WHY BIOCHAR? Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

#  You are a farmer. A salesman knocks on your door selling a new “miracle” soil additive that he claims will both increase your crop yield and help the environment. After taking high school biology, you decide that you better research this new “miracle substance” for yourself before you use it on your farm. After discussion with the salesman, you learn that the substance is biochar which is a byproduct of making biofuel. The salesman leaves you a small sample so you can “See for yourself” the huge, amazing gains your crops will make with biochar. After researching biochar you will test the effectiveness of biochar on your specific crop’s growth.

# PROJECT OVERVIEW

The purpose of this lab is to:

1. Research the production, characteristics, and use of biochar.
2. Describe the characteristics and growth of a specific species of plant.
3. Design an experiment to test how applying biochar affects the plant’s growth.

**You will be responsible for taking care of your own plants.**

**QUESTION – What is the effect of biochar on the height and dry biomass of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

\*Use the following guidelines to write a formal lab report. You will follow the AP lab write-up.

**TITLE:** Write a descriptive title including the independent and dependent variables in the title.

**CONDUCTING BACKGROUND RESEARCH:**

**Paragraph #1** of the background will include information about biochar.

1. What is biochar?
2. How is biochar made?
3. What are the benefits of biochar both to plants/agriculture and the ecosystem?
4. Does biochar have any negative qualities?

**Paragraph #2** of the background should include the following **general information** about your plant. Find the answers to at least 15 of these questions. You must answer questions 1-13.

1. Scientific name
2. Common name
3. Physical description –what does it look like?
4. Germination time
5. Planting instructions
6. Flowering time and bloom time (spring, summer or fall)
7. Annual, biennial or perennial
8. Growing season
9. Average height
10. Water needs
11. Nutrient needs
12. Soil type (sandy, loam, clay, not particular)
13. Soil moisture (a. mesic: moist, adequate soil moisture retention year round b. sub-xeric: moist to dry, seasonally moist, periodically dry c. xeric: dry and drought resistant, little moisture retention)
14. Effect of wind
15. Type of pollination (wind, insect, animal, other—be specific)
16. Importance of this plant to the ecosystem, insects, animals…
17. Major uses of the plant

**PURPOSE:**

The purpose of this experiment is to determine if \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**HYPOTHESIS:** Make a prediction about what will happen to your plants because of your variable. It should be consistent with the research done on your variable in the background information.

If \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,

then \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

This is because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**MATERIALS:** List all the materials you will use in this experiment.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 8. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 9. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**METHOD/ PROCEDURE:**

1. In your group of three, obtain 6 pots.

2. Fill one pot with each of the six treatments

 a. local soil d. local soil with 10% biochar

 b. potting soil e. potting soil with 10% biochar

 c. sand f. sand with 10% biochar

3. Follow the instructions from the seed packet (or you teacher) to plant your seeds.

4. Water the plants with 200 mL of water twice a week.

5. Measure the pH of the soil at the start and end of the experiment.

6. Measure the height of the plant once a week.

7. At the end of the experiment (6 weeks) remove the plants from the pots and remove the soil from the roots.

8. Remove the roots (all below ground parts of the plants) from the shoots and leaves (the above parts of the plants).

9. Dry the plants for several weeks in the classroom (you can also place the on foil and bake them at 100F overnight).

**DEPENDENT VARIABLE/IDEPENDENT VARIABLE/CONTROL GROUP**

Independent Variable - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Dependent Variable - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Control Group - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**DATA TABLES:** You will be collecting the following data on your plants. This will be done once a week.

1. Date planted
2. Germination date
3. Height (mm) from soil to the top of the stem.
4. Mass of the plant (will be done at the end of the experiment).
5. In an observations column record any other information about the plants (ex. coloration of leaves, differences in leaf appearance, etc.)

**RESULTS:** Your results will be recorded in a class data table. You will then create graphs to represent your data.

* For each of the six treatments calculate the root to shoot ratio of dry biomass of the plant.

**ANALYSIS:** Describe the results shown on your graphs and include the following items:

* Describe the rate of growth in the control and the variable. Include specific data (calculate actual rates) not just terms like slower or faster.
* Describe differences in height between the control and the variable. Use specific data not terms such as taller of shorter.
* Describe differences in the control and the variable in number of leaf pairs. Include specific data not terms such as more or less.
* Describe differences in leaf coloration between the variable and the control—observational.
* Describe the differences in flowering time between the variable and the control—use exact times.
* Discuss any differences between individual plants. (Were there dramatic differences in the control plants?)
* OTHER:

**CONCLUSION:** The conclusion should be at least three paragraphs in length with an optional fourth paragraph if needed.

**Paragraph 1**

Offer an explanation for your results and explain why it is either consistent or inconsistent with your original hypothesis. Use the background research to help you. Were there other variables that might have influenced your results?

**Paragraph 2**

After completing your experiment, what would you do differently if you repeated the experiment? What information would you share with research scientists who may replicate your experiment on a larger scale? Suggest other experiments that you would conduct after this experiment. In other words, are there other experiments would you need to conduct before you make a decision about the use of biochar?

**Paragraph 3**

In the third paragraph, connect your experiment to applications of biochar at a local, state, national and global level. Begin by using evidence from your experiment to make a decision if you will be using biochar in your fields. Also connect your results to applications from the class to the global scale.

**Paragraph 4 (optional)**

Any other information that is important to discuss after the completion of the project.