

Module 4: Plant Growth, Management & Pest Control

Hands-On Activity: DIY Spore Print & Culture

Student Data Collection Worksheet for HOA Module 4 Lesson B - HOA B1

Grouping: Groups of 2–4 students

Time: 25–40 min setup, plus short observation sessions over several days

Materials Reference:

(You should have these available – check them off as you use them.)

- Powdery mildew-infected leaf source
- 2 Petri dishes with agar (labeled *Control* and *Clove Oil*)
- Dropper with water (control)
- Dropper with clove oil (treatment)
- Gloves, marker, tape for sealing plates
- Ruler (for measuring colony size)
- Data sheet (this worksheet) and pencil

Part A: Initial Setup Notes (Day 0)

Record some details right after setting up your plates.

- **Date/Time of setup:** _____
- **Plant source of spores:** e.g. “*rose bush from school garden*” (if known)

- **Visible spores on agar after leaf press?** (Yes/No, describe any initial powdery residue or imprint)
 - Control plate (water): _____
 - Clove oil plate: _____
- **Any immediate observations or smells:** (e.g., *strong clove smell on treated plate, appearance of agar*)

(At Day 0, you likely won't see fungal growth yet – just note what things look/smell like at the start.)

Part B: Fungal Growth Observations

Over the next several days, you will observe and measure the growth of the powdery mildew fungus on each plate. Use the table below to record your data. If you have two observation days, fill in both columns. If you only do one follow-up, use the “Final Observation” column.

Plate	Observation 1 Date: _____ (Day __ after setup) <i>Describe growth</i>	Observation 2 (Final) Date: _____ (Day __ after setup) <i>Describe growth</i>
Control (Water)	Growth: _____ (colony diameter or % plate covered) Description: *(e.g., “~ mm fuzzy white patch, center” or “no visible growth”)*	Growth: _____ (colony diameter or % plate covered) Description: __ (e.g., “now covering about __% of plate, thick white mildew”)
Clove Oil	Growth: _____ (colony diameter or % plate covered) Description: *(e.g., “only tiny spots ~ mm, faint” or “no growth seen”)*	Growth: _____ (colony diameter or % plate covered) Description: *(e.g., “one small colony ~ mm at edge; rest of area clear”)*

Additional Notes: (Any other observations? Odor, contamination, color changes, etc. You can also note if one plate’s fungus looks different in texture or if other molds appeared.)

Calculation – Percent Inhibition: Using your **final observation** measurements, calculate how effective the clove oil was in inhibiting the fungal growth. Show your work below:

Percent Inhibition equals *Control growth minus Clove oil growth, divided by Control growth, multiplied by 100 percent.*

Percent Inhibition = $[(\text{Control growth} - \text{Clove oil growth}) / \text{Control growth}] \times 100\%$

- Control plate final growth size = _____ (mm of colony diameter, or estimate of area)
- Clove plate final growth size = _____
- Difference = _____
- **Percent Inhibition =** _____ %

(Explain in words what this percentage means: e.g., “Clove oil reduced the fungal growth by about 90% compared to the control.”)

Part C: Reflection & Analysis Questions

Answer the following questions based on your observations and results. Be detailed – use **evidence from your data** in your answers (for example, refer to the measurements or percent inhibition you found). Discuss with your team and then write your consensus answers below.

1. **Comparing Outcomes:** Which Petri dish had more mold growth in the end – the water (control) plate or the clove oil plate? **By how much?** Describe the difference you observed. Why do you think one had more growth than the other?

○ **Answer:**

(Tip: State your observations – e.g., “The control had a patch ~5 cm across, while the clove plate had only a few small spots ~0.5 cm. The control clearly grew more.” Then explain that the clove oil must have slowed or stopped the fungus.)

2. **Effectiveness of Clove Oil:** Based on your data, how effective was the clove oil at inhibiting the powdery mildew fungus? Include the **percent inhibition** you calculated and interpret it. What does that number tell us about clove oil’s impact on fungal growth?

○ **Answer:**

(Example: “We calculated about 80% inhibition. This means the clove oil treatment prevented roughly 80% of the mold growth that we saw in the control. In other words, the fungus grew much less (only 20% as much) on the plate with clove oil.”)

3. **Mechanism – Why?** Why do you think the clove oil affected the fungus the way it did? In other words, **how might clove oil be inhibiting or killing the powdery mildew?** (Think about what clove oil is – maybe something in it is harmful to microbes. You don’t need the exact chemistry, just a logical idea.)

○ **Answer:**

(Consider: Clove oil is a natural extract – many plant extracts have antimicrobial properties. Perhaps mention that it contains a compound (such as eugenol) that can kill fungal cells or prevent spores from germinating. It's okay if you're not sure of the exact reason; describe what you suspect.)

4. **IPM & Sustainable Farming Connection:** How does this experiment demonstrate principles of **Integrated Pest Management (IPM)** or sustainable agriculture? Imagine you are a farmer dealing with powdery mildew. How could the ideas tested here (both the monitoring and the type of treatment) help you manage the problem in an eco-friendly way?

- **Answer:**
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*(In your answer, try to cover: a) **Monitoring** – identifying the disease (we did a spore print, analogous to scouting for disease in the field); b) **Targeted control** – using a natural product (clove oil) instead of a synthetic chemical, which is better for the environment and can be part of organic farming; c) how this fits into IPM – for example, using a less toxic remedy after detecting an issue, rather than routinely spraying all plants. You might also mention combining this with other IPM tactics, like removing infected leaves (cultural control) or encouraging beneficial microbes that compete with the mildew (biological control).)*

Skills You've Practiced:

- **Scientific Observation:** You observed subtle biological changes (fungal growth) over time and noted details carefully.
- **Data Collection & Recording:** You measured colony sizes and recorded data in an organized way (tables, notes), similar to how scientists track experiment results.
- **Quantitative Analysis:** You calculated a percentage to quantify the effect of a treatment, practicing how to derive meaning from numbers in a scientific context.
- **Experimental Design Understanding:** You worked with a control and a treatment, reinforcing how comparisons are made in experiments to test a hypothesis (in this case, "Clove oil will inhibit fungal growth").
- **Safety & Technique in Microbiology:** You learned to handle microorganisms (plant spores/fungi) safely by keeping plates sealed and maintaining clean procedures—an introduction to microbiology lab protocols.
- **Integrated Thinking:** You connected a lab experiment to real-world agricultural practices. By reflecting on IPM, you saw how monitoring and using a botanical treatment can be part of a larger system to manage pests sustainably.

Conclusion: From Lab to Farm

This activity wasn't just about a leaf and some mold in a dish; it's a **small-scale model of sustainable pest management**. In the real world, farmers face challenges like powdery mildew on their crops. Instead of immediately reaching for heavy chemical fungicides, an IPM approach suggests first monitoring and confirming the problem (as we captured spores to observe the fungus), then applying a **targeted solution** that minimizes

harm (we used clove oil, a natural antifungal, as an example). In our mini “crop,” clove oil significantly slowed or stopped the disease, showing promise for gentler methods to control pests.

Think about how this could scale up: Could gardeners or farmers use clove oil or other plant-based oils to treat mildew on leaves? (Yes, and some do!) What are the pros and cons? This kind of question is at the heart of designing sustainable food systems. By doing this experiment, you’ve practiced the same kind of thinking – and value-based decision-making – that goes into **growing healthy plants with minimal environmental impact**. Keep these insights in mind as we continue exploring sustainable agriculture. Every small observation – even something like mold on a Petri dish – is a clue to a larger puzzle of how we can work with nature to improve our food system. 🌱🌍