

Soil Characteristics and Plant Growth Lab

Problem:

What soil characteristics are best for plant growth?

Objective:

Develop a testable hypothesis and design an experiment to test which soil mixture will grow successful radish plants as measured by biomass.

Soil Characteristics:

We live in an era of increasing concern over the conservation and management of our renewable and non-renewable resources. We seldom think of soil in these terms, and yet improper development or natural erosion can devastate a landscape that nature took centuries to create. Similarly, the mineral elements in the soil that nourish growing plants can be depleted through repeated cycles of cultivation and harvest, resulting in an exhausted soil incapable of supporting healthy plant growth.

Soil consists of a mixture of mineral materials of different sizes and chemical composition, air, moisture, and living organisms. Particle size influences water-holding capacity and pore space. Pore space allows air to penetrate the soil. Plants need three resources from the soil in order to grow. The roots need oxygen to carry on aerobic respiration and grow. Water is needed as a transport medium and a raw material for photosynthesis. Mineral nutrients, such as nitrogen, phosphorus, and potassium, as well as many minor nutrients are needed for the addition of new living material to the plant. In this experiment, you will look at the way in which soil type influences the growth of plants.

Questions to address in the Introduction:

1. What components comprise a healthy layer of topsoil?
2. What is the chemical formula for both photosynthesis and aerobic respiration? Explain how both of these processes interact to allow for plant growth.
3. Describe the attributes of the most common soil types as they relate to plant growth.
4. What are some natural sources of the nitrogen, potassium and phosphorous found in soil?
5. Would you expect to find an excess of nutrients in soil? Explain why or why not.

Lab Design:

1. Create a testable hypothesis based on the question posed with regard to plant growth. Remember to use “if..., then...because” and include changes (increase/decrease). Needs to be specific. (*Hint: You may want to do some background research on soil types and radish growth before designing hypothesis.*)

2. Determine both the independent variable and dependent variable(s) for your experiment. *What are you going to manipulate? What all are you going to measure?*
3. Design a control group for your experiment.
4. Determine all external factors that must be controlled throughout the experiment. Include maintenance of growing over 2-week period. (*Reminder you don't want to over- or underwater your plants.*)
5. Develop your own set of procedures based on the lab design and materials available.
6. Set up experiment to test radish growth using one control and minimum of 3 test groups.

Materials for Use:

Syrofoam cups	Water	Commercial potting soil
Graduated cylinders	Sand	Balance
Ruler	Pea gravel	Paper towels
Radish plant seeds	Topsoil	

Data: Design a table to include your collected data, which should include all characteristics you will monitor during the 2-week growth period and after growth (may include any of the following):

1. Water holding capacity (per soil type).
2. Number of germinated seeds (daily).
3. Color of plant visible (daily).
4. Height of plant visible (daily).
5. Plant root growth (after growth; average and total).
6. Biomass production (after growth; average and total).

Graphs: Create graphs to represent your data. Graphs should be scatter plot graphs with lines of best fit. Axes need to be appropriately labeled, include units and must have an appropriate title. NO HISTOGRAMS OR PIE CHARTS. Only one dependent variable per graph. Must be drawn on graph paper or constructed using Excel.

Questions to address in the Conclusion:

1. Describe how the results of the experiment supported or refuted your original hypothesis.
2. What soil characteristics do you believe contributed to these results and why?
3. Evaluate the fertility of the soils based upon your results. Specify your reasons.
4. Explain how sources of error may have skewed your results (cannot be human error). How could the lab have been improved in order to provide better results?
5. Based on the results, develop a follow-up hypothesis to extend the experiment.
6. A farmer in a nearby area has mainly sandy loam soil. As an extension agent, would you recommend he plant radishes in his fields, and if not, what type of edible vegetation would he economically benefit from?