The Effect of Garlic on the Germination of Wild Oats

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Grade Level:
High School

The Effect of Garlic on the Germination of Wild Oats

Purpose:
To observe and record the effect of different amounts of garlic powder on the germination of wild oat seeds.

Objectives:
Students will be able to:

1. improve their skills in creating hypotheses, designing experiments, collecting and analyzing data, drawing conclusions, and communicating results.
2. observe the effect of different amounts of garlic powder on the germination of wild oats.

Discussion:
Crushed garlic, *Allium sativum*, produces a bioactive volatile called allicin. Volatiles are compounds that vaporize or evaporate quickly. Intact garlic bulbs or cloves contain a colorless, odorless precursor, allin, which comes in contact with the enzyme, allinase, in injured cells and allicin is released. The odor and flavor of garlic develop only after the cells are damaged and release the chemical allicin. Allicin inhibits both the growth of microorganisms and seed germination. Allicin protects the damaged garlic from microorganisms and competition from other monocots for nutrients.

Materials:
The following materials are for each **pair** of students:

- 80 wild oat seeds
- four 9 cm petri dish
- eight 9 cm Whatman #1 filter paper

The following materials are for the entire **classroom**:

- distilled water
- garlic powder (7 oz.)
- masking tape
- aluminum foil
- graduated cylinders
- balance

Supplier:
Valley Seed Service,
P.O.Box 9335
Fresno, CA 93791
Phone (209) 435-2163
Fax (209) 435 - 8319
$15/quart of wild oat

Preparation:

This lab is an excellent activity to do during your plant hormone unit. Make sure you order the seeds from a seed supplier ahead of time. You may want to substitute wild oats with any other member of the grass family.

Other free/recycable items can be substituted for many of the materials:

- paper towels your school uses for drying hands instead of filter paper.
- bottoms of milk cartons covered with plastic instead of petri dishes.
- grass seeds from the school grounds.
- tap water is OK to use.
- bottle caps instead of aluminum foil.

You do not need to measure exact amount of water, but you should be consistent throughout the experiment.

Procedure:

1. Divide students into pairs using any type of random separation.
2. Explain to students that they will have an opportunity to observe and measure a plant's response to a plant hormone.
3. Each team will create a hypothesis regarding how different amounts of garlic powder would affect wild oat seeds' germination.
4. Each pair will write a report containing the following information: hypothesis, materials, procedure, control, results, analysis, and conclusion.
5. Students will have to review their experimental design with their teacher before beginning their project. Teacher approval is required.
6. Each group will complete their experiment, record and analyze the data, reach a conclusion, and write down new questions their experiment has raised.

Safety:

There is no need for any special safety procedures. You may want to check if any student is allergic to garlic.

Questions to ask:

1. What is allelopathy?
2. What other plants show allelopathy?
3. Does garlic smell?
4. You could pass around a garlic clove in a sealed container and ask students to describe the smell. Garlic would produce its characteristic smell only if you break the cell wall, then the garlic will release a bioactive volatile called allicin.
5. What causes garlic to smell?
6. What are some beneficial effects of garlic?

Where to go from here?

- Do a library research on the beneficial effects of garlic.
- Use pine needles to extract another plant inhibitor.
- Extract a plant inhibitor from one tomato variety and try in another variety.

References:

1. Beltz, G. G. and et.al. Influence of long-term garlic intake on pulse wave velocity along the aorta, http://www.mistral.co.uk/garlic/influence.htm
2. Great garlic: A miracle right under our noses; http://wellweb.com/ALTERN/column/garlic.htm.
3. Kebede, Zewdu. Allelopathic chemicals: Their potential uses for weed control in agroecosystems, http://www.colostate.edu/Depts/Entomology/courses/en570/papers_1994/kebede.htm
4. Shimabukuro, M.A., and Fearing, V. How does your garlic grow? *Science and Childre*n, May 1993, 8-11.

Suggestions for assessment:
Each group will present their data to the class, as well as produce a written report.

Student Activity
The Effect of Garlic on the Germination of Wild Oats

Purpose:
To observe and record the effect of different amounts of garlic powder on the germination of wild oat seeds.

Procedure:
You will design an experiment to determine the effect of garlic powder on the germination of wild oats. The following information is required for your experimental design:

1. Your names and date.
2. Your hypothesis.
3. List the materials you will need for the experiment.
4. How will you measure the effect of different amounts of garlic powder on the germination of wild oats? (Procedure)
5. How will you record your data?
6. Get your teacher's approval.
7. Run the experiment, record and graph the data, state your conclusion.
8. Make a poster to present to the class.

The Effect of Garlic on the Germination of Wild Oats
(group report)

Names:

Date:

Purpose:
To observe and record the effect of different amounts of garlic powder on the germination of wild oat seeds.

Hypothesis:

Materials:

Procedure step-by-step (i.e. 1, 2, 3):

What is the control for your experiment?

Results: Create a table to collect your data.

Approved: _____
teacher's signature

Graph your data.

Conclusion:

New questions you have from the experiment: