Name: _____

CASE

Purpose

In *Activity 2.2.1 What is the pH Problem?* you learned about pH and tested substances to determine the pH level. Buffering, which is the pH change from acid or base towards the neutral point of the pH scale, is used to correct pH problems. In a basic substance, the pH is changed by adding an acidic substance to cause the solution to become neutral.

In crop production, you can do the same for soils and media. Typically, rain or irrigation water will leach out elements causing the soil to become acidic. In regions with high rainfall, acidic soils are a problem when growing many crops that are sensitive to low pH. A pH that is too extreme will affect the availability of nutrients needed for plant growth.

A corrective practice used in areas known for acidic soil is to apply lime. Lime is essentially calcium carbonate derived from naturally occurring limestone. Lime is a base substance that works by replacing the hydrogen and aluminum ions and converts hydrogen ions to water. The result is a neutralized soil.

To determine how much lime is required to correct an acidic soil the first step is to test the pH of the soil. This process is done for the crop producer by agricultural service companies who sell and apply lime. However, greenhouse producers typically manage this aspect of production themselves.

Materials

Per pair of students:

- LabQuest® interface
- Vernier pH sensor
- Soil sample
- pH buffer solution
- 500ml beaker
- 250ml beakers
- (2) plastic spoons
- 100ml graduated cylinder
- Distilled water spray bottle
- Hydrated lime
- Weigh dish
- Electronic balance
- Calculator

Per student:

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

Procedure

In this activity, you and your partner will be the technician determining the recommended rate of lime application required to correct an acidic soil. You and your partner will test the pH of a soil sample and determine the amount of lime required to raise the pH of the soil sample ½-point on the pH scale.

Part One – Measuring pH Levels

1. Add 50ml of pH buffer solution to a 250ml beaker. This will be used to "store" the pH sensor between data collections.
2. Weigh out 80g of soil and place it in a second 250ml beaker.
3. Add 200ml of distilled water to the soil in the beaker.
4. Stir the mixture with a plastic spoon until the soil is completely suspended.
5. Let the sample settle for five minutes. You do not want soil particles floating in your mixture when you test for pH.
6. While you are letting the sample settle, set up the LabQuest® and pH sensor:
    - Connect the pH sensor to LabQuest® and choose "New" from the File menu.
        - **Important:** Keep the pH sensor soaking in the storage beaker.
    - On the Meter screen, tap "Mode". Change the data-collection mode to Selected Events.
    - Select Average over 10 seconds and select OK.
7. Measure the pH.
    - Start data collection.
    - Rinse the tip of the sensor with distilled water and place it into the **liquid part** of the sample.
    - Tap "Keep". **Important:** Leave the probe tip submerged while data is being collected for 10 seconds.
    - Repeat data collection by again tapping "Keep". Leave the probe tip submerged for the full 10 seconds.
    - Stop data collection by tabbing "Stop".
    - Tap "Table" to view the data. Record the averaged pH value in Table 1.
8. Rinse the sensor off using distilled water from your spray bottle into the wastewater beaker.
9. Return the sensor to the pH sensor storage beaker.
10. Place a weigh dish on the electronic balance and tare the balance (set to zero).
11. Measure out 2g of lime using the second plastic spoon, the weigh dish, and the electronic balance.
12. Add the lime to the solution and repeat Steps 4–9.
13. Repeat this process, adding 2g of lime at a time, until the pH has increased by 0.5. Record the number of grams of lime that are used and the pH reading for each addition in Table 1.

Table 1 ***Data***

(You may not need to use all rows of Table 1)	
Sample	**Average pH Reading**
Soil Sample Initial Reading	5.67
__2__ g of lime added	7.2
___2_ g of lime added	7.5

__2__ g of lime added	7.54
__2__ g of lime added	7.5
__2__ g of lime added	7.54
____ g of lime added	7.56
____ g of lime added	7.56
____ g total added	N/A

Part Two – Calculating Correction Requirements

With the data from Table 1, you can determine the percentage of lime added relative to the volume of soil that is required to raise the pH by ½ point. To do this you will use mathematics:

1. Divide the total number of grams of lime added to raise the pH ½-point by the initial soil sample mass of 80g.
14. Multiply this value by 100 to convert it to a percentage. See formula below.

$$\frac{\text{Total number of grams of lime added}}{\text{Initial soil sample mass in grams}} \times 100 = \text{Percentage of Lime in Soil}$$

Percentage of Lime to Soil for pH Correction	30%

Conclusion

1. What is the best approach for correcting potting soil mixes for optimal pH range – before or after planting plants? Explain your answer.

   till it and add soil then till it again

15. What problems can your plants experience if the pH is too low?

    they could die because the soil is acidic

16. What contributes to a low pH level in natural soils?

    high acidic