Soybean Aphid and virus incidence in snap beans

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Outline

Why do we care?

Viruses and vectors involved

Extent of the problem

Approaches/Methods

Data/Observations

Future directions

Snap Bean Industry

- In 2001,
  - ~225,000 lbs of beans were produced
  - Over 73,000 acres were harvested
  - With a crop value >$28 million
  - Which represents >25% of total US production
- $8 million in losses recorded from 2000 to 2001
  - Appearance of the soybean aphid
  - Associated with the occurrence of virus
    - Alfalfa Mosaic Virus (AMV)
    - Cucumber Mosaic Virus (CMV)

Insect transmitters of plant viruses

Thrips

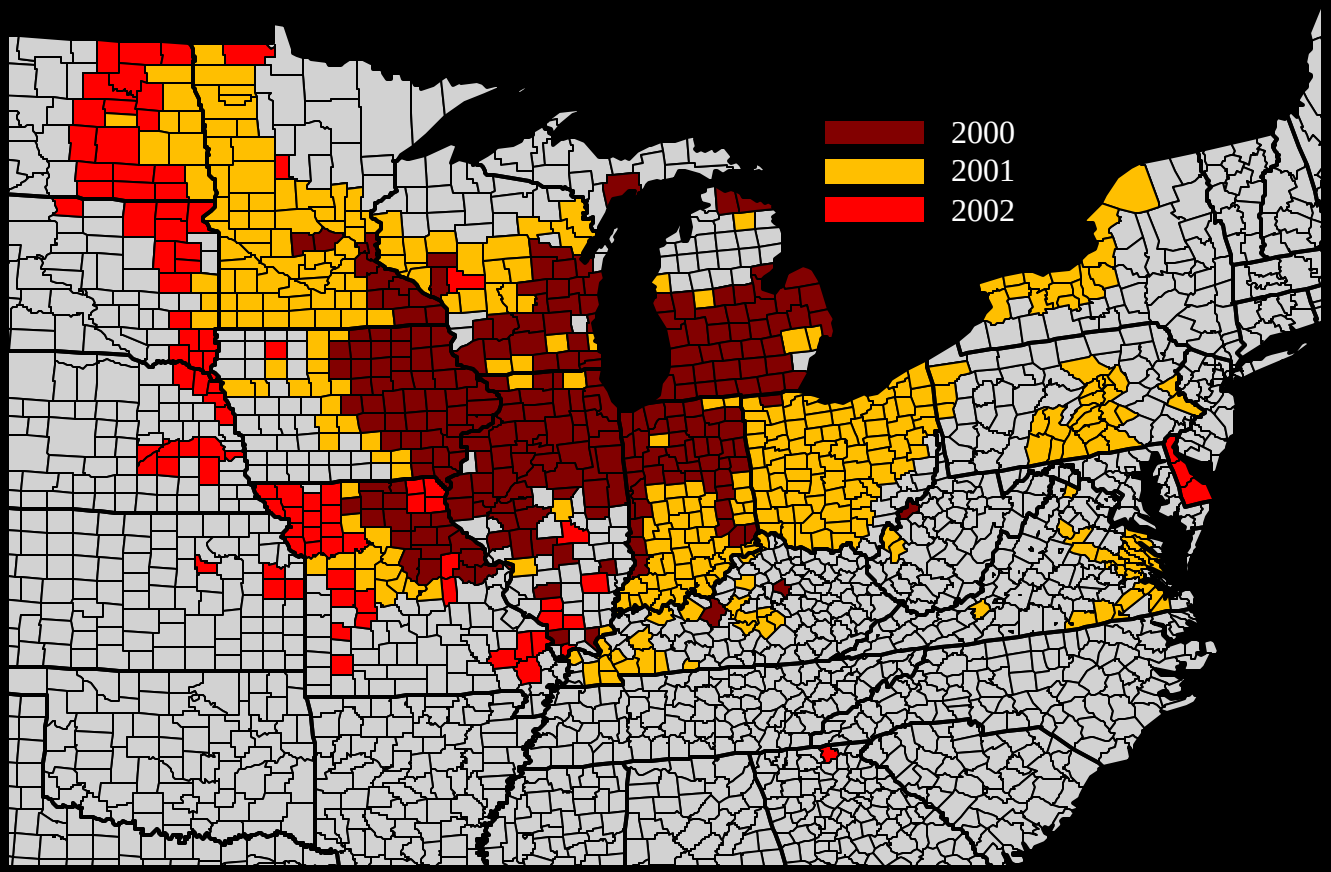
Whiteflies

Beetles

Aphids

Leafhoppers / Planthoppers

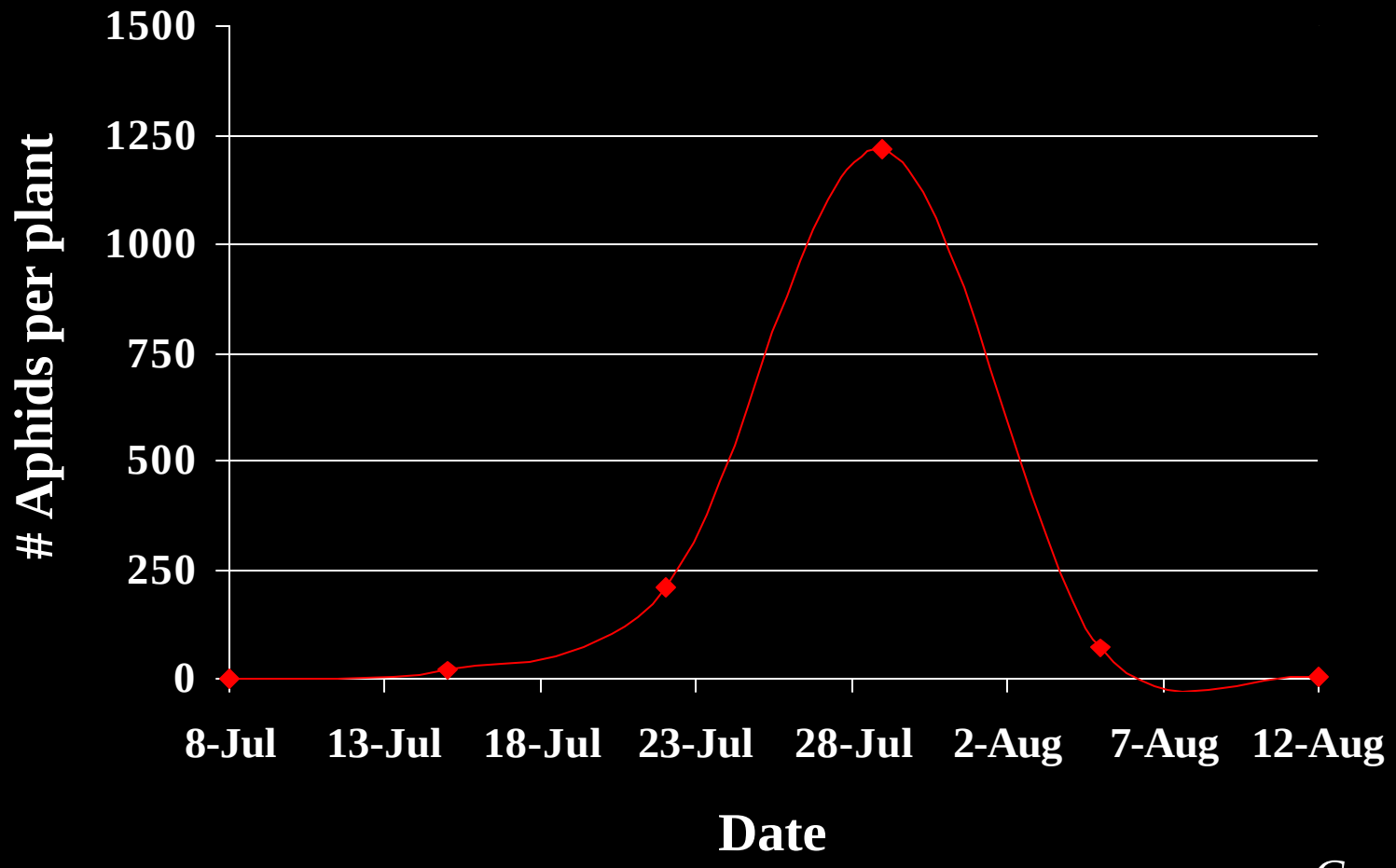
Detection of the soybean aphid



Map by R. Venette

Population Growth of Soybean Aphid

Arlington Research Station



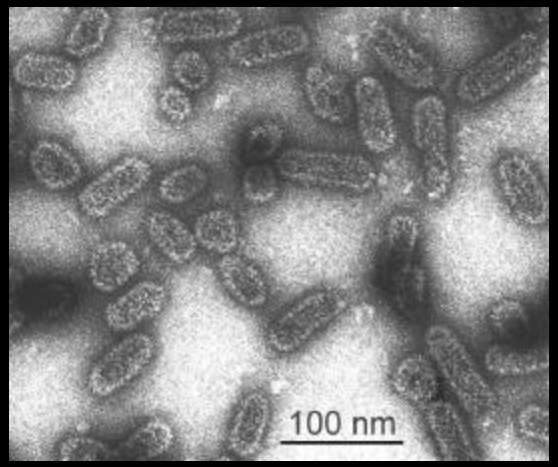
Capozzi

Rate of Increase = 126.25 Aphids/Day from July 22th to July 29th

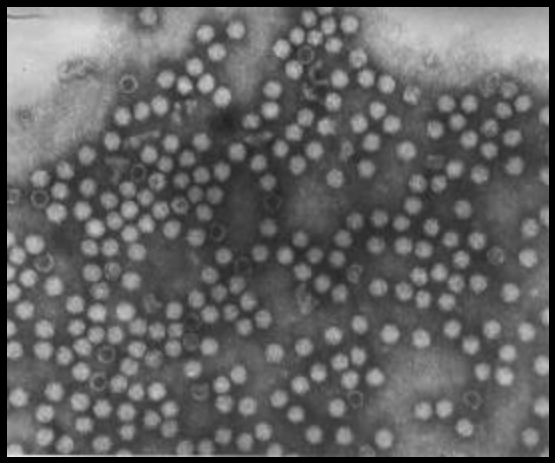
The Problem

Lee 2002

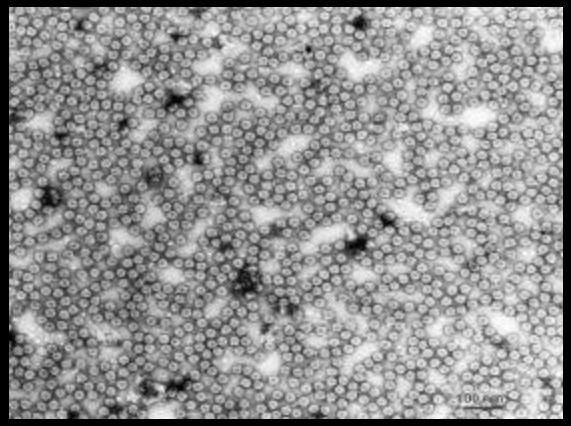
The Players



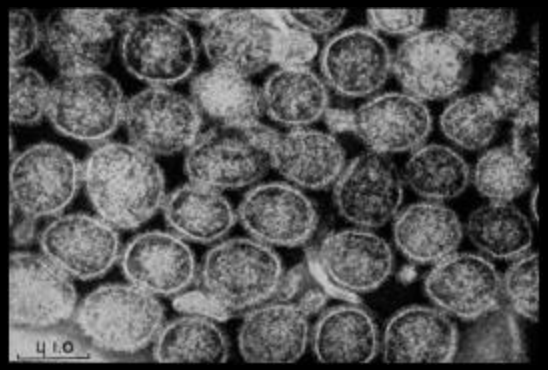
Alfalfa Mosaic Virus (AMV)



Bean Pod Mottle Virus (BPMV)

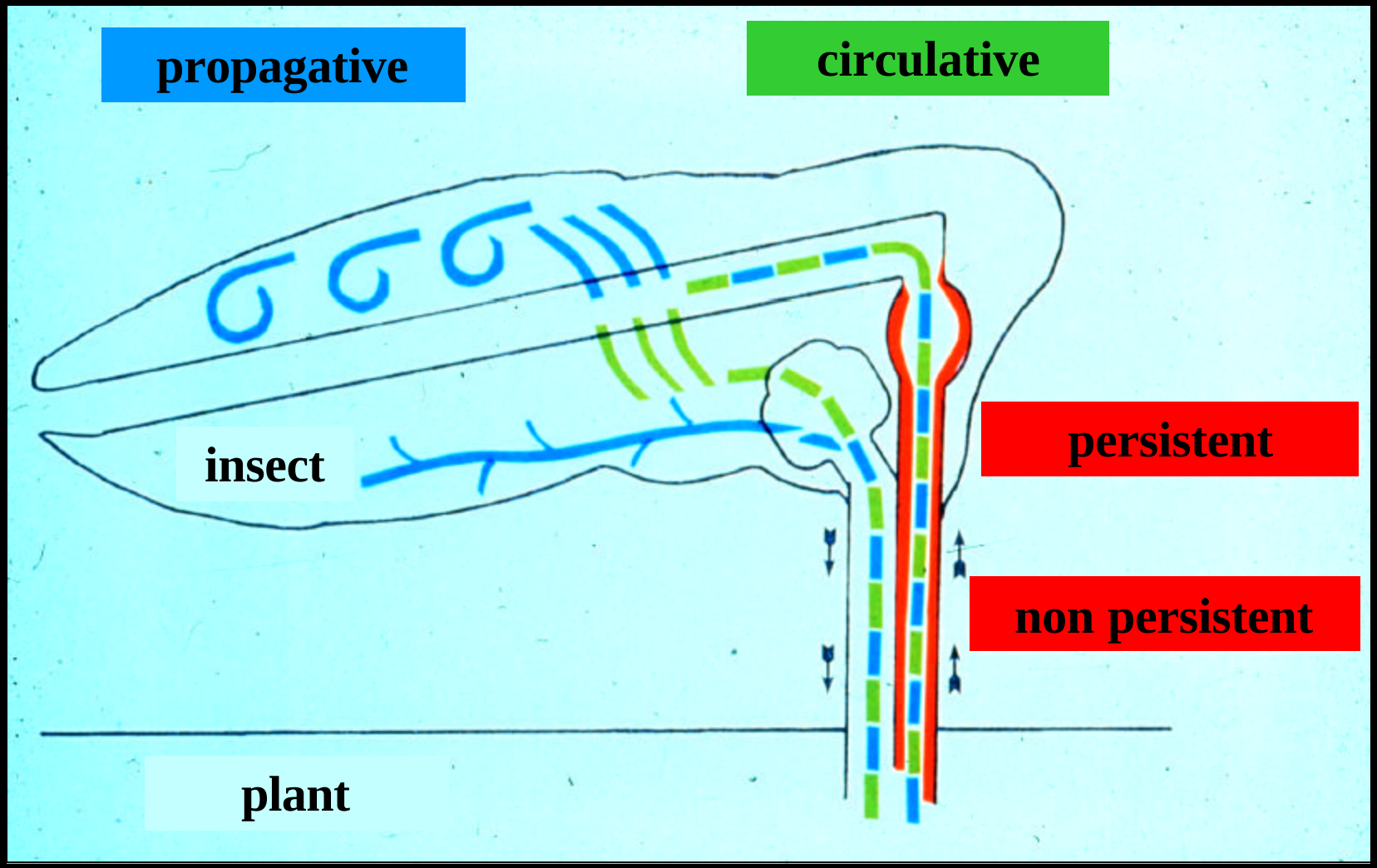


Cucumber Mosaic Virus (CMV)

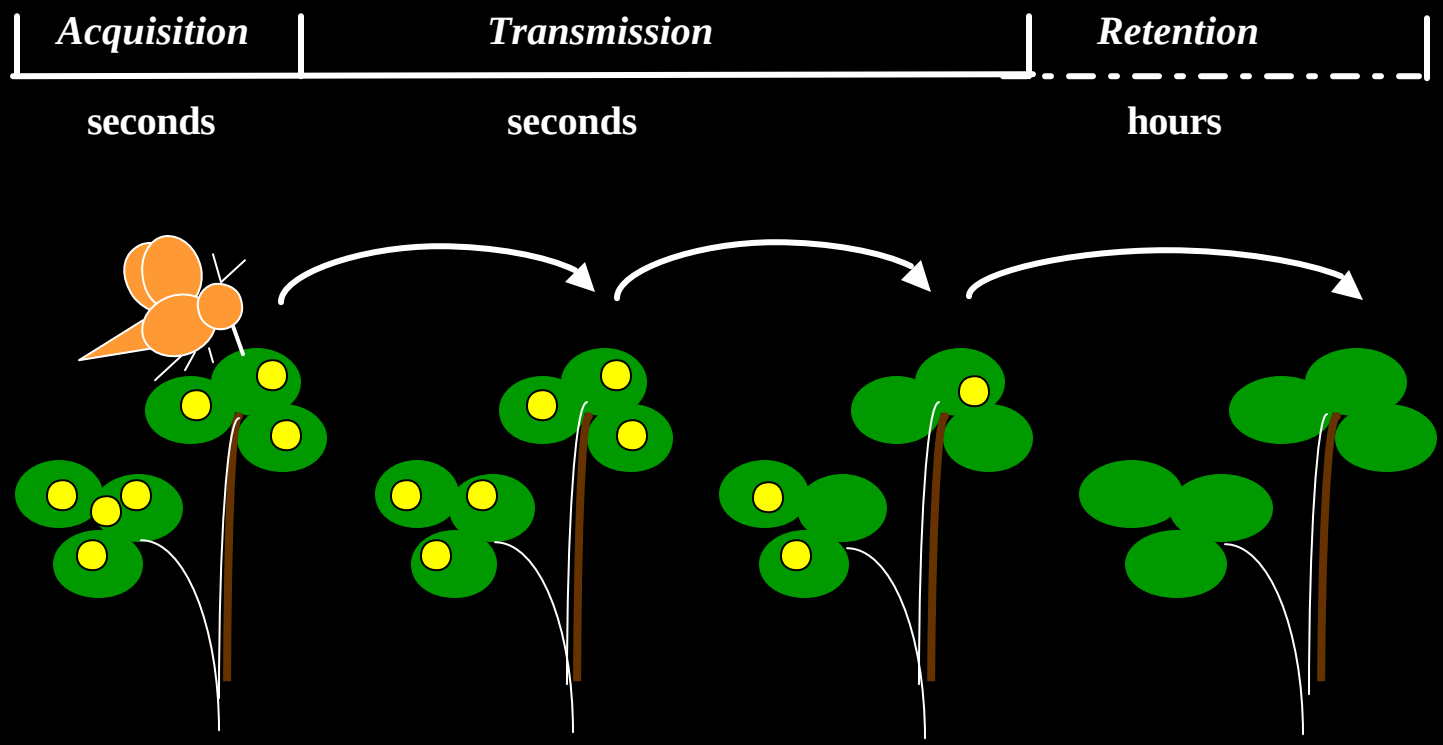


Tomato Spotted Wilt Virus (TSWV)

Transmission pathways

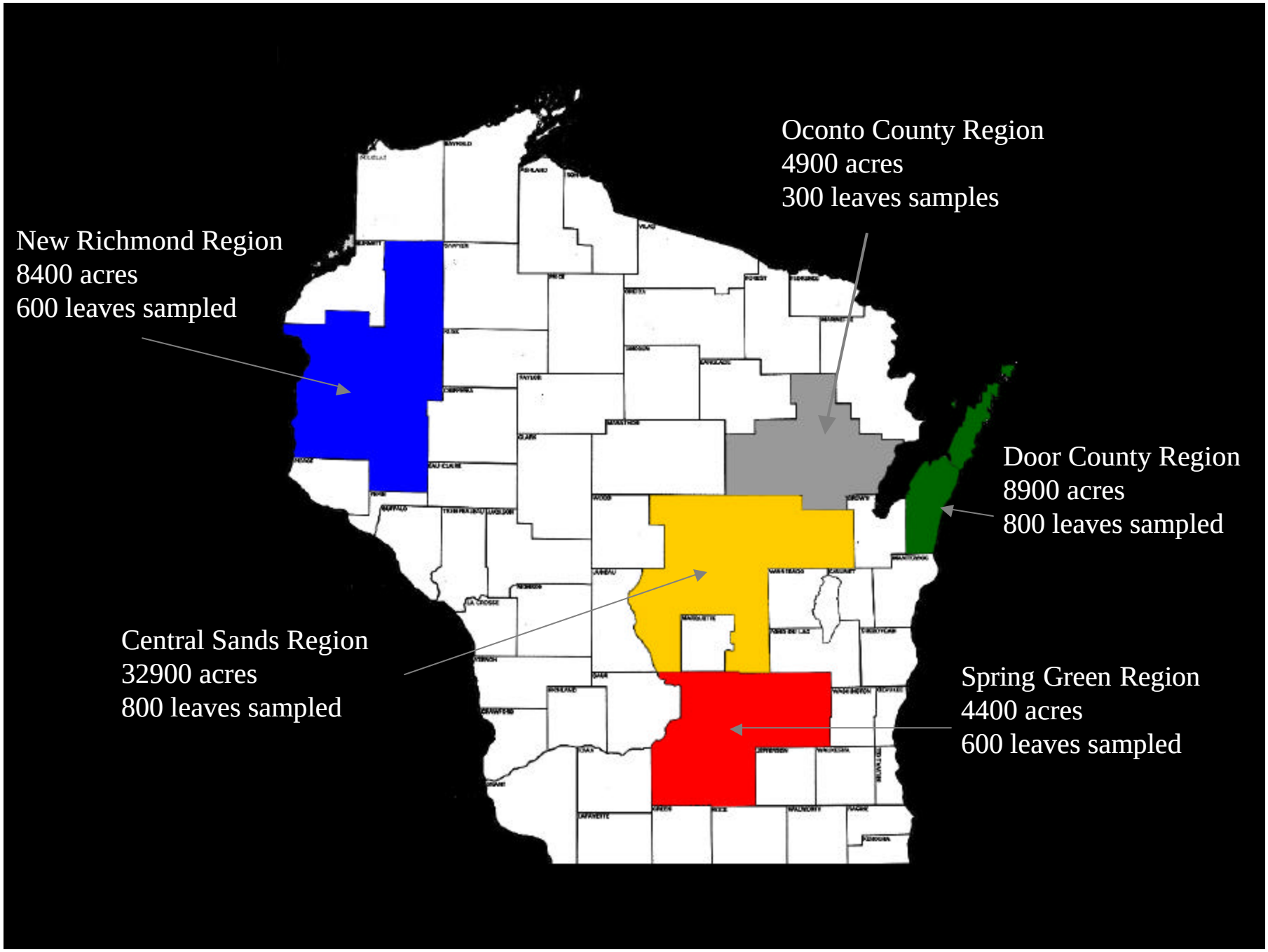


Non-persistent transmission



Snap Bean Survey Data

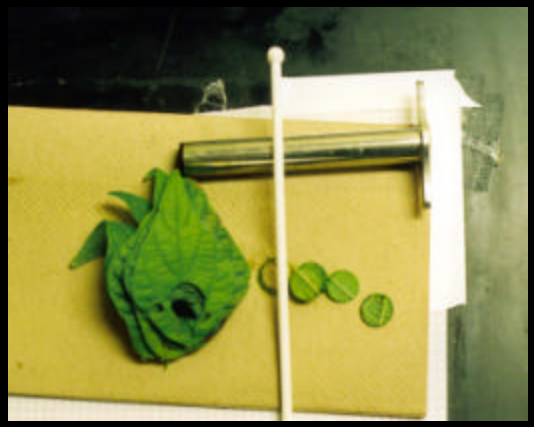
- 42,386 total leaves tested
- 4,172 composites of 10 leaves
- 4,949 single leaves tested
- **15,105 total wells used**


Oconto County Region
4900 acres
300 leaves samples
New Richmond Region
8400 acres
600 leaves sampled
Door County Region
8900 acres
800 leaves sampled
Central Sands Region
32900 acres
800 leaves sampled
Spring Green Region
4400 acres
600 leaves sampled

The Process

Picking leaf samples

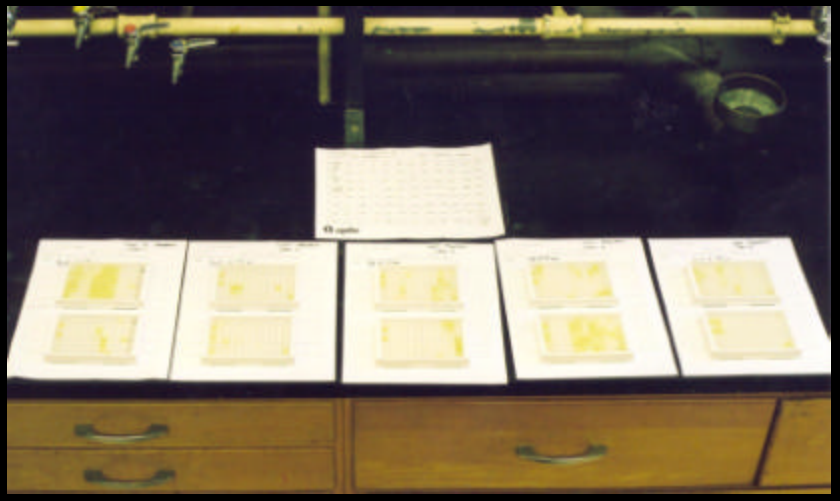
Stacking samples



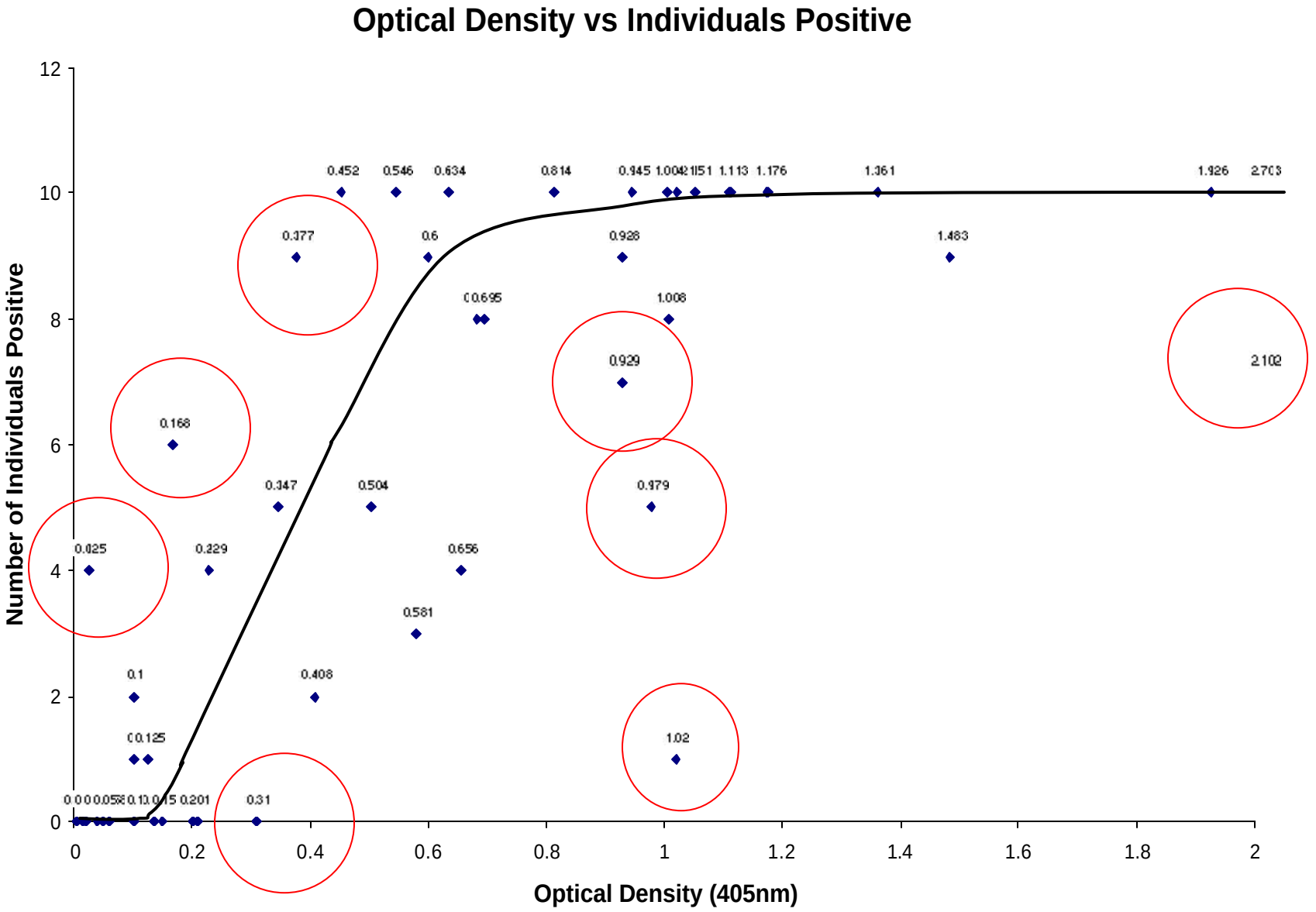
Cork-boring samples

The Process

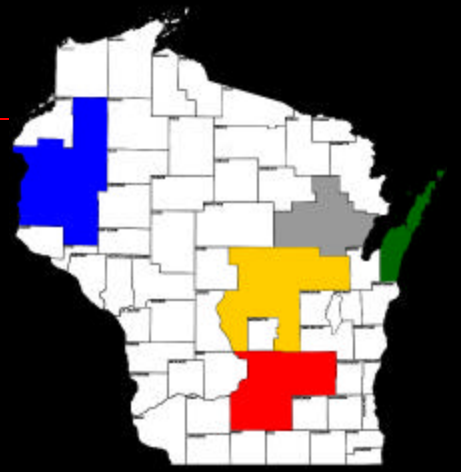
Grinding samples



Plating samples


Optical Density vs Individuals Positive
Number of Individuals Positive
Optical Density (405nm)
0
2
4
6
8
10
12
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0.452
0.546
0.634
0.814
0.945
1.004
1.151
1.113
1.176
1.361
1.926
2.703
0.377
0.6
0.928
1.483
0.695
1.008
0.929
2.102
0.168
0.347
0.504
0.979
0.025
0.229
0.656
0.581
0.1
0.408
0.125
1.02
0.31
0.201

Wisconsin Snap Bean Survey



Percent Infection

60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%

Location	AMV	CMV
Central Sands	35.3%	1.9%
New Richmond	14.7%	6.7%
Spring Green	50.4%	9.2%
Door County	33.2%	7.5%
Oconto County	0.0%	11%

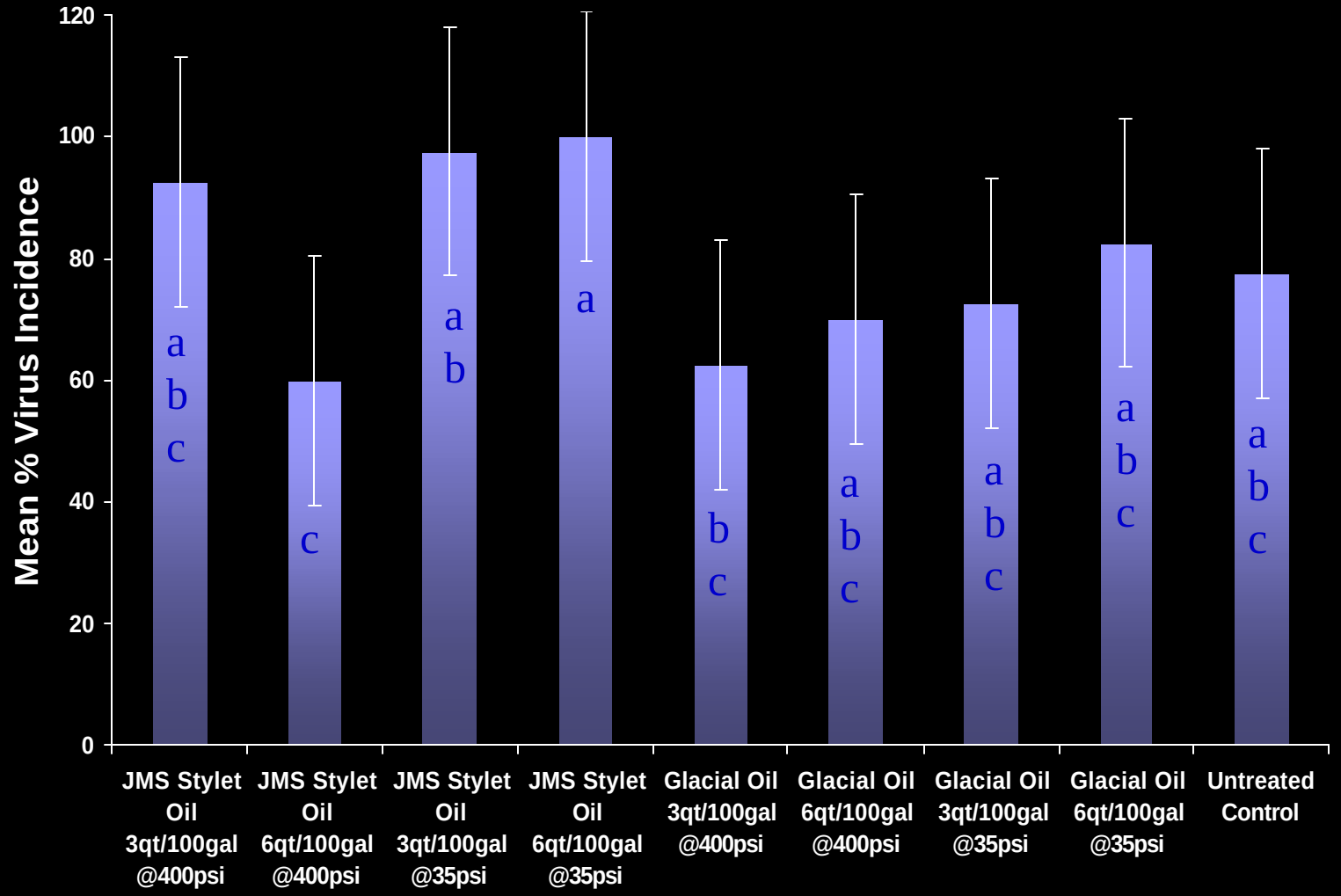
AMV
CMV

Location

IPM Applications

- Pesticide Application

Stylet Oils



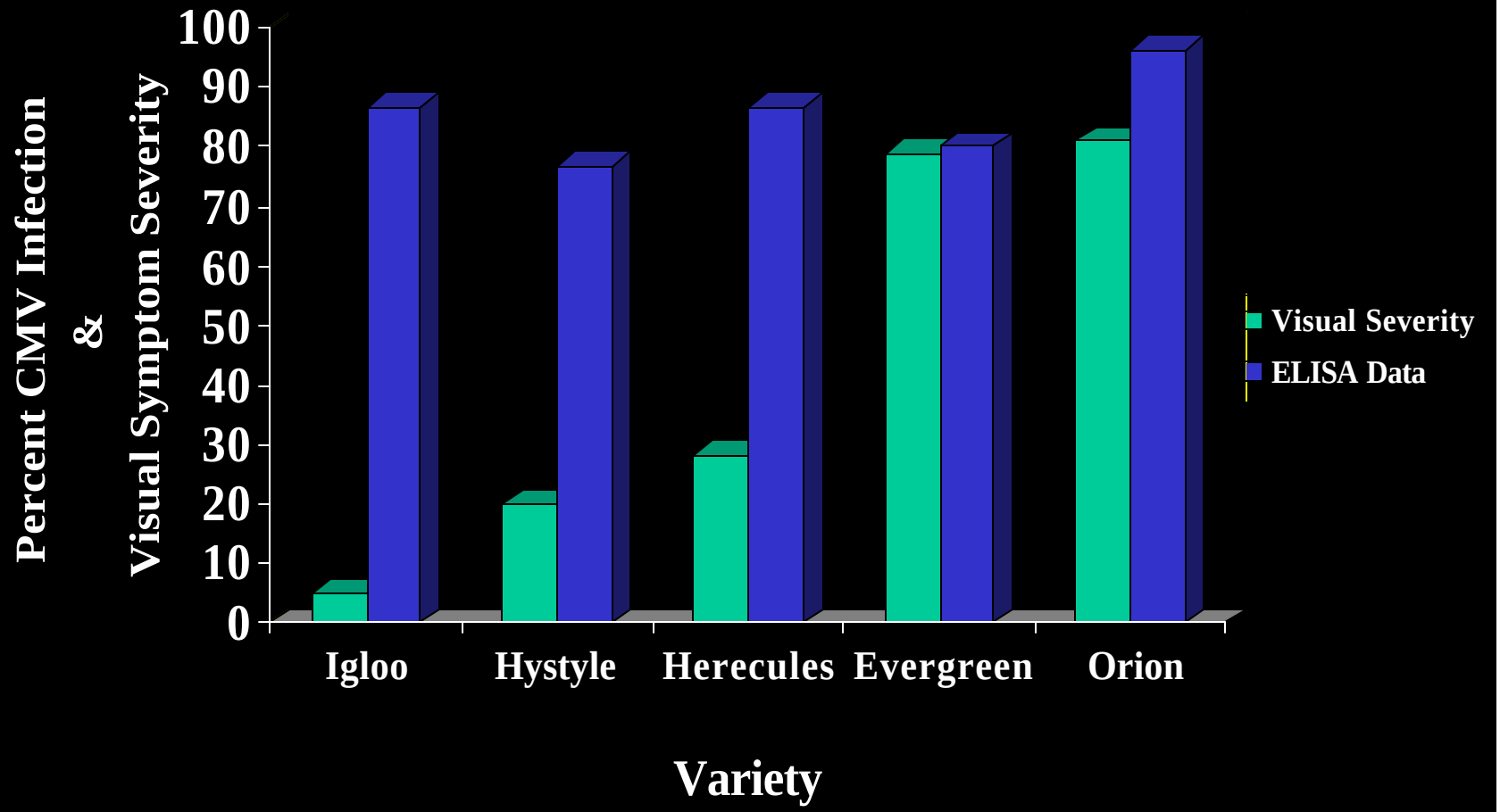
P = 0.05

Wyman, Capozzi

IPM Applications

- Pesticide Application
- Cultivar Resistance

Visual Symptom Analysis vs. ELISA Data



Grau, Stevenson

IPM Applications

- Pesticide Application
- Cultivar Resistance
- Alternative Cultivar Resistance

Alternative Source of Resistance

- Most of the lines were 100 percent infected with virus
- Some escapes were found
  - 22 PI lines
  - 2 cultivars
  - 7 crosses
- Seven PI lines showed some escapes in both replications
- One PI line showed 100% escape in both replications

Michell Sass, Felix Navarro, James Nienhuis

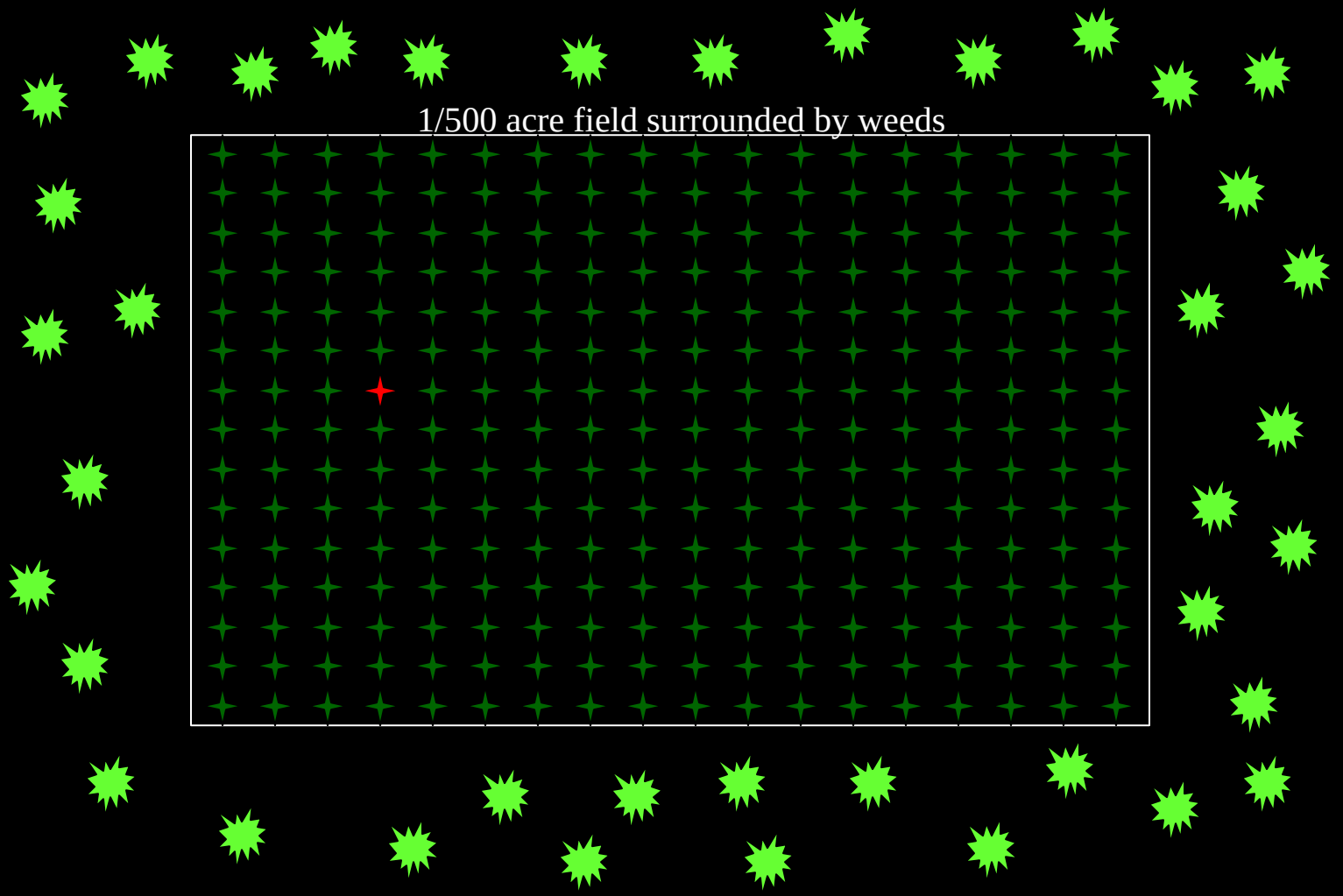
IPM Applications

- Pesticide Application
- Cultivar Resistance
- Alternative Cultivar Resistance
- Seed Transmission

Seed Testing

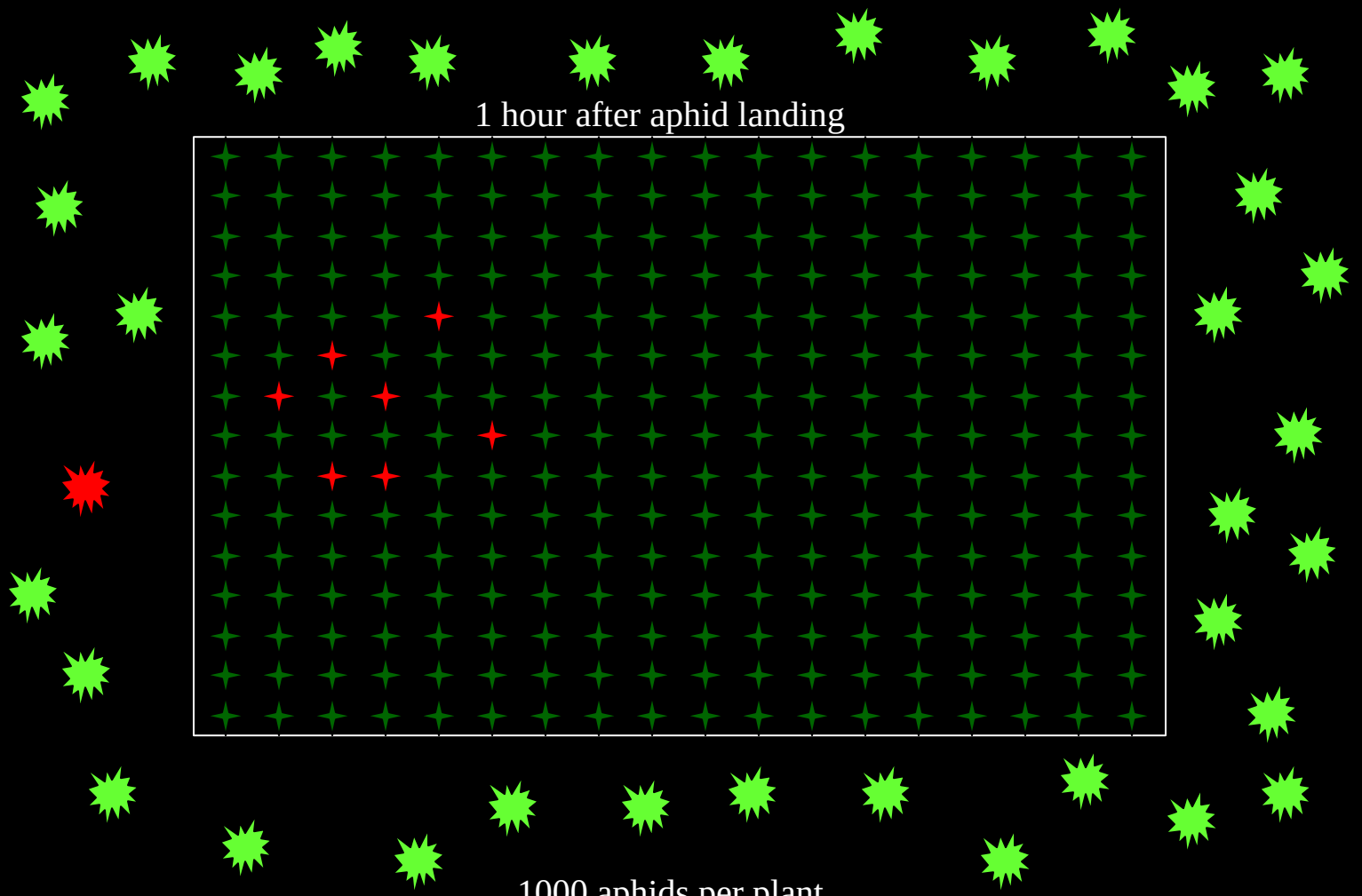
- In progress

Aphids role of spreading a non-persistent virus

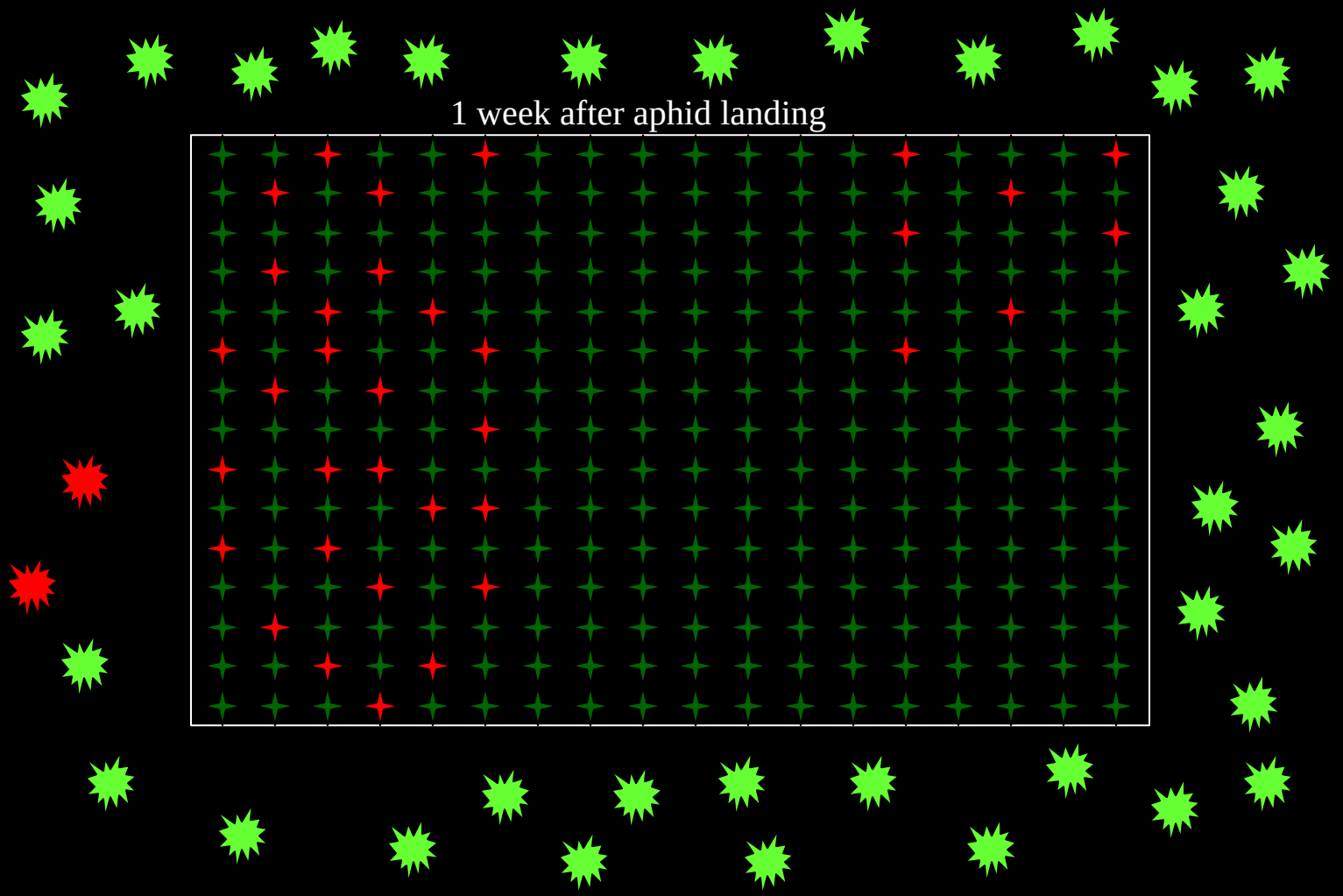


~ 0.3% seed borne virus infection

Aphids role of spreading a non-persistent virus

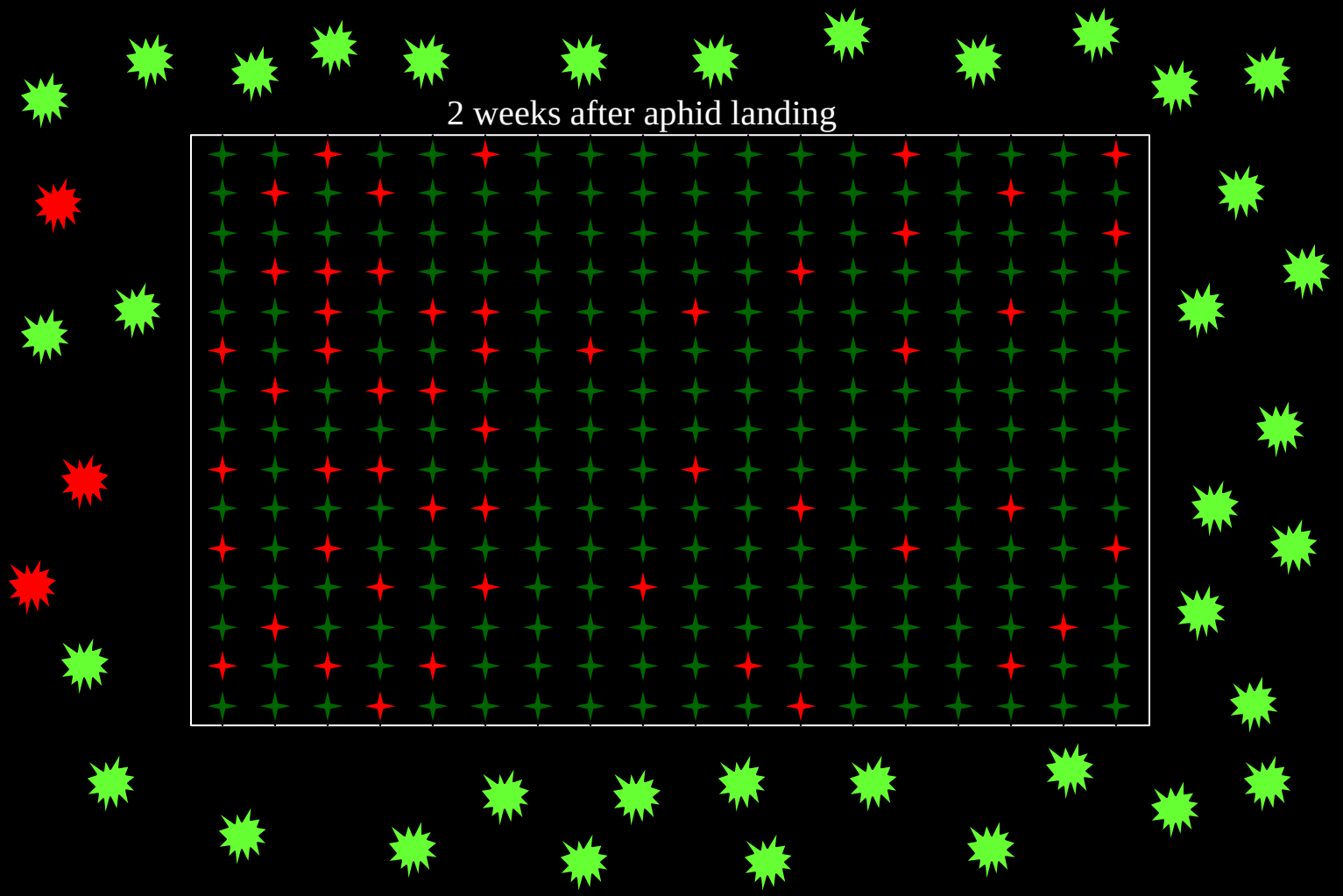


Aphids role of spreading a non-persistent virus



Each winged aphid visits 5 different plants

Aphids role of spreading a non-persistent virus



Each winged aphid visits 1 different plants

Future Directions

- Determine the effects of virus on the yield and quality of beans
- Identify useful resistance to virus
- Identify inoculum sources

The Source of Virus Inoculum

- Do weeds that surround fields contain virus?
- Do aphids arrive with or without virus?
- Do seed borne viruses spread at a high rate?

Sow thistle infected with AMV

Future Directions

- Determine the effects of virus on the yield and quality of beans
- Identify useful resistance to virus
- Identify inoculum sources
- Characterize other viruses affecting snap beans

Additional Virus Players



- What other viruses are present?
  - Bean common mosaic
  - Tomato spotted wilt virus

Future Directions

- Determine the effects of virus on the yield and quality of beans
- Identify useful resistance to virus
- Identify inoculum sources
- Characterize other viruses affecting snap beans
- Develop IPM procedures
  - Planting date
  - Variety resistance
  - Weed management
  - Pesticide application

Acknowledgements

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Thank you.

Questions?

Wayne B. Hunter and Diane E. Ullman