

Soil Respiration

(Modified from a Lab Prepared by Ken Kephart, PSU)

Introduction

Living things use oxygen to metabolize their food. During this process of respiration, CO₂ is released. We often associate respiration with animals. But plants and even bacteria respire. A lot of bacteria live in the soil – they're important for plant production because they help release available nutrients.

The numbers and metabolic rates of bacteria in the soil depend on several factors:

- Temperature
- Moisture
- Available oxygen
- Organic matter

Just like people, there is an optimal range for temperature and moisture. If it's too hot or too cold, bacteria won't thrive – they may even die. Likewise, if it's too dry or too wet, bacteria have a hard time surviving. Organic matter provides the food source for bacteria. If the level of organic matter in soil is high, bacteria will be abundant and this helps to enhance crop production.

When conditions are optimal for bacteria, they'll use more food and release more CO₂.

Materials Needed

- Flower pots or coffee cans (one for each sample of soil)
- Samples of low organic matter soil (sand or clay) and high organic matter soil (black soil or compost)
- Plastic cling wrap to cover each flower pot or coffee can lids
- Large rubber bands if using flower pots
- Lab Pro CO₂ detector apparatus

Experiment 1 – Measuring soil respiration

Note, to conduct these experiments start with soil samples that are relatively dry.

1. Place low organic matter soil into one flowerpot or coffee can so it is about 2/3 full. You may have to place a paper towel in the bottom to keep the sand from slipping through the holes of the flower pots.
2. Pack the material in each of the pots firmly to mimic field conditions prior to plowing.
3. Cut two pieces of plastic cling wrap that will fit completely over the top of each flowerpot.
4. Cover both pots simultaneously and seal each with a rubber band or cover the coffee cans with a plastic lid. Note the time.
5. Prepare to collect data by setting up the laptops, Lab Pros and CO₂ detectors. Select LoggerPro 3, Biology with computers and Respiration Lab 11-B

6. Wait for 30 minutes or as long as possible to still be able to complete data collection. It may be necessary to allow the soil samples to set until the next day if CO₂ levels are not sufficiently above background levels.
7. When all is ready, cut a hole in the plastic and insert the CO₂ detector. You may wish to hook up a second probe to measure atmospheric CO₂ simultaneously.
8. Select *Collect* to begin data collection.

| | <i>CO₂ Concentration, ppm</i> | |
|------------|--|-----------------------------|
| Background | Low Organic Matter Soil | High Organic Matter Soil |
| _____ | _____ | _____ |
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