**Lesson Plan: Root Phenotype**

**Rational:** Phenotyping and measuring important traits is key to being able to make any reliable inference. In this lesson we will go understand how to process samples so that useful measurement can be taken.

**Student Learning Objectives**

Students will….

1. Understand that the process of taking root samples
2. Understand how to use the scanning software
3. Understand how to take measurements with the software

**Materials Needed for Lesson**

* Root Phenotyping protocol
* Plants at the right growth stage
* Student Activity 1
  + Extracting Roots from plants
* Student Activity 2
  + Scanning roots
* Student Activity 3
  + Analyzing roots

**Anticipatory Set up time** (5 min)

Gauge how comfortable students are with the material with a series of warm-up questions, for example:

1. What is soil?
2. What is a root?
3. How many different types of root structures exist?
4. Why is it hard to study roots

**Direct instruction and guided practice**

Activity 1: Extracting Roots

1. Divide students into groups and pass out protocol
2. Bring in a practice set of plants
   1. Dissect the plants
   2. Wash the roots

This Activity 2: Scan the roots (30 min)

* 1. Get the software working and scan the roots
  2. Play with the software features
  3. Output data

Activity 3: Play with the data

* 1. Create a plot with the data

**Independent Practice**

List places where the protocol was easy for you and what was difficult.

**Output:** Students should start a datasheet that allows them to collect root data for the rest of the term.

**Follow up / Homework**

At the beginning of the next class, have students share their thoughts and what they learned during the lesson and some of the opinions on how to optimize the protocol (3 min).