# Microbial Biomass Project

This sample experiment is appropriate for high school and advanced middle schoolers. It is designed to help students study soil health and understand the impact of soil biology on soil health and plant growth. Supplies are minimal cost and nothing recommended is dangerous or controlled. We expect students to use this as a guide to develop their own experiment.

## Background:

Soil is made up of organic and inorganic matter. It provides structural support for plants and serves as a medium for their growth. It absorbs, holds, and purifies water. Microbes are single-celled organisms like bacteria and fungi. Although organisms such as bacteria and fungi are often perceived poorly, they are actually the best indicator of the health of your soil. One gram of soil contains as many as 5,000 different types of bacteria. Healthy soil needs a healthy and diverse microbial life. Plants and microbes work together in a symbiotic relationship to produce the fertile soil you are looking for. The plant provides the microbes with food, while the microbes mine the soil for nutrients to give to the plants. Water, temperature, and pH also play an important role in having a thriving soil microbial population. A healthier soil microbial population means healthier soil and healthier food grown in that soil.

## Purpose/Research Question:

Determine if adding an amendment to the soil improves soil health by monitoring soil microbial biomass carbon using the microBIOMETER®.

## Hypothesis:

If soil is treated with an amendment, the soil microbial biomass will increase and therefore soil health will improve.

## Materials:

- (5) small planters
- (1) bag of potting soil
- (1) Packet of bean seeds
- (4) different soil amendments – Fulvic Acid, Humic Acid, Seaweed Powder, and a Mycorrhizal Fungi Treatment.

## Procedure:

1. Fill each pot with soil. Be careful to not compact the soil.
2. Place one seed in each of the pots and push them approximately 1 inch into the soil and smooth the soil over the top with your fingers.
3. Use the microBIOMETER to determine the microbial biomass of each for an initial reading. Record results as Day 1.
4. Apply each amendment to its respective pot. Leave one pot untreated as the experimental control.
5. Repeat the testing process every 3 days and record the results. Be sure to note any significant observations in soil or plant appearance.

*NOTE:* Water the soil in the morning at least every other day or every day if needed. The temperature, light, moisture intake, and seed type will need to be kept the same for all pots throughout the experiment to limit variability in soil conditions.

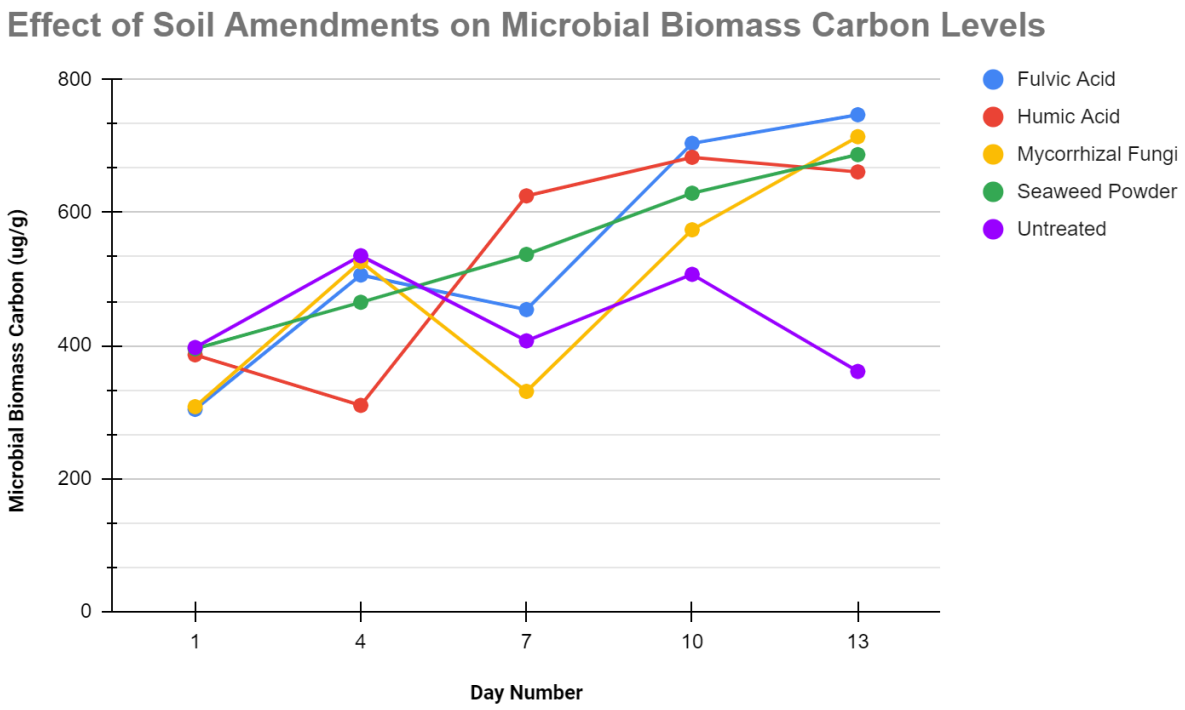
## Observations:

All bean plants grew at similar rates except for the one treated with fulvic acid. The pot treated with the fulvic acid amendment had a much shorter bean shoot than the other plants and only had a couple small wilted leaves. I've hypothesized that the amount of fulvic acid added to the soil was too much for the plant to sustain, which had a poor effect on it physically, despite keeping the soil healthy. All other plants appear physically healthy.

## Data Table

| Day Number | Fulvic Acid | Humic Acid | Mycorrhizal Fungi | Seaweed Powder | Untreated |
|---|---|---|---|---|---|
| **1** | 304 | 386 | 308 | 395 | 397 |
| **4** | 506 | 310 | 526 | 465 | 535 |
| **7** | 454 | 625 | 331 | 537 | 407 |
| **10** | 704 | 683 | 574 | 629 | 507 |
| **13** | 747 | 661 | 714 | 687 | 361 |

## Data Graph



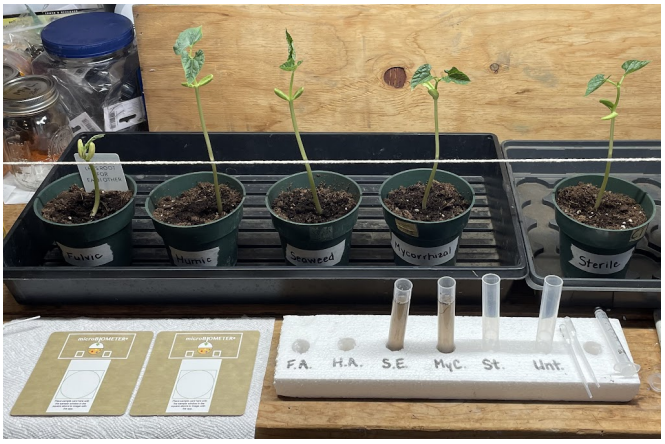

## Conclusion:

My hypothesis was correct; All pots treated with the soil amendments had an overall increase in microbial biomass. The untreated soil was the only one that had a decreased microbial biomass from the initial reading. The microbial biomass of the plants treated with fulvic acid and mycorrhizal fungi doubled and both amendments had the highest microbial biomass at the end of the experiment. I believe these amendments increased the microbial biomass the most because they increased the organic matter in the soil.

## Lead Experimenter:

This experiment was created and performed by our intern, Leanna Ramus. Leanna is majoring in Environmental Science at Siena College, where she is also a member of the school's eSports team. When she's not with her team, you can find her crocheting or tending to her family's vegetable garden. In this experiment, she decided to use bean seeds because beans are an easy, fast growing crop and are easily recognizable by kids, which helps them engage more in the experiment. You can reach Leanna through her LinkedIn at https://www.linkedin.com/in/leanna-ramus-3aa252213/


LET'S ROOT FOR EACH OTHER
H.A.
F.A.
S.E.
Myc.


Fulvic
Humic
Seaweed
Mycorrhizal
Sterile
F.A.
H.A.
S.E.
Myc.
St.
Unt.


KOBALT

# Microbial Biomass Sample Project Outline

## Background:

Provide a background on your experiment. Why is doing this experiment important?

## Purpose/Research Question:

State the purpose of your experiment / identify the question behind your research.

## Hypothesis:

Formulate a hypothesis. Predict what you think the outcome will be.

## Materials:

- (X) small planters
- (1) bag of soil of choice
- (1) Packet of seeds of choice
- (X) various soil amendments*

    *Example options:*

    - Organic Fertilizer
    - Homemade Compost
    - Homemade Starchy Mixture
    - Fulvic Acid (Garden Tea Co., $3.00)
    - Humic Acid (Garden Tea Co., $3.00)
    - Seaweed Powder (Garden Tea Co., $4.00)
    - Mycorrhizal Fungi Treatment (Garden Tea Co., $5.00)

*Research should be done by students to select different soil treatments. Some students even select traditional or negative amendments to study the impact on soil microbes.

## Procedure:

1. Fill each pot with soil. Be careful to not compact the soil.
2. Place one seed in each of the pots and push them approximately 1 inch into the soil and smooth the soil over the top with your fingers.
3. Use the microBIOMETER to determine the microbial biomass of each for an initial reading. Record results as Day 1.
4. Apply each amendment to its respective pot. Leave one pot untreated as the experimental control.

5. Repeat the testing process every 3 days and record the results. Be sure to note any significant observations in soil or plant appearance.

*NOTE:* Water the soil in the morning at least every other day or every day if needed. The temperature, light, moisture intake, and seed type will need to be kept the same for all pots throughout the experiment to limit variability in soil conditions.

## Observations:

Write what you've noticed throughout the experiment. This can include any notes on changes in plant height, plant or soil appearance, soil smell, etc.

## Data Table:

| Day # | Amendment 1 | Amendment 2 | Amendment 3 | Amendment 4 | Untreated |
|---|---|---|---|---|---|
| 1 | | | | | |
| 4 | | | | | |
| 7 | | | | | |
| 10 | | | | | |
| 13 | | | | | |

## Conclusion:

Write whether your hypothesis was correct or incorrect. Discuss what your results mean and why you believe they turned out that way.