Name_____

# The Sponge Effect – Sample Activity

## Purpose

In the previous activities, you have learned about factors contributing to soil porosity and permeability. However, high-quality soil must have a balance of drainage and water storage. Good drainage prevents damage to roots due to a lack of oxygen, while the storage of water in the soil allows roots to avoid drying out.

Available water-holding capacity (WHC) is the term used to describe the ability of soil to hold water in the soil profile for plant use. Think of soils acting like a sponge, soaking up water and holding it until plant roots utilize it or evaporation occurs.

Some soils do not retain water very well because of their coarse texture. Others, such as clay soils, can hold a lot of water, sometimes too much water for certain kinds of plants. Determining the water-holding capacity of soils is important for you to be able to make management decisions for different soil types. What are the characteristics of soil with good water-holding capacity?

## Materials

**Per pair of students:**

- Water
- Sponge, dry, 6 in.$^3$
- Steel wool pad, course, 6 in.$^3$
- Graduated cylinder, 100ml
- Collection pan

**Per student:**

- Pencil
- *Agriscience Notebook*

**Per group of four students:**

- Electronic balance

## Procedure

Test the water holding capacity of two different substances as a simulation of differences found in soil types. Follow the procedures outlined below and report your findings.

### Part One – Recording Mass

1. Weigh the dry sponge and the dry steel wool using the electronic balance.
2. Record the *Dry Mass* of each substance in Table 1. Be sure to include the correct unit of measurement in all observations.

### Part Two – Soaking It Up

1. Hold the sponge over the collection pan.
2. Pour 30ml of water over the sponge, slowly allowing the water to soak into the sponge. Avoid spilling the water over the edge of the sponge.
    - Continue adding 30ml of water until the sponge begins to drip.
    - Keep track of the amount of water poured into the sponge and record the total in Table 1 in the *Initial Water Input* row.

**Table 1.** ***Data***

| Observations | Sponge | Steel Wool |
|---|---|---|
| Dry Mass (A) | | |
| Wet Mass (B) | | |
| Mass Difference (B-A) | | |
| Run-off Water (X) | | |
| Water Holding Capacity (Y) | | |
| Combined Total (X+Y) | | |
| Initial Water Input (Z) | | |
| Unavailable Water(Z-(X+Y)) | | |

3. Once the sponge begins to drip, allow the sponge to drip until it stops.
4. When the drips have stopped, weigh the sponge, and record the *Wet Mass* in the appropriate row of Table 1.
5. Measure the water in the collection pan. Record the *Run-off Water* volume in Table 1.
    - **NOTE:** The person holding the sponge must be careful not to squeeze water out of the sponge.
    - The water measured in the collection pan is the run-off water. The soil met the saturation point, and the water run-off is the excess water the sponge could not hold.
6. Discard the run-off water.
7. Squeeze the water from the sponge into the collection pan. Twist the sponge several times to remove as much water as possible from the sponge.
8. Measure the volume of water in the collection pan collected from squeezing the sponge. The water amount represents the water holding capacity (WHC) of the sponge. Record the measurement in Table 1.
9. Calculate the unavailable water.
    - Add the run-off total with the water-holding total.
    - Subtract the combined total from the total amount of water initially added to the sponge.
    - The amount remaining is the water held in the soil that is unavailable for plant use. Record the calculated total in Table 1 in the *Unavailable Water* row.
10. Repeat Steps 1–9 for the steel wool sample and compare the results.
11. Answer the *Part Two Analysis Questions*.

***Part Two Analysis Questions***

**Q1** What types of soil textures do you believe the sponge and steel wool represent? Why?

**Q2** Why is there a difference in water holding capacity between the two substances?

**Q3** How do the sponge results compare with the steel wool results?

# Sample Teacher Notes

Students compare the water-holding capacity of a sponge and steel wool cleaning pad to simulate the holding capacities of soil.

***Teacher Preparation***
Present the PowerPoint® *Water Behavior* to provide background for a discussion about available, unavailable, and run-off water.

You will need to provide an equal-sized sponge and steel wool (e.g., coarse steel wool used for dishes) for each pair of students. Ensure that as students pour the water into the sponge and steel wool, it remains in the material (instead of running over the edges).

***Student Performance***
Students measure the dry mass of a sponge and steel wool pad. Then, they slowly pour water over the sponge, 30ml at a time, until it has reached its saturation point. Students collect and measure water run-off that is not absorbed and measure the wet mass of the sponge. Then, they remove as much water as possible by squeezing the sponge. Students measure the available water removed from the sponge and calculate the total unavailable water left in the sponge and lost as run-off. After finding the water capability of the sponge, they repeat the process with the steel wool pad.

***Results and Evaluation***
Students should find that both materials will have some unavailable water (the sponge more so than the steel wool). Lead them in a discussion regarding where that unavailable water is and why plants cannot access it. Potential answers to analysis questions are shown below.

**Table 2. *Analysis Questions and Potential Responses***

| | | |
|---|---|---|
| Q1 | What types of soil textures do you believe the sponge and steel wool represent? Why? | *The sponge represents loaming clay soil, and the steel wool represents sand or gravel.* |
| Q2 | Why is there a difference in water-holding capacity between the two substances? | *The sponge has smaller pores to hold the water.* |
| Q3 | How do the sponge results compare with the steel wool results? | *The sponge has a higher water-holding capacity than steel wool.* |

# Sample Activity

This sample is a modified version of *Activity 2.1.4 The Sponge Effect* from the CASE 4 Learning *Principles of Agricultural Science – ASP* (ASP) curriculum. For more information about the course visit **www.case4learning.org**. The sample has been modified for time and material simplification to fit a workshop format and is not for resale or profit. Teachers are permitted to use this sample in their classroom without certification.

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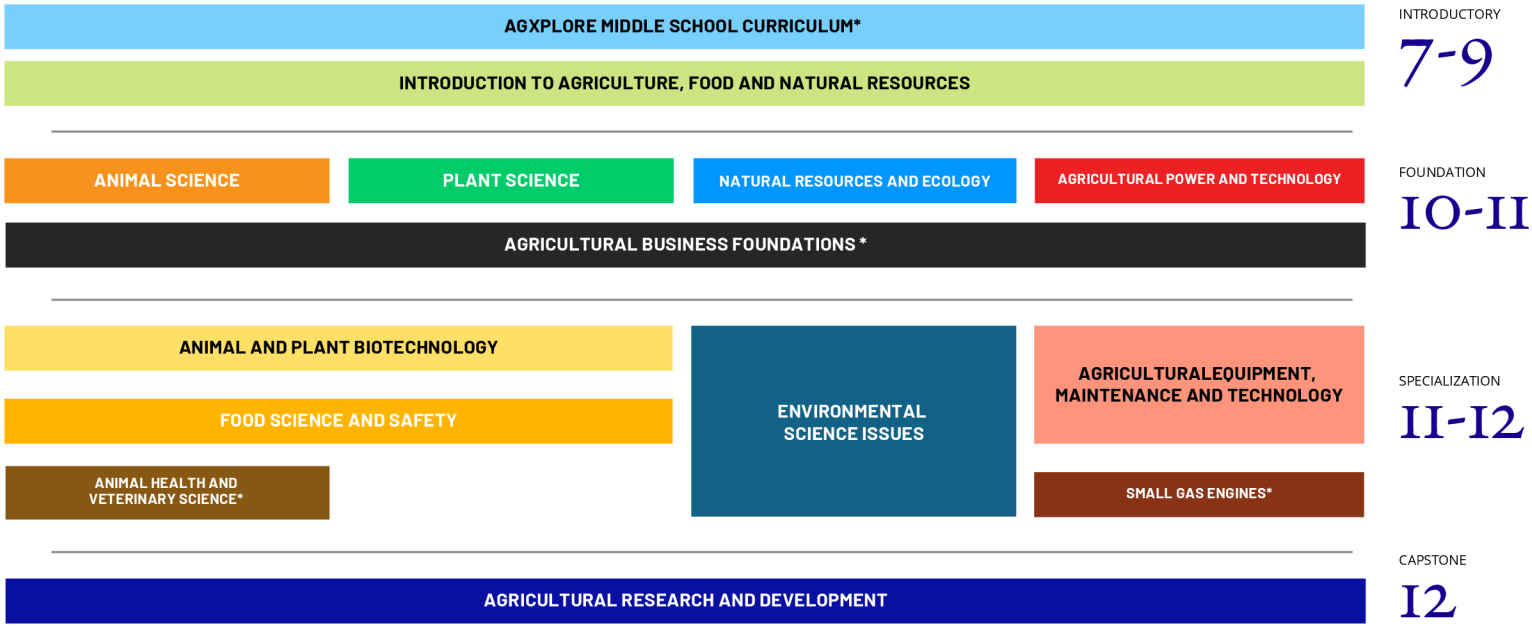


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