The Scientific Method I

Objectives

1. Students will learn how to apply the scientific method to the design of an experimental plan or procedure that addresses an agricultural challenge.
2. Students will start to recognize the importance of the scientific method in uncovering the benefits of soil remineralization.
3. Students will begin to plan their own local remineralization trial.

Overview of Activities

Using their knowledge of the steps that are involved in the scientific method, students will create an Experimental Design Diagram in response to a real-life scenario.

Through a Four-Question Strategy activity focused on plants, students will come up with the starting materials for their unique investigation.

Experimental Design Diagram

Ask the students to plan (in groups) an experimental approach to the following scenario:

James, a student living in Barbuda, would love to be able to grow more fruits and vegetables on his island. After watching a YouTube video about Hawaii, he is amazed by the amount of vegetation as well as the many volcanoes. Although James lives on a flat coral limestone island, he is reminded of a small neighboring island called Montserrat. Montserrat had a volcanic eruption about 15 years ago when all the inhabitants had to evacuate the island because it was covered in volcanic ash. James starts thinking . . .

https://www.theguardian.com/world/2016/jan/28/montserrat-volcano-british-territory-geothermal-energy-tourism-sand-mining

Do you think James could tackle the agricultural issue that his home is facing? How so? What role will Montserrat's situation play in this? You will design an experimental procedure to test a potential solution.

Firstly, what is the observation? Is it quantitative or qualitative?

Ask the students to create a diagram or poster that outlines the experiment that they would like to pursue, incorporating (some of) the following elements: title, hypothesis, prediction, independent variable and an appropriate range of values, control group, dependent variable and its measurements, control variables or

constants, number of repeats/trials, timescale, and relevant equipment. Ask students to present their approaches to the class.

An example of an Experimental Design Diagram will be provided under the "Resources" section of this document.

After student presentations, hold a classroom discussion in which student approaches are compared and contrasted to the actual experimental execution for the provided Barbuda scenario; refer to "Soil Remineralization Trial: Preliminary Effects of Montserrat Volcanic Ash on Barbuda Limestone Soils." The literature itself is appropriate for high school students.

Lastly, guide students through a unique research question using the Four-Question Strategy example from the second bullet point in the "Resources and Citations" section below. At this point in time, students have not been entirely exposed to the concept of soil remineralization, so this activity would be most effective if it is modeled after the thorough example on Page 5 of the resource. We will revisit this activity once students have acquired the basics of remineralization.

What materials are readily available for conducting experiments on plants?

How do plants act?

How can I change the set of plant materials to affect the action?

How can I measure or describe the response of plants to change?

Resources & Citations

Two Experimental Design Diagram Examples (Pages 3-4)

More on the Four-Question Strategy (Pages 4-6)

Soil Remineralization Trial: Preliminary Effects of Montserrat Volcanic Ash on Barbuda Limestone Soils

Scientific Method Review

Volcanic Eruptions Context and Photos

Volcanic Eruption Video

RTE Montserrat Article

RTE Barbuda Experiment Article

RTE How Volcanic Rock Dust Can Save Tropical Soils

Please note that the first two bullet points are links to the same document; they are separated to distinguish between the two ideas that are discussed in the lesson plan.