

**AGRONOMY FEEDS THE WORLD**
**Investigations in Plant/Soil Nutrition, Plant Stresses, Food Production, or Geography and Water**
**Mentor’s Guide: Overview**

**Expect teachers to adapt the module for their students:**

PlantingScience provides seeds and grape-flavored drink packets (Kool Aid®) to teachers. Teachers provide additional plant materials for testing, different soils, cups, funnels, etc. The equipment available and class experience with inquiry learning will influence the direction investigations take.

- Connect with your teams’ teacher via the **Classroom Group** for details about the students and teacher’s goals and schedule.
- Please see the **Agronomy Feeds the World Teacher’s Guide** for learning goals, suggested sequence of activities, and schedule planner.

The **purpose of this tip sheet** is to help you as a scientist mentor **anticipate and respond** to students as they post online about their agronomy-related investigations. After initial inquiries – such as watching purple Kool-Aid run through 3+ types of soil, evaluating water-holding capacity of various soil types, etc. – students will need to develop research questions to address any potential agronomy issues. Your role as a mentor is to guide students through this process. Students will be using radish seeds to develop a research project based on a local agronomy problem – e.g., excessive droughts, frackwater, etc.

The **nutrient and water holding capacity** inquiry labs demonstrate to students the varying levels of nutrient and water holding capacities of different types of soils. Students will be expected to be able to explain that every soil has a unique composition and texture and should have an understanding that soil types vary by region and have different general nutrient- and water-holding capacities. Soil properties affect which inputs (water, fertilizer, etc.) are applied to cropland, as well as how much and how often these inputs are needed. Consequently, by the end of this initial inquiry, students will be asked to look at their local soil and develop and develop a list of questions local farmers may face if s/he had a field with that soil type. E.g., Will fertilizer wash away when it rains? Will water drain before plants are able to use it? Is this the best soil to be growing in?). After these initial inquiries, students will need to develop research questions to address any potential agronomy issues.

**Juicy Questions for student investigations:**

- Do plants need soil to grow?
- Which type of soil texture will have a higher nutrient holding capacity?
- What soil properties affect how much water it can hold and how fast water will drain?
- Is there an ideal soil texture for growing all kinds of plants?


**Video Resources:**

[http://www.ted.com/index.php/talks/richard\\_preston\\_on\\_the\\_giant\\_trees.html](http://www.ted.com/index.php/talks/richard_preston_on_the_giant_trees.html) (First 4.5 min).

Bruce Bugbee

Soil Science Society of America videos produced for the 2015 International Year of Soils:

Soils and Climate

([https://www.youtube.com/watch?v=T4A\\_rMIHcyE](https://www.youtube.com/watch?v=T4A_rMIHcyE)) (2:55)

Soils support Agriculture

([https://www.youtube.com/watch?v=GGV2jlg\\_P4M](https://www.youtube.com/watch?v=GGV2jlg_P4M)) (2.5 min).

### What are students thinking when it comes to agronomy and soil science?

As students blog about their investigations, they reveal their ideas. It is common for students to believe...

- sunlight, carbon dioxide, water, and minerals are food.
- plants breathe in carbon dioxide and drink water.
- plants get food from the soil; plant mass comes from soil.
- there is little genetic variation within crops.
- that all/none of a field is sprayed with pesticides or herbicides.
- that all the nutrients and water crops need are in the field naturally.

### Attending to students' ideas and thinking

By attending to students' thinking, attention shifts from a right-answer orientation to uncovering student ideas and reasoning. As experts, we often make assumptions about what a student is meaning and connect concepts in ways novice learners cannot. Assumptions are often turned on their heads when probed. Also, responding as a naïve mind opens up possibilities in the discussion. Although students often learn by rote that plants need sunlight to carry out photosynthesis, that sunlight is energy and that plants are essential to life on the planet are often “missed” concepts. **Why and how do plants make their own food? What do they do with it? How does that relate to the food humans and other animals consume?** Students also have little experience with the concept of plant stress or disease/pest management. **What do farmers do when plants “get sick”? Can farmers protect plants from pests?** This process of armchair inquiry, or **digging into juicy questions**, is a highly valued process in science.

### Resources and References

- Sample Lab Exercise (Determining Impurity/Nutrient Holding Capacity)  
<http://www.doctordirt.org/teachingresources/soilfilter>
- “Soil is a Filter” YouTube Video, showing possible lab set-up, procedure, & results:  
<https://www.youtube.com/watch?v=Ve2eXis0j9I>
- “Soil is a Filter Annotated” YouTube Video, showing the lab in the last video from another perspective: <https://www.youtube.com/watch?v=ex9WiWdOwal>
- “Water Cycle Experiment” YouTube Video, showing water holding capacity of bare vs. covered topsoil: <https://www.youtube.com/watch?v=og9cQKxIFnE>
- *Agronomy – Grow with It!* Textbook: Quote from page 57

*Teachers say it is hard to find accessible, scientifically accurate background information for students. Are there resources you recommend?*