

13. SOIL pH

Do soil samples taken from different locations have the same pH? How could different soil pH levels affect the health of agricultural crops?

Objectives

- Compare the acidity or alkalinity of different soil samples.
- Relate soil pH to agricultural capacity.

Materials and Equipment

- Data collection system
- pH sensor
- Beakers (3), 250-mL
- Graduated cylinder, 100-mL
- Stirring rod
- Tablespoon
- Digging tool such as a hand trowel
- Zip seal plastic sandwich bags (3)
- Soil samples (3), 6 Tbsp. each
- Distilled water, 200 mL
- Marking pen
- Wash bottle filled with distilled water
- Paper towels

Safety

Follow these important safety precautions in addition to your regular classroom procedures:

- Wear safety goggles at all times.
- Do not collect soil samples in areas with high levels of animal waste.
- Follow your teacher's guidelines regarding safe soil sample collection in the field.

Procedure

1. This step will be completed outdoors. Dress appropriately and take the tablespoon, digging tool, marking pen, pen for writing, damp and dry paper towels, sandwich bags, and this handout with you. Collect 3 different soil samples from three different locations according to your teacher's guidelines. Use the following technique:
 - a. Wipe the digging tool with a damp paper towel and dry it.
 - b. Clear leaves and other solid debris directly above your soil collection site.
 - c. Use the digging tool to loosen the soil to a depth of about 8 cm. Mix upper and lower portions of the loosened soil.
 - d. Place 6 tablespoons of loosened, mixed soil in the sandwich bag and zip it closed. Wipe the Tablespoon with a damp paper towel and dry it.
 - e. Label the bag with the location from which the sample was collected, for example, *vacant lot*.
 - f. Record the location name in Table 1 along with detailed observations of living and nonliving features of the location such as:

- The appearance of the soil and soil composition, including conditions such as arid or humid.
 - The appearance and types of plants and other organisms.
 - Animal tracks and the appearance of animals.
 - The terrain, holes in the ground, and the geological features of rocks.
 - Nearby buildings and whether nearby roads are asphalt, cement, gravel, or dirt
 - Anything unusual about the area.
 - Include sketches if you believe they will be helpful.
2. Return to your classroom. Select Sensor Data in SPARKvue.
 3. Connect the pH sensor to your device.
 4. Make sure the pH measurement is checked and choose the Digits template.
 5. Label 3 beakers to match the location names on your soil sample bags.
 6. Remove rocks, sticks, or foreign objects from the sample bags.
 7. Remove excess air from the bag and seal it. Use the digging tool to crush the soil sample. When finished, mix the soil to ensure moisture content is evenly distributed throughout the sample.
 8. Place 4 tablespoons of the soil sample in the appropriate beaker.
 9. Add 60 mL of distilled water to the beaker and mix thoroughly with a stirring rod. Rinse the stirring rod when you have finished mixing.
 10. Let the soil-water mixture stand to promote hydrogen ion (H^+) dissociation while you continue with the procedure.
 11. Rinse the graduated cylinder and stirring rod with distilled water. Repeat Steps 6-10 to prepare the other two soil samples.
 12. Remove the cap and storage bottle from the pH sensor and rinse the end of the probe thoroughly with distilled water.
 13. Place the pH probe in the first beaker you prepared. Select Start to begin collecting data and gently stir the mixture with the probe until the reading stabilizes (up to 60 seconds); avoid striking the beaker with the probe. Make sure the glass bulb at the end of the probe remains immersed in water.
 14. Record the pH in Table 2. Remove the sensor from the mixture and rinse it thoroughly with tap water. Perform a final rinse with distilled water.
 15. Repeat Steps 13 and 14 to measure the pH for the other two samples and record the result in Table 2.
 16. Stop collecting data. Return the storage bottle and cap to the pH sensor after a final rinse with distilled water.

Data Collection

Table 1: Observations of soil sample collection sites

Site Name	Observations

Table 2: pH measurements of soil samples

Site Name	pH

Questions and Analysis

1. Using your data, list soil samples from most acidic to most alkaline. Propose a reason for the varying pH of each sample, and indicate which sample is most likely to neutralize acid rain.
2. Based on pH data, which, if any of the soil samples from your three collection sites would be capable of supporting a healthy agricultural crop? Explain your answer.
3. How could you safely alter the soil in the most agriculturally promising of your three sites in order to improve its ability to support agricultural crops?
4. What did you notice about the different types and number of living organisms in your soil samples relative to the soil pH? What might this indicate about the health of soil in your area?
5. What evidence of human interaction or interference could you identify when collecting your samples? How do you think that this interaction has altered the original condition of the soil?