tests are needed for demonstration of variations in soil physical conditions due to soil properties and management. Tests that can be used by producers in their fields are preferred. A test of wet aggregate stability of soil is described that can be used in teaching crop producers about soil physical properties. The test requires little equipment and less than 10 minutes of teaching time. The test is also appropriate for use by producers to diagnose problems and monitor trends on their fields.

Charles S. Wortmann
Nutrient Management Extension Specialist
University of Nebraska
cwortmann2@unl.edu

S. Corey Brubaker
Resource Conservationist
Natural Resource Conservation Service
corey.brubaker@ne.usda.gov

Crop growth is often constrained by poor root development, by slow water infiltration and water movement through the soil, and by poor soil aeration. These constraints are often associated with poor soil porosity. Soil aggregation is important to developing and maintaining good soil porosity and hence to good root growth and to movement of soil water and gases. With more soil in water stable aggregates, it is expected that:

- The rate of water infiltration and percolation will increase
- Soil crusting will be less;
- Resistance to the splash effect of raindrops will increase and soil erodibility will decrease; and
- Runoff will decrease, making more water available to the crop.

The importance of soil physical properties to crop growth, including soil aggregation properties, is often under-estimated by producers, and practical exercises can be useful in conveying information on the importance of these properties.

Soil wet aggregate stability is determined as an estimate of the proportion of soil in aggregates that are stable against flowing water. Measuring wet aggregate stability for research purposes requires much equipment and time. Even some simpler tests developed for teaching (Patton, Burras, Konen, & Molstad, 2001) and for soil quality testing (USDA, 2001) need more equipment and time than is generally available in a field-based teaching event for crop producers.

The test of wet aggregate stability described here requires little cost and equipment and can be used in a practical exercise requiring only about 10 minutes of teaching time. We have found the test to be useful in teaching about how soil physical properties are affected by tillage, by land use, by sodium absorption ratio, and by clay content. We did not find it to be sensitive enough to demonstrate effects of manure application on soil aggregate stability.

The test is easily mastered by producers, and it is a test that they can use in their own fields in the diagnosis of the physical condition of the soil and in monitoring changes in aggregate stability with time or with change in management practices. The soil wet aggregate stability test is therefore valuable in conducting hands-on exercises when teaching producers about soil physical properties

but has the added value of being a test that producers can apply in their own fields to diagnose problems, make comparisons, or monitor trends.

Learning Objectives

After completing the practical exercise, producers will:

1. Understand how soil aggregate stability is affected by one or more soil properties or management factors such as land use, tillage practices, soil texture, and sodium absorption ratio; and

2. Be able to apply the wet aggregate stability test in their fields to diagnose problems or to monitor effects of management practices on soil aggregate stability.

Procedure

The required materials for a practical exercise are easily available and inexpensive (Table 1).

Table 1.
Materials for Aggregate Stability Tests

Quantity	Item	Description
1[1]	Tea strainers	Common tea strainers of 2 to 3" diameter
1[1]	Transparent cup or beaker	Diameter is slightly wider than for the tea strainer
1	Plastic serving tray	One for every 2 or 3 samples
1[1]	Paper towels	
1	Marker pen	Waterproof ink
1	Measuring spoon	Can be 1 tablespoon, 1/16 cup, or about 15 g measure
1[1]	Graduated cylinder	Desired but not essential; 50 ml size
>1[2]	Soil samples	Samples of at least two soils of differing aggregate stability. May pre-sieve with 8 mm sieve. Collect 100 g or more if demonstration is to be repeated or eventually conducted for other audiences
	Water	Water is used for the tests and for cleaning. Squeeze bottles are convenient. One or more liters may be needed.

[1] One, or more if replicated, is required for each soil sample or soil treatment.

[2] Two interesting and educational comparisons of soil aggregation are: between soil from the surface soil to 2" depth for conventional tillage, continuous no-till, and perennial grass; and between sodic and non-sodic soil.

The exercise is conducted as follows.

1. Label one (more if replicated) cup and a paper towel for each sample.
2. Arrange cups and towels on trays.
3. Fill cups to near brimful with water.
4. Place approximately 15 g (1/16 cup or just over a tablespoon) of soil into a tea strainer.
5. Touch the bottom of the tea strainer to the surface of the water in the cup until the soil is moist.
6. Submerge the soil in strainers in the cups of water 20 times at about 2 seconds per cycle. Members of the class normally participate actively in steps 5 to 8.
7. Carefully dump the wet soil on the paper towel.
8. Observe the quantity and shape (degree of slumping) of the wet soil mass, and the presence of soil aggregates. The soil mass should be greater with less slumping and with more visible aggregates with greater aggregate stability.
9. Allow the sediment to settle in the transparent cups for 10-15 minutes and observe the soil load.
10. Decant most of the water from each cup and transfer the remaining water with sediment into 50 ml graduated cylinders. Use squeeze bottle to wash out the sediment.
11. Allow the sediment to settle again and observe sediment depth in the graduated cylinders.

Begin the exercise early in the session with the intention of returning to it twice following sedimentation intervals. First, complete steps 1 to 8, and then go on to cover other material for approximately 15 minutes while sedimentation occurs in the cups. Then, do steps 9 and 10, which are again followed by about 15 minutes of sedimentation in the graduated cylinders. Finally, sediment depth in the cylinders is determined.

The implications of the results of the practical exercise are generally immediately obvious to producers, creating an opportunity for further discussion of the important of aggregate stability and factors that affect it.

References

Patton, J., Burras L., Konen, M., & Molstad, M. (2001). An accurate and inexpensive apparatus and method for teaching and measuring stable aggregate content of soils. *Journal Natural Resources and Life Science Education* 30:84-88.

USDA (2001). *Soil quality test kit guide*. Soil Quality Institute, ARS-NRCS-USDA.