Soil Testing Experiment and Lesson Plan

Whether you are planting crops or flowers in your classroom or in the schoolyard, testing the soil for pH and nutrient levels is a good idea, and can be a great introduction to plant needs and real-world chemistry.

The lesson can be adapted to any grade, but plenty of connections to plant growth and change, chemistry, plants for food and fibre, interactions and ecosystems, environmental chemistry, cycling of matter in living systems, math (measurement, graphing), and language arts/English (communicating results).

Materials Needed:

- Rapitest Soil Testing Kit – can be purchased for $20 from Lee Valley. Depending on your preferred group size, you may need two kits, but you will be able to use each kit for up to 10 soil tests (or keep it for following years – can be stored in dry location in original packaging).
- Extra droppers (3 extra if you have one kit, 4 extra if you have two kits) to encourage easy participation by all students
- Soil in pots that you intend to use to plant crops or flowers
- Clear measuring cups or beakers for each group (1L)
- Bowl or container for each group
- Small trowel for each group
- Tweezers or small tongs for each group
- Copies of Soil Test Experiment Handout for Students
- Copies of the pH reference list and fertilizer recommendation found in the Rapitest Soil Test kit.

Safety and Hygiene Notes:

- Dispose of test solutions by rinsing down sink.
- Dispose of capsule in classroom garbage.
- Wash hands after using – and try not to touch powder or solution with hands.
- Do not eat, drink, or smoke while using the kit. Keep kit away from food, drink, or animal feed.
- If any capsules or solutions are accidentally taken internally, drink large amounts of water and seed medical advice.

Introduction:

1. Your students are ready to plant food crops or flowers. You've talked about the nutrients plants need to grow – but ask your students, how do you know that the soil has everything that's needed? Lead a discussion about their ideas, but help them to end up at the conclusion that they'll need to scientifically test the soil to see what nutrients are there.
2. Show the soil test kit and explain that the small capsules have chemicals in them that will react with the nutrients in the soil. The solution they make will change colours, and will show the students the levels of nutrients and the pH of the soil. They will then be able to compare this to the ideal nutrient and pH levels for each type of plant.
3. Break students up into small groups – 4 groups if you have one kit, 8 groups if you have 2 kits. Assign each group a nutrient or pH to measure (phosphorus, potash (potassium), nitrogen, and pH).

Body:

4. Have students write a hypothesis – what results do they think they will get? Activate their thinking through class discussion, asking questions such as, What does it say it has on the package of potting soil? Or Have plants been growing in this soil before, using the nutrients? Are there any animals or bugs that have access to that soil – and could their activities change the nutrients and/or pH?
5. Hand out supplies to make and test the soil samples. Each group will need 1 clear measuring cup or beaker, a trowel, tweezers, dropper, comparator and matching capsule, water, and access to a pot with soil or soil found outdoors.
6. Instruct students to follow the directions below (handout) or read it aloud for them while they complete the steps.

Conclusion:

7. Students will record results and share with the class. Students will use the pH reference list and fertilizer recommendations handouts to analyze their results and discuss corrective steps that may need to be taken before planting.

Extension Activities:

- Take soil samples from several different areas and compare results.
- Purchase different types of potting soil and test to see if they contain the nutrients they say they contain.
- Try testing soil before and after growing plants and see what nutrients those plants used the most of.

1. Using the trowel, take a 125mL soil sample from 2-4 inches below the surface. Place sample in large beaker or clear measuring cup. Avoid touching the sample.
2. Break up any lumps with the trowel. Use the tweezers to remove any rocks or old plant matter.

3. Allow the sample to dry for at least 30 minutes, more if the soil was damp to begin with.
4. For the **pH** group:
    - Remove the cap from the green comparator.
    - Fill test chamber to soil fill line with soil sample.
    - Carefully separate the two halves of the green capsule and pour powder into test chamber. Discard capsule with classroom garbage.
    - Add water to the water fill line using the dropper. Replace the cap and shake thoroughly. Allow soil to settle and colour to develop for **one minute**.
    - Compare the colour of the solution to the pH chart, allowing daylight (not direct sunlight) to illuminate the colour.
    - Record the result.
    - Dispose of solution by rinsing down the sink. Wash the comparator with warm, soapy water, rinse well, and dry or allow to air dry.
    - Wash hands.
5. For the **nitrogen**, **phosphorus**, and **potash** groups:
    - Measure 625mL of water and pour into the soil sample. Thoroughly shake or stir for at least one minute, then allow to stand undisturbed until it settles, 30 minutes or up to 24 hours. Clarity will vary depending on the soil, but the clearer the better.
    - Use the appropriate comparator – the colour of the comparator cap should match the colour of the capsule.
    - Using the dropper, fill both the test and reference chambers in the comparator to the fill mark. (Add solution to the reference chamber to compensate for any discolouration in the tested sample caused by the soil. Do not disturb the sediment – transfer only liquid.
    - Carefully separate the two halves of the orange, blue, or purple capsule depending on your assigned nutrient, and pour powder into test chamber only. Discard capsule with classroom garbage.
    - Replace the cap and shake thoroughly. Allow soil to settle and colour to develop for **ten minutes**.
    - Compare the colour of the solution to the colour chart, allowing daylight (not direct sunlight) to illuminate the colour.
    - Record the result.
    - Dispose of solution by rinsing down the sink. Wash the comparator with warm, soapy water, rinse well, and dry or allow to air dry.
    - Wash hands.