

# Plant Sciences

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*For more information, contact:*

*Natalie Bumgarner, Department of Plant Sciences*

*Heather Kelly, Department of Entomology and Plant Pathology*

## Understanding Soils

### Investigation

- Measure important indicators of soil quality.
- Model the process of soil erosion and how to reduce or prevent it.
- Evaluate methods of managing crop fields with tillage and no-till.
- Contrast how the soil food web might differ in no-till soils from tilled.
- Compare and contrast no-till and other farming practices that can impact soil organic matter or lead to nutrient loss.

### Experimentation

- Hypothesize about the organic matter present after years of no till and then find reports from West Tennessee sites that have been under no-till and compare your hypotheses to actual results.
- Compare sites in East, Middle and West Tennessee on web soil survey in terms of suitability for row crops.

## Agronomic Crops and Plant Breeding

### Investigation

- Research field crops in different countries around the world and use climate to explain why some crops may be most consumed in certain areas of the world.
- Select three agronomic crops and describe some of the breeding efforts and traits in current varieties.
- Describe dominant and recessive traits and be familiar with terms such as F1 and F2, inbred line.
- Model breeding efforts of a hybrid and non-hybrid crop and compare and contrast corn, bean and wheat breeding efforts.
- Investigate how different locations or controlled environment facilities are used in breeding.
- Create an educational piece to teach younger 4-H'ers how to classify annual vs. perennial and monocot vs. dicot plants.



### Experimentation

- Collect seeds from fruit of two F1 hybrid plants (tomato possibly).
- In the next growing season, grow transplants and garden plants of these plants from hybrid fruit and compare them to plants from new hybrid (F1) seed. Then describe any differences in plants, variability and fruit.

## Crop Production in Tennessee

### Investigation

- Compare the signs of nutrient deficiency and toxicity for specific macro and micronutrients in key row crops.
- Create an educational display that teaches younger 4-H'ers about fertilization practices and methods that are used in crop production.
- Investigate different methods of adding nitrogen and describe their pros and cons (poultry litter, anhydrous ammonia, etc.).
- Calculate nitrogen needs for a corn and bean field both with and without the use of cover crops.
- Compare the crops, cropping season and yields in Tennessee to another production region in the southern hemisphere (e.g., Brazil).

### Experimentation

- Grow corn and soybean plants in pots or raised beds where you can closely control nitrogen. Compare the growth of plants at different levels of fertilization.
- Measure time to harvest as well as plant weight and describe quality (color, insect damage, etc.).

## Crop Management — Insects, Diseases, Weeds

### Investigation

- Research some of the most problematic weeds that have developed resistance to herbicides.
- Create an educational display to teach younger audiences various methods that farmers use to manage the potential for pest resistance.
- Create a crop management plan that includes application restrictions for both general and restricted use pesticides.
- Critique pest management plans for both organic and conventional row crops.
- Compare and contrast how methods of insect control could impact pollinators in the landscape.

### Experimentation

- Plant non-BT and BT sweet corn to compare insect damage and explain the difference (i.e., how BT affects insects) or grow non-BT sweet corn and use organic BT spray to control insects.
- Compare and contrast differences (pros/cons) of BT build into the variety vs. using BT in a spray.

## Understanding Pesticides

### Investigation

- Create an educational display for younger audiences that describes how pesticide resistance develops.
- Design a management plan to avoid developing pesticide resistance.
- Choose a pest that is now commonly resistant to pesticides (palmer pigweed to glyphosate, frogeye leaf spot to QoI fungicides, thrips to thiamethoxam) and develop a hypothesis of how to control that pest..

### Experimentation

- Develop a guide on how to identify and confirm a pest has developed resistance to a pesticide.

## Past, Present and Future of Crop Farming

### Investigation

- Hypothesize possible reasons that the green revolution was not able to be replicated in all crops or areas.
- Identify key challenges that farmers face in today's markets and develop possible solutions.

### Experimentation

- Develop a long-term (~20 years) business plan/model for farming row crops and discuss the challenges of building such a plan.

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