Module 4: Plant Growth, Management & Pest Control
Activity Worksheet C: Rapid Diagnostic IPM Integration
Red Notes

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 Recap (Teacher-Facing Version)
Main Goal: Students will step into the role of a crop manager facing a real-world pest or disease outbreak. They will analyze symptoms, explore diagnostic tools, and decide how to act — using data to balance cost, speed, and accuracy. The goal is to help students understand how early detection improves farm decisions and reduces wasted time, money, and chemicals. Answers should be around the range, doesn't have to be exact

Activity: Diagnosis in the Field

1. Case Analysis Case Title:  koike et al,. 2018 CASE CARD 1 – "Wilting Lettuce Mystery" Crop: Crop: Romaine Lettuce Symptoms Observed: → Symptoms: Wilting leaves, soggy stems Possible Causes (list 2–3): → Likely Causes: Soil fungus (Pythium, Fusarium) Bacterial soft rot	2. Tool Selection Chosen Diagnostic Tool: Best Diagnostic Tool: LAMP Test • Speed: Fast (~30 mins) • Cost: $50 cost is justified to avoid spraying or soil fumigation • Can it be done in the field? ✅ / ❌ • What does it detect? → Detects DNA from bacterial/fungal pathogens

3. Decision Plan Action Plan IF POSITIVE: → Remove infected plants, improve field drainage, avoid spraying fungicides Action Plan IF NEGATIVE: → Likely fungal: consider solarization or soil fungicide, focus on soil health	4. Resource Impact Estimated Crop Loss from Delay (per week): $2,000/acre Cost of Diagnostic Tool: $50 Potential Savings from Timely Action: $~1,950+

1. Case Analysis Case Title:  Cherlinka et al,. 2025 CASE CARD 2 – “Tomato Trouble” Crop: Crop: Greenhouse Tomatoes Symptoms Observed: → Symptoms: Leaf spots, gray mold Possible Causes (list 2–3): → Likely Causes: Botrytis (gray mold) Early blight	2. Tool Selection Chosen Diagnostic Tool: Best Diagnostic Tool: Paper Microfluidic Chip ● Speed: Fastest option (~15 mins) ● Cost: low cost ($20) ● Can it be done in the field? ✅ / ❌ ● What does it detect? → Detects fungal proteins/DNA
3. Decision Plan Action Plan IF POSITIVE: → Remove infected fruit/foliage, apply biofungicide, improve airflow Action Plan IF NEGATIVE: → Consider early blight treatment, possibly test again or improve hygiene	4. Resource Impact Estimated Crop Loss from Delay (per week): $3,500/acre Cost of Diagnostic Tool: $20 Potential Savings from Timely Action: High (>$3,000) if unnecessary sprays or delays are avoided

1. Case Analysis
Case Title:

George et al,. 2019
CASE CARD 3 – “The Citrus Scare”

Crop:

Crop: Oranges
Symptoms Observed:

→ Symptoms: Yellow shoots, blotchy leaves, psyllids seen

Possible Causes (list 2–3):

→ Likely Cause: Huanglongbing (HLB, citrus greening)

2. Tool Selection
Chosen Diagnostic Tool:

Best Diagnostic Tool: CRISPR Sensor

- Speed: Fast (~20 mins)
- Cost: $75/test — cost worth avoiding premature tree removal
- Can it be done in the field? ✅ / ❌
- What does it detect?

→ High precision for detecting bacterial pathogens like HLB

3. Decision Plan Action Plan
IF POSITIVE:

→ Remove infected trees, apply psyllid control (chemical or biological)
Action Plan IF NEGATIVE:

→ Monitor psyllids, delay drastic actions, avoid unnecessary pesticide use

4. Resource Impact
Estimated Crop Loss from Delay (per week):

$4,000/acre
Cost of Diagnostic Tool: $75
Potential Savings from Timely Action:

~$3,925+ if infected trees are confirmed before acting

1. Case Analysis
Case Title:

Grisak et al., 2023
CASE CARD 4 – “Leafy Intruder”

Crop:

Crop: Spinach
Symptoms Observed:

→ Symptoms: Powdery coating, yellow leaf patches

Possible Causes (list 2–3):

→ Likely Causes: Powdery mildew Nutrient deficiency

2. Tool Selection
Chosen Diagnostic Tool:

Best Diagnostic Tool: Paper Microfluidic Chip

- Speed: Fast (~15 mins)
- Cost: Inexpensive ($20)
- Can it be done in the field? ✅ / ❌
- What does it detect?

→ Good for detecting powdery mildew proteins

3. Decision Plan Action Plan
IF POSITIVE:

→ Targeted spray or biological treatment
Action Plan IF NEGATIVE:

→ Apply nutrients (e.g., magnesium), adjust fertilization, avoid fungicides

4. Resource Impact
Estimated Crop Loss from Delay (per week):

$1,800/acre
Cost of Diagnostic Tool: $75
Potential Savings from Timely Action:

~$1,780 if testing prevents wrong input

Filled out Budget Sheet Support

Case	Crop Value/Acre	Loss/Week	Test Cost	Likely Savings
1 – Lettuce	$6,000	$2,000	$50	~$1,950
2 – Tomato	$9,000	$3,500	$20	~$3,480
3 – Citrus	$12,000	$4,000	$75	~$3,925
4 – Spinach	$4,000	$1,800	$20	~$1,780

Reflection Guidance for Teachers Prompt:

“If no diagnostic tools were available, what might be wasted or misdiagnosed?”
Look for responses that mention:

- Overuse of pesticides or fertilizers
- Crop loss from delayed action
- Economic waste (spraying when it’s not needed)
- Unintended environmental impacts
- Missed opportunities for early containment

Teaching Tips

Encourage discussion:
Did teams choose the same tool? Why or why not?
Ask: Would a cheaper tool have been good enough?
Optional extension: Introduce a "budget cap" to simulate real-world financial constraints.