



Chapter 31 Project

Plant Nutrition Experiment

Project Goal + Timeline

In this project, we will be reviewing your knowledge of soil and plant nutrition by investigating plant growth in response to different soil conditions. This project should be completed in a group of two students over three weeks.

Directions

Part 1: Plant Nutrition Experiment

What do you do with your leftover coffee grounds? Maybe throw them out? Believe it or not, there are many plants out there that would appreciate those grounds! Coffee grounds contain a good amount of nitrogen, some potassium and phosphorous, and even trace amounts of magnesium, calcium, and other minerals. All these elements are essential for plant growth. In this experiment, you'll be monitoring the response of plant growth to treatment with different levels of coffee grounds.

First, develop a hypothesis for how you think coffee grounds will impact the growth and appearance of plants grown from seedlings. Will more coffee grounds lead to more growth?

Next, obtain and label four 12-oz paper cups as "Control," "10% CG," "30% CG," and "50% CG." Then, add sterile potting soil and coffee grounds to each cup in the amounts provided in Table 1. Add some water to moisten (not drench) the soil. Use a wooden stick to mix the soil and coffee grounds together.

TABLE 1: Volume of Potting Soil and Coffee Grounds per Treatment

Treatment	Sterile Potting Soil (tablespoons)	Coffee Grounds (tablespoons)
Control	10	0
10% CG	9	1
30% CG	7	3
50% CG	5	5

Sprinkle a few seeds on the top of the soil in the cup. If the seeds are larger, you may need to push them into the soil. Use a spray bottle to mist water over the soil, or sprinkle water gently over the soil. Seeds can be from any plant, but tomato or pepper seeds may work best.

Place the cups together on a windowsill. Check the cups for plant growth daily. Record the date when germination (sprouting) first begins, and thereafter, monitor the appearance of the plants. Make sure to spritz the plants with water every day or so to prevent them from drying out. Allow your plants to grow for three weeks. At the end of each week, measure the heights of all plants in centimeters (cm) and describe their appearance.

Complete Table 2 with your findings. If seeds in a treatment never germinated, write "no germination" in the Number of Days Required for Germination column.

TABLE 2: Effect of Varying Levels of Coffee Grounds on Plant Growth

Treatment	Number of Days Required for Germination	Plant Height (Week 1)	Plant Height (Week 2)	Plant Height (Week 3)	Plant Appearance Each Week
Control					
10% CG					
30% CG					
50% CG					

Part 2: Data Analysis and Conclusions

Create a line graph that shows the plant height versus time for your different treatments. Plant height will go on the y -axis, and time (in weeks) will go on the x -axis. Begin the x -axis with a time of 0 weeks, with a corresponding height of 0 cm for all plants. Each treatment should have three additional heights plotted, one for each week, 1 through 3. Different treatment points should be marked with different symbols or colors to easily identify each treatment. Make sure to label each axis and include units. Include a descriptive title for your graph and a key labeling each treatment.

Then, answer the following questions.

1. Which treatment resulted in the greatest amount of growth and healthiest plant? Which treatment resulted in the least amount of growth?
2. Did growth happen at a faster rate in certain treatments? Did growth rate differ between weeks for different treatments?
3. Do your results support your hypothesis? If your results do not support your hypothesis, develop a new hypothesis to explain your results.
4. Based on the results of your experiment and your responses to Questions 1 and 2, state a formal conclusion about the effect of coffee grounds on plant growth.

Part 3: Review Questions

1. What elements are considered macronutrients in plants, and what are the functions of these macronutrients? What are some signs of macronutrient deficiency?
2. Explain the benefits of rhizobia in legume root nodules and mycorrhizae around plant roots.
3. Consider an insectivorous plant like the Venus flytrap. This plant can photosynthesize to create food. Why, then, does it also need to consume insects?

Project Materials

- Sterile potting soil
- 12-oz paper cups
- Marker or pen
- Seed packet (such as tomato or pepper)
- Coffee grounds
- Tablespoon (measuring spoon)
- Wooden stick for stirring
- Water
- Graphing paper, or computer with graphing software
- Pen or pencil

Student Checklist

- ☐ Develop a hypothesis for the effect of coffee grounds on plant growth
- ☐ Create treatment groups and plant seeds
- ☐ Monitor plant growth for three weeks
- ☐ Complete Table 2 with experimental results
- ☐ Create graph of results
- ☐ Complete Data Analysis and Conclusions questions
- ☐ Complete Review Questions