

Chemical Competition in Plants (Exercise 1)

Objective- This lab exercise uses the moss *Sphagnum* to examine chemical competition in plant ecology.

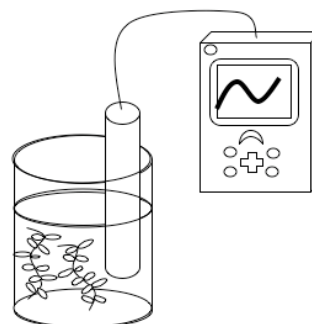
Introduction - A resource can be defined as any part of the environment that an organism uses for its growth, maintenance, and reproduction. In nature, food and water are common examples of resources. Some resources may be in limited supply. A frequently overlooked resource is space. Although not “used up” space can be in short supply in many environments and competition for space can be fierce. Plants compete for space above ground primarily to acquire light, necessary for photosynthesis. Some plants outcompete their neighbors by growing taller and faster. Other plants take a subtle, yet extremely effective approach: chemical alteration of the environments to prevent growth of their competitors. This strategy is displayed by a group of bryophytes, the peatmosses (scientific name: *Sphagnum*). In this lab you will follow the change in water chemistry or pH induced by the presence of *Sphagnum* in the water.

Experimental Question:

How does *Sphagnum* alter its environment to compete against neighboring plants?

Materials needed:

- 3 × 500 mL Beakers (or similar sized container)
- Pond water (Tap water works as well)
- Sphagnum* moss, rinsed
- Other non-moss aquatic plant (ex. *Elodea*, Duckweed)
- Digital pH meter (ex. Vernier Labquest, Pasco Spark)



Procedure:

1. Rinse and dry each of the beakers to ensure that they are clean. Label them A, B and C.
2. Measure out and place 300mL of water into each beaker.
3. Place the probe from the digital meter into the beaker to measure the initial pH of the water. Record this value in your notebook.
4. In beaker A place 30g of the rinsed *Sphagnum*. Record the pH of the water every minute for the next 15 minutes.
5. In beaker B place 30g of the other non-moss aquatic plant. Record the pH of the water every minute for the next 15 minutes.
6. In beaker C do not place any plants. Record the pH of the water every minute for the next 15 minutes.
7. Graph the data, with time measured in minutes on the X-axis and pH on the Y-axis. Plot pH through time for the three beakers A, B, and C.

Questions for Chemical Competition in Plants, Exercise 1:

Instructor-Directed Analysis and Discussion

1. What is the purpose of beaker B with the other aquatic plant in it?
2. What was the purpose of beaker C with no plant in it?
3. What did you observe in beaker A with the *Sphagnum* moss in it over the course of the experiment?
4. What advantage would this give the *Sphagnum* in its environment?
5. Based on what you know about pH, what must the *Sphagnum* be doing to the water around it chemically? (Hint- Think of what pH really measures!)
6. Based on your knowledge of cells, how might *Sphagnum* be doing this to the water around it?

Student-Centered Investigations

7. Based on your findings, identify a question that you would like to investigate to better understand how the moss is affecting its environment.
8. Design and describe an experiment that would test the question you chose.

Chemical Competition in Plants (Exercise 2)

Objective- This lab exercise uses the moss *Sphagnum* to examine chemical competition in plant ecology.

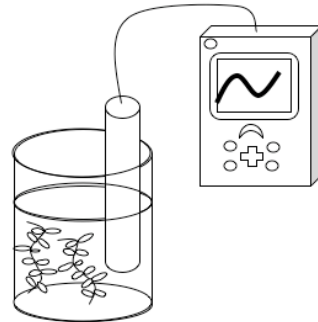
Introduction - A resource can be defined as any part of the environment that an organism uses for its growth, maintenance, and reproduction. In nature, food and water are common examples of resources. Some resources may be in limited supply. A frequently overlooked resource is space. Although not “used up” space can be in short supply in many environments and competition for space can be fierce. Plants compete for space above ground primarily to acquire light, necessary for photosynthesis. Some plants outcompete their neighbors by growing taller and faster. Other plants take a subtle, yet extremely effective approach: chemical alteration of the environments to prevent growth of their competitors. This strategy is displayed by a group of bryophytes, the peatmosses (scientific name: *Sphagnum*). In this lab you will follow the change in water chemistry or pH induced by the presence of *Sphagnum* in the water.

Experimental Question:

What role do ions play in *Sphagnum*'s ability to alter the pH of its environment?

Materials needed:

- 1 x 600 mL Beakers (or similar sized container)
- Distilled water
- Sphagnum* moss, well rinsed
- 1.5 g NaCl (table salt)
- Digital pH meter (ex. Vernier Labquest, Pasco Spark)



Procedure:

1. Rinse and dry the beaker to ensure that it is clean.
2. Measure out and place 300mL of distilled water into the beaker.
3. Place the probe from the digital meter into the beaker to measure the initial pH of the water. Record this value in your notebook.
4. Set your digital data collection unit to collect data every 30 seconds for the next 30 minutes and start the data collection just before you do step 5.
5. In the beaker, place 15g of the rinsed *Sphagnum*. Record the pH of the water every 30 seconds for the next 15 minutes.
6. After the 15 minutes is up, place the salt into the beaker and gently stir to dissolve. Allow the data collection unit to continue to collect data for the next 15 minutes.
7. Graph the data by plotting pH (Y axis) through time (X axis).

Analysis Questions for Chemical Competition in Plants, Exercise 2:

Instructor-Directed Analysis and Discussion

1. What is distilled water? Why do we use it?
2. What is the dependent variable in the experiment? What are the independent variables that you, as the researcher, controlled during the experiment?
3. What is the purpose of the first 15 minutes of data?
4. What did you observe during the first 15 minutes with the *Sphagnum* moss in the beaker?
5. What did you observe during the second 15 minutes with the *Sphagnum* moss and salt in the beaker?
6. What conclusion can you draw based on the data collected in this lab? Make sure to back up your answer with the data that support it.
7. Based on what you know about pH, what must the *Sphagnum* be doing to the water around it chemically? (Hint- Think of what pH really measures!)

Student-Centered Investigations

8. Based on your findings, identify a question that you would like to investigate to better understand how the moss is affecting its environment.
9. Design and describe an experiment that would test the question you chose.