Module 4: Plant Growth, Management & Pest Control

Hands-On Activity: Seeing Microbes in Action

Data Collection Worksheet for HOA Module 4 Lesson A - HOA A
Grouping: 2–4 students
Time: 45–50 minutes per day over 3 days

Materials: Baker's yeast packets; optional biocontrol (e.g. *Bacillus* sp.); pre-poured yeast-agar plates (~20–30); apples, cutting board, toothpicks; water, sugar, baking soda; balloons; rulers; markers; tape or Parafilm; droppers/micropipettes; gloves, goggles, apron; 10% bleach for disposal.

Your Task: Graphic Organizer

Step 1: Identify the IPM Strategy
Check which strategy each experiment focuses on:

Apple Infection Model:	**Microbe Face-Off (Dual-Culture Plates):**	**Baking Soda Balloon Test:**
☐ Cultural – Plant health or wounds	☐ Cultural – Plant health or wounds	☐ Cultural – Plant health or wounds
☐ Biological – Friendly microbes or biocontrol	☐ Biological – Friendly microbes or biocontrol	☐ Biological – Friendly microbes or biocontrol
☐ Chemical – Baking soda	☐ Chemical – Baking soda	☐ Chemical – Baking soda

Step 2: Experiment Setup. Fill in what you added:

Apple Infection Model

- What did you add to each apple section?
    - Control-Unwounded: _____
    - Control-Wounded: _____
    - Yeast-Wounded: _____
    - Yeast + Biocontrol-Wounded: _____

Microbe Face-Off: Which microbes did you place on each side of each plate?

- Control Plate (both sides yeast): _____
- Test Plate (yeast vs. biocontrol): _____

Baking Soda Balloon Test: List the baking soda concentrations you used in each cup.

- 0%: _____ 0.5%: _____ 1.0%: _____ 2.0%: _____

Step 3: Observe & Measure (Day 2). Record your observations and measurements below:

Apple Lesions: Measure diameter of any lesion (softened/discolored area).

Treatment	**Diameter (mm)**	**Notes (texture, color, smell)**
Control-Unwounded		
Control-Wounded		
Yeast-Wounded		
Yeast + Biocontrol		

Dual-Culture Plate: Measure radius of each microbial colony and any inhibition zone.

	Yeast radius (mm)	Biocontrol radius (mm)	Inhibition zone (mm)	Notes
Plate 1 (yeast vs. yeast)				
Plate 2 (yeast vs. biocontrol)				

Baking Soda Balloon Test: Record balloon circumference (cm) at each time point.

Time (min)	0% $NaHCO_3$	0.5% $NaHCO_3$	1% $NaHCO_3$	2% $NaHCO_3$	Notes e.g. bubbles, smell, etc.
15					
30					
45					
60					

Step 4: Claim–Evidence–Reasoning (CER). Use your data to answer the questions below:

Claim: Which tactic(s) worked best to limit microbial infection or growth?
Write a concise scientific claim about the most effective IPM strategy.

Evidence: What data from your experiments support your claim?
Use measurements and observations from the tables above.

Reasoning: How do your results relate to microbial biology and IPM?
Explain why the data make sense biologically (e.g. how baking soda affected yeast metabolism) and how each tactic fits into an IPM strategy.

Step 5: Design Your IPM Plan. Farmers use IPM to keep crops healthy with minimal chemicals. Your experiments represented:

- Wounds → cultural factor (plant injury increases infection)
- Biocontrol → biological factor (beneficial microbes suppress pathogens)
- Baking soda → chemical factor (a mild treatment affecting microbes)

How: Based on your observations, fill in the table below to show how you would use each strategy in a real IPM plan:

Strategy Type	Observations (From lab)	How You Would Use It in an IPM Plan
Cultural		(e.g., sanitation, crop rotation, resistant varieties…)
Biological		(e.g., use beneficial microbes, encourage predators…)

Chemical		(e.g., targeted, minimal pesticide use, or organic sprays)
Monitoring		Farmers might monitor disease spots on leaves, or balloon growth in our model. What could you measure to decide when to act?

Reflection Questions

1. How did each factor (wounds, biocontrol, baking soda) affect microbial growth?

2. Which strategy worked best and why?

3. How does this activity help you understand what farmers do to protect crops?

Skills You'll Use

- Observation and measurement
- Cause-and-effect reasoning
- Systems thinking in plant protection
- Designing practical IPM strategies

Example:

- Wounded apple disks grew yeast faster → shows cultural factor importance.
- Biocontrol slowed yeast → shows biological control in action.
- 1% baking soda slowed growth without overusing chemicals → chemical strategy.