Module 4: Plant Growth, Management & Pest Control
Think, Pair, Share Activity C: Rapid Diagnostic IPM Integration

Lesson C
Grouping: Pairs or individuals
Time: 25-30 minutes

Option 1: Diagnosis in the Field

Materials:
- Pest Case Cards (choose or receive one scenario)
- Diagnostic Tools Reference Sheet (LAMP, CRISPR, microfluidics, agar/PCR)
- Budget Sheet Template (crop loss vs tool cost)
- Printed Student Worksheet
- Calculator (optional for savings math)
- Markers/whiteboard or poster paper (optional for visual presentations)

Objective:
Students will analyze a real-world pest/disease scenario, choose a rapid diagnostic test, and recommend a data-driven response. They will justify their decision based on timing, cost, test function, and crop loss risks.

Use these resources for the Activity Options that will help you learn more below!

Instructions:
You'll receive a Pest Case File with a description of a crop problem. Use the Diagnostic Tools Reference Sheet and Budget Sheet to choose a test, then build a plan.

Your Task:
You're the crop manager. Your farm is facing a mystery pest or disease problem. You must act quickly, every week of delay could cost thousands of dollars in crop loss.

1. Review your Case File - read about your crop and what symptoms it has
2. List 2–3 possible causes of the problem based on symptoms and context.
3. Choose the most effective diagnostic tool for this situation using the reference sheet.
4. Fill out the worksheet:
    a. What does your test detect?
    b. Is it fast? Expensive? Field-ready?
5. Make two plans:
    a. If the test is positive (you confirm the pest/disease) → What will you do?
    b. If the test is negative (you don't find anything) → What will you do instead?
6. Use the Budget Sheet to calculate how much you could save by testing before acting.
7. Prepare a short report or pitch explaining:
    a. What you tested
    b. Why you chose that test
    c. What your results mean
    d. What action you'll take

DIAGNOSTIC TOOL REFERENCE SHEET

Tool	Detects	Speed	Cost	Can Use in Field?	Notes
LAMP Test	DNA (pathogens)	~30 mins	$50/test	Yes	Fast & accurate
CRISPR Sensor	RNA/DNA	~20 mins	$75/test	Yes	High precision

	(viruses, bacteria)				
Paper Microfluidic Chip	Pathogen proteins or DNA	~15 mins	$20/test	Yes	Low-cost, single-use
PCR Lab Test	DNA/RNA	1–2 days	$100/test	No	Requires lab
Agar Culturing	Fungus/Bacteria growth	3–5 days	$10/test	No	Cheap, but slow

Activity: Diagnosis in the Field

1. Case Analysis

Case Title:

_____

Crop:

_____

Symptoms Observed:

→ _____

Possible Causes (list 2–3):

→ _____

→ _____

2. Tool Selection

Chosen Diagnostic Tool:

_____

- Speed: _____
- Cost: _____
- Can it be done in the field? ✅ / ❌
- What does it detect?

→ _____

→ _____

→ _____

3. Decision Plan Action Plan

IF POSITIVE:

→ _____ Action

Plan IF NEGATIVE:

→ _____

4. Resource Impact

Estimated Crop Loss from Delay (per week):

$_____

Cost of Diagnostic Tool: $_____

Potential Savings from Timely Action:

$_____

Prepare a short report or pitch explaining: What you tested, Why you chose that test, What your results mean, What action you'll take

Reflection “If no diagnostic tools were available, what might be wasted or misdiagnosed in this situation?”

CASE CARDS (EXAMPLES)

koike et al., 2018

Case Card 1 – “Wilting Lettuce Mystery”

Crop: Romaine lettuce	Symptoms: Wilting outer leaves, yellowing edges, soggy base stems
Conditions: Wet field after recent storm	Economic Loss: $2,000/acre/week
Clues: Soil fungus or bacterial wilt suspected	Challenge: Avoid unnecessary chemical treatment if it’s not bacterial

Cherlinka et al,. 2025

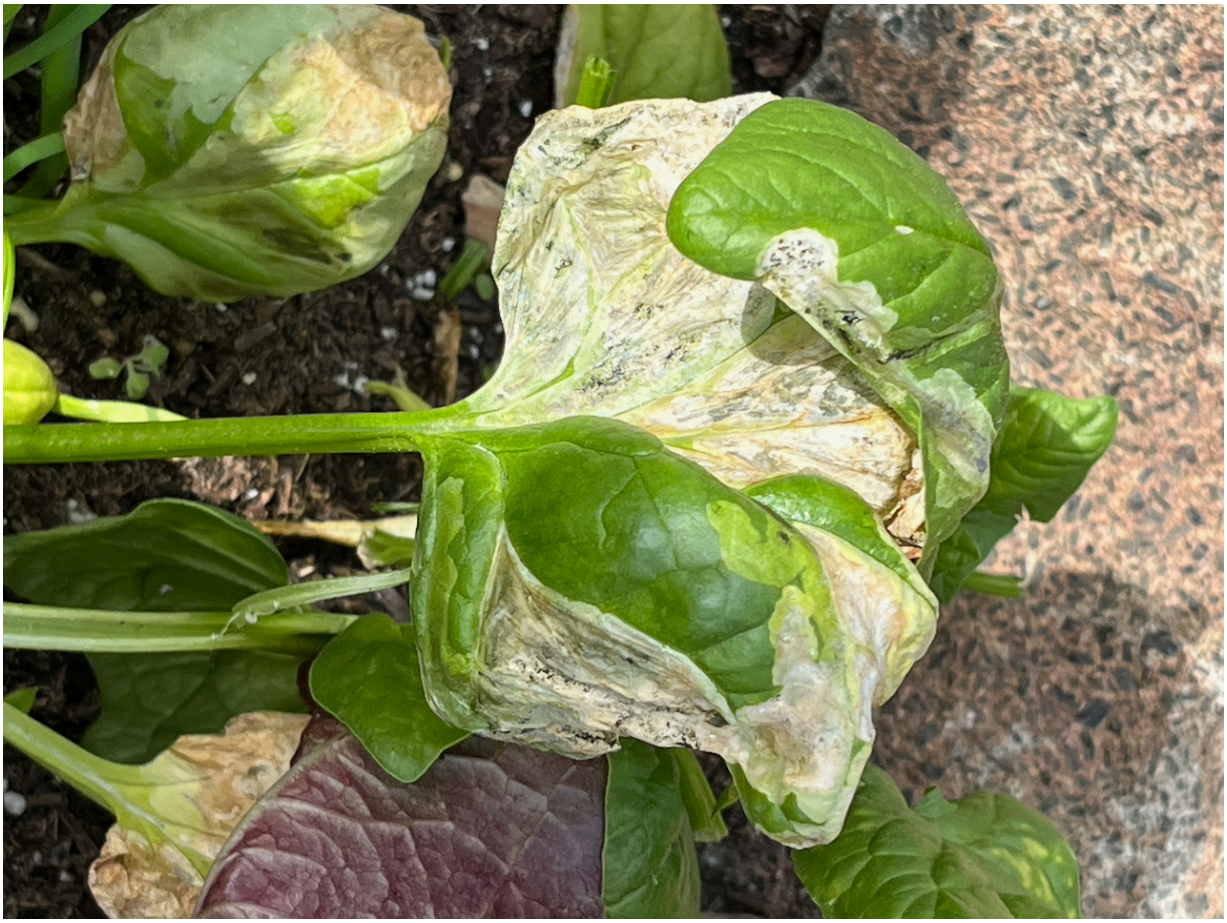
Case Card 2 – “Tomato Trouble”

Crop: Greenhouse tomatoes	Symptoms: Brown leaf spots, some fruit rot, fuzzy gray mold in corners
Conditions: High humidity, poor ventilation	Economic Loss: $3,500/acre/week
Clues: Botrytis (gray mold) or early blight	Challenge: Lab PCR takes too long; growers need fast decision

George et al,. 2019

Case Card 3 – “The Citrus Scare”

Crop: Oranges	Symptoms: Yellow shoot tips, lopsided fruit, blotchy leaf patterns
Conditions: Warm, dry season; psyllid insects spotted nearby	Economic Loss: $4,000/acre/week
Clues: Possible HLB (citrus greening)	Challenge: Confirm infection before removing trees or spraying



Grisak et al., 2023

Case Card 4 – “Leafy Intruder”

Crop: Spinach	Symptoms: Powdery coating on leaves, yellow patches underneath
Conditions: Cool morning fog	Economic Loss: $1,800/acre/week
Clues: Likely powdery mildew or nutrient deficiency	Challenge: Diagnose fast to avoid over-fertilizing or spraying unnecessarily

BUDGET SHEET TEMPLATE (OPTIONAL)

Item	Value
Crop value per acre	$_____
Estimated loss/week	$_____
Test cost	$_____
Action cost (spray/removal)	$_____
Potential savings if early	$_____

OPTIONAL EXTENSION IDEAS

Debrief: Groups rotate and compare decisions. Did they all choose the same test? Why or why not?
Class Vote: Which team saved the most money with the least environmental impact?
Bonus Writing Prompt: “Imagine you’re a farm manager. How would you decide when to spend money on testing versus just treating a problem?”

Skills You’ll Use:

- Evidence-based decision making
- IPM planning
- Systems diagramming
- Sustainability reasoning