A LOOK AT ALLELOPATHY

When Plants Fight Back!

Alan Windham, Professor and Extension Specialist, Entomology and Plant Pathology
A Look at Allelopathy
When Plants Fight Back!

Skill Level
Beginner

Learner Outcomes
The learner will be able to:

• Identify the components of allelopathy
• Understand plant germination in different environments

Educational Standard(s) Supported
5.LS3.1
5.LS3.2

Success Indicator
Learners will be successful if they:

• Participate in the activities
• Think critically about the experiment
• Carefully follow directions of the experiment

Time Needed
30 minutes, plus five days of checking for germination

Materials List
Radish seed
Plastic sandwich bags
Paper towels
Small disposable cups
Water
Needles or leaves of cedar, pine, grass (tall fescue or ryegrass), walnut or holly

Introduction to Content
This lesson introduces the concept of allelopathy among plants in terms of gardening and cultivating plants. Students learn how invasive species and the biology of certain plants affect germination of other plant species.

Introduction to Methodology
With guidance from the instructor, students will use an experiment to understand the terms allelopathy and germination. Students will have the opportunity to observe seed germination over the course of multiple days and determine how the environment of the seeds affects whether or not the seeds germinate.

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Prepared using research based practices in youth development and experiential learning.
Terms and Concepts Introduction

**Allelopathy**: biological phenomenon by which a plant produces one or more biochemicals that influence the germination, growth, survival and reproduction of other organisms.

**Germination**: process by which an organism grows from a seed or similar structure.

Setting the Stage and Opening Questions

Tell students, “**Gardening is fun. When you plant a seed in the soil, it will grow as long as water, light, temperature and some nutrients are near normal for the plant.**”

Ask students to share experiences they have had with growing a plant either at home or for a school project. Ask them what steps they took to care for the plant.

Tell students, “**However, there are times when plants do not grow well. Plant a tomato near a black walnut and it will grow slowly and wilt due to a chemical called juglone that is produced in walnut leaves and roots.**”

Explain to students that when a plant produces a chemical that inhibits the growth of another plant, it’s called *allelopathy*.

Share an example with students. You may have seen trees where nothing is growing under the tree. Some of this is due to competition for light, water and nutrients, but in some cases, allelopathy plays a role. The tree produces chemicals that prevent the growth of other plants.

In this activity, we are going to duplicate allelopathy as it occurs in nature. We’ll use needles and leaves of native trees and grasses found across Tennessee to see if they influence the germination of radish seed.

Experience

1. Collect leaves or needles. Place them in a small disposable cup, add an equal volume of water, and leave overnight. Try placing leaves and needles from several plants in different cups.
2. The next morning, moisten a paper towel with the suspension from a cup and place 10 radish seed on the moistened towel. Carefully slide the paper towel and seed into a sandwich bag and seal. Place in a dark place such as a drawer, box or closet overnight.
3. For the control group, moisten a paper towel with water only, place 10 radish seeds on the moistened towel, and place in the dark.
4. The next day, count the number of seeds that have germinated in the control group bag and in the treated bags. Check bags each day to check germination. Record the results in the chart.
5. Repeat and dilute some of the plant extract to see if this affects germination.
Life Skill(s)

5th Grade Head
Understand what it means to be a 4-H member.
Communicate information learned from a specific project area to the larger 4-H club.

Share

Ask students, “What patterns do you see on the data chart? What might this tell us about allelopathy and germination?”

Process

Ask students the following questions:

- Which plants affected germination of the radish seed the most? Trees with needles? Trees or shrubs with leaves? Grass leaves?
- Did diluting the plant extract before moistening the paper towel affect germination?

Generalize

Invite students to create a simple bar graph to illustrate the results of the experiment.

Apply

Ask students the following questions:

- How does allelopathy benefit the plant that produces chemicals that affect nearby plants?
- Would it be possible to use plant extracts to prevent weed seed from germinating?
- Do invasive plants use allelopathy to slow or prevent the growth of native plants?
Educational Standards Met:

5.LS3.1. Distinguish between inherited characteristics and those characteristics that result from a direct interaction with the environment. Apply this concept by giving examples of characteristics of living organisms that are influenced by both inheritance and the environment.

5.LS3.2. Provide evidence and analyze data that plants and animals have traits inherited from parents and that variations of these traits exist in a group of similar organisms.
Allelopathy in Plants Experiment Data Sheet

Name: __________________________

Experiment Hypothesis: __________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Materials:

Procedure:
Data Collection: Use the following chart to keep track of and make notes about germination.

<table>
<thead>
<tr>
<th>Plant Extract</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cedar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holly</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Results:

Conclusions: