

## Activity 2.2.3 Salty Soil

### Purpose

Salts, especially in the form of chemical fertilizers, can build up in soils and greenhouse container media. The cause is poor water movement in the soil or lack of water altogether. This condition can be a problem in arid regions that do not have much rainfall and have poorly drained soils. The other common place this condition is found is in greenhouse crops when a wick or bottom watering system is used.

In the case of farmland, the situation is difficult to correct and is very expensive to reclaim soil. These regions are normally desert areas that require intensive irrigation in the first place. However, in a greenhouse situation the problem is easily corrected. Salts can be washed through the soil column with enough water. If you have a pot with a growing media that has good drainage characteristics, simply watering the plant container from overhead is the best method to correct or prevent salts from accumulating. The movement of salts downward through the soil profile is called leaching.

To determine if salts are a problem in a soil, you can test a sample of the soil using a LabQuest® sensor. Soil salinity is detected by measuring the electrical conductivity of a soil-water mixture. Electrical conductivity will increase as the level of salinity increases. You report electrical conductivity using deciSiemens per meter represented by dS/m. This activity will allow you to practice this test.

### Materials

#### Per pair of students:

- LabQuest® interface
- Vernier conductivity sensor
- 100ml graduated cylinder
- Garden soil sample
- Sand
- Peat moss
- MiracleGro® fertilizer
- (3) 250ml beakers
- (3) plastic spoons
- Permanent marker pen
- Distilled water
- Distilled water rinse bottle
- Electronic balance
- Weigh dish
- 100ml beaker
- Paper towels

#### Per student:

- Pencil
- *Agriscience Notebook*
- *PPE: safety glasses, lab apron, and disposable gloves*

## Procedure

You and a partner will test samples of soil and determine the level of salinity for each sample. Follow the directions outlined in the steps below.

### Part One – Setting Up the Experiment

1. Prepare the water-soil mixture in a 2:1 ratio.
  - Use a permanent marker and label three 250ml beakers, “garden soil,” “sand,” and “peat.”
  - Place four spoonfuls (about 80g) of each soil sample into the respective beaker. To avoid cross-contamination of the soils, leave the spoon in each beaker. You will use it later.
  - Use the graduated cylinder to add 100ml of distilled water to each beaker.
  - Stir all three mixtures thoroughly.
  - Stir each beaker once every three minutes for 15 minutes. Continue with Step 2 while you are waiting.
2. Set up the LabQuest<sup>®</sup> and conductivity sensor:
  - Set the selector switch on the side of the conductivity sensor to the 0–20000  $\mu\text{S}/\text{cm}$  range.
  - Connect the conductivity sensor to LabQuest<sup>®</sup> and choose New from the File menu.
  - NOTE: The conductivity sensor will only measure microSiemens per centimeter represented by  $\mu\text{S}/\text{cm}$ . You will need to convert this to deciSiemens per meter (dS/m). To convert, divide  $\mu\text{S}/\text{cm}$  by 1000.

### Part Two – Collecting Baseline Data

You will use measurements of salinity from the garden soil sample as the baseline data.

1. Place the tip of the electrode into the garden soil solution. The hole near the tip of the probe should be completely covered by the water-soil mixture. Gently move the tip in the solution to ensure an adequate measurement.
3. Monitor the salinity value displayed on the screen.
4. When stable, record the salinity data for  $\mu\text{S}/\text{cm}$  in Table 1.
5. Rinse the conductivity sensor with distilled water.
6. Do not discard the garden soil mixture; it will be used later.

### Part Three – Soil Components

As you learned in a previous lesson, natural soils contain several components including organic matter (i.e., plant tissue) and inorganic matter (i.e., rocks and minerals). Some substances add to the salinity of



		Conductivity (dS/m)	
Garden Soil	3656	3.6	
Sand	175	0.1	
Peat Moss	613	0.6	
Garden Soil + 1g of fertilizer	9808	9.8	
Garden Soil + 2g of fertilizer			

**Table 2. Plant Response to Salinity**

Salinity (dS/m)	Plant Response
0–2	Few problems
2–4	Some sensitive plants have trouble
4–8	Most plants have trouble
8–16	Only some plants will survive
above 16	Very few plants will survive

## Conclusion

- Did either soil component (i.e., sand or peat) contribute significantly to salinity? If so, explain why this is important to know.
- Based on your experiments, what do you think will happen if you over-fertilize with a chemical fertilizer?
- How do you correct a problem of high salinity levels in soil?

Source: Johnson, R. L., Stahmer-DeMoss, G., & Sorensen, R. (2007). *Earth science with Vernier*.  
Beaverton, OR: Vernier Software & Technology.