Soil Testing

Grade Level: 7th

Season: Fall/Winter

Larger IGS Unit: Soil

Essential Question: What is soil? Why is soil health important? What is balanced soil?

Objective: Students will understand how to analyze a soil test. Students will be able to amend soil according to soil test results. Students will be able to identify the major elements in the soil and the significance of each element, as well as the relationships between elements.

Materials:
Soil testing materials
Soil test results
Amendments
Measuring tape
Scale
Paper cups
Cultivators

Note: If possible, bring in a soil specialist to help students analyze soil test results.

Introduction:
Review soil knowledge. Ask students, "What is balanced soil? What does it mean to have healthy soil?"

- Elements in the soil
    - Students identify main elements (beyond NPK!)
        - Make list on board
- Connection between plants and soil? Bacteria!
    - Reflect on decomposition jars – what were your observations from the jars? How are the nutrients delivered to the plants? (Microorganisms) Remember: soil is alive!

Part 1

Discussion:
"Why is healthy soil important?"

- Human health
    - Introduce William Albrecht – he made the connection between healthy soil and healthy people. This was a radical idea!
    - Explain "nutrient density"
- Global warming/Climate change
    - Carbon sequestered in the soil: organic matter dictates how much water the soil can take in, and how much Carbon the soil can hold.

Explain that soil samples were collected from the school garden and were sent to be analyzed. We have the results, and we are going to explore them together and figure out what we need to do to make our garden grow the best food for our school!

Ask students, "how do we know how much we can amend the soil/how much fertilizer we can add? Is there such a thing as too much fertilizer?"

- Gas tank analogy
- Soil percolation dictates how much it can hold

Activity 1: Soil Test Analysis
In small groups, students analyze the soil test results. (The ideal levels for each element should be listed on the test. If not, post the ideal levels on the board)

In their journals, students respond to the following questions:

- Which elements are too high?
    - Discuss the issue of phosphorus on the island
    - What can we do to lower levels of certain elements?
- Which elements are too low?
- Find relationships between elements (do you see any patterns when one element is high another is low and vice versa?)
    - Calcium and Boron
    - Sulfur and Magnesium
    - Potassium and Calcium
    - Introduce *cations*

How do we amend these? What can we use as fertilizers? Are there other ways to amend the soil? (Refer to cover cropping lesson and/or compost tea lesson, if possible)

- Epsom Salts = Mag Sulfate
- Borax = Boron

- Lime for acidic soil
- Kelp meal = micronutrients
- Sea salt = micronutrients

What about the micronutrients? Explain that there are 60-90 micronutrients that we also have to pay attention to – it's not just about N, P, and K! Where can we find most of these nutrients? Hint: it's surrounding the island (salt water)

Part 2

Discussion:
Introduce the history of New England soil – pH levels and acid rain. Ask students to list plants that like acidic soil. "Do the vegetables in our school garden like acidic soil? How can we balance the pH?"

Activity 2: Garden Bed Amendments
Explain to students that it is their job to figure out how to make the soil in the garden beds the best it can be, to grow the best food for the school.
Break students into small groups, and assign each group a different area/bed. Hand out results from each area.
In order to figure out how much of each amendment they are going to need, students must first do the math:

- Area of bed
- Rate per acre of each amendment (usually ton/acre)
- There are 43,560 sq feet in an acre
- 2,000 lbs. in a ton

Using this ratio, students find their amendment measurement:

$$\frac{2000 \text{ lbs}}{43{,}560 \text{ sq feet}} = \frac{x}{\text{(your garden's sq feet)}}$$

If lbs. is too large a measurement, convert to ounces using this measurement:

$$\frac{16 \text{ oz}}{\_\_\_\_} = \frac{x}{\_\_\_\_}$$

1 lb (your garden's boron lbs)

Students present their findings to the class. Next, students measure the correct amount of each amendment for their bed, in paper cups. Finally, students go out to the garden and scratch their fertilizer into the soil using cultivators.

Students record their amendments in their journals, and in the garden binder for future students to see what they've done.

Wrap up/ Assessment:
Journals

Vocabulary:

- Cation
- Organic matter
- Carbon sequestering
- Microorganisms
- Micronutrients
- Nutrient density
- pH levels

Extensions:
Cover cropping lesson
Compost and Compost Tea lesson
Soil texture and percolation