Project:
Genotype to phenotype research with corn seedlings

GOALS

- Understand how leaf angle of crops affect crop yields in agriculture.
- Apply to plant science the concept that the phenotype is determined by the genotype and the environment.
- Learn how to grow plants and how to measure phenotypic parameters such as leaf angle in corn.
- Examine the variability of the phenotypic parameter leaf angle among corn genotypes.
- Learn to analyze plant images using the software PlantCV.
- Compare leaf angle measurements between manual and PlantCV measurements.
- Contribute data to projects from Danforth scientists.

DURATION OF THE PROJECT

~3 weeks:
- 2 weeks to grow the corn plants
- 1/2 day to measure manual leaf angle and photograph seedlings
- 2 days to learn how to use PlantCV, analyze the images, compare results and share the collected data with the Danforth Education Lab

MATERIALS

Provide by the Danforth Center	Provide by the Student
5x10 cone tray with lid	Area to grow plants with plentiful sunlight (outdoors or indoors)
Black paper	Cell phone camera or other digital camera
Corn seeds (15 seeds, 5 from each of 3 genotypes)	Computer
Metro Mix 360 with turface blended soil	Internet connection
Plant tags	Plastic container
Protocol – How to grow corn and measure leaf angle manually	Protection of plants from pets and wildlife
Protocol – How to analyze plant images with PlantCV	Scissors
Protractor	Spray bottle, water can or hose
Sharpie	Water
Thermometer	

ORDER OF ACTIVITIES

1. Read the background document.
2. Use Protocol 1 to grow corn seedlings of different genotypes and measure leaf angle.
3. Use Protocol 1 to photograph the corn seedlings.
4. Use Protocol 2 to analyze the images of the seedlings photos to measure leaf angle using the PlantCV software.
5. Compare the leaf angle manual and image-based measurements using the Questions document.
6. Compare leaf angle measurements among the corn genotypes (manual and or computer generated data) using the Questions document.
7. Share your results with the Danforth Education Lab.

THINGS TO DO

Check mark the tasks as you are done with them.

☐ Contact Sandra Arango-Caro (sarango-caro@danforthcenter.org) to coordinate the delivery of the materials and to have access to the project documents.

☐ Access your Google Classroom space using the link provided by e-mail.

☐ Read the assigned material first.

☐ Read, sign and return the photo release form to Sandra Arango-Caro (sarango-caro@danforthcenter.org).

☐ Plant the corn seeds, record their germination dates and take care of the seedlings (Protocol 1).

☐ Measure and record the seedlings leaf angles at 16 to 18 days since sowing (Protocol 1).

☐ Photograph the seedlings and store them in your Google Classroom (Protocol 1).

☐ Analyze the photos of the seedlings using PlantCV (Protocol 2).

☐ Examine your data and compare it among genotypes and between manual and computer measurements (Questions document).

☐ Submit your data on-line using Google Classroom.

☐ Provide a photo of yourself conducting this research project.

☐ Complete the survey about your research experience.

CONTACT INFORMATION

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