University of Idaho Extension

IPM WEBINAR SERIES PART 3:

CULTURAL AND PHYSICAL PEST CONTROL

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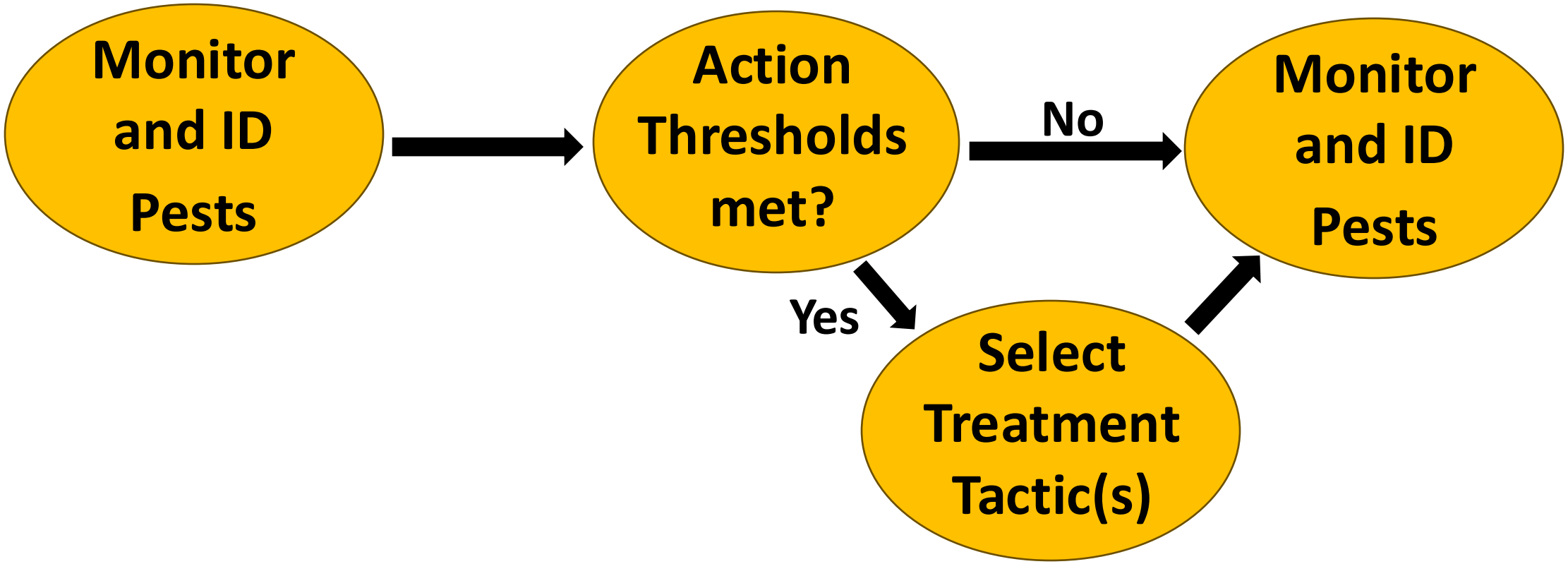
UI INTEGRATED PEST MANAGEMENT PROGRAM MANAGER

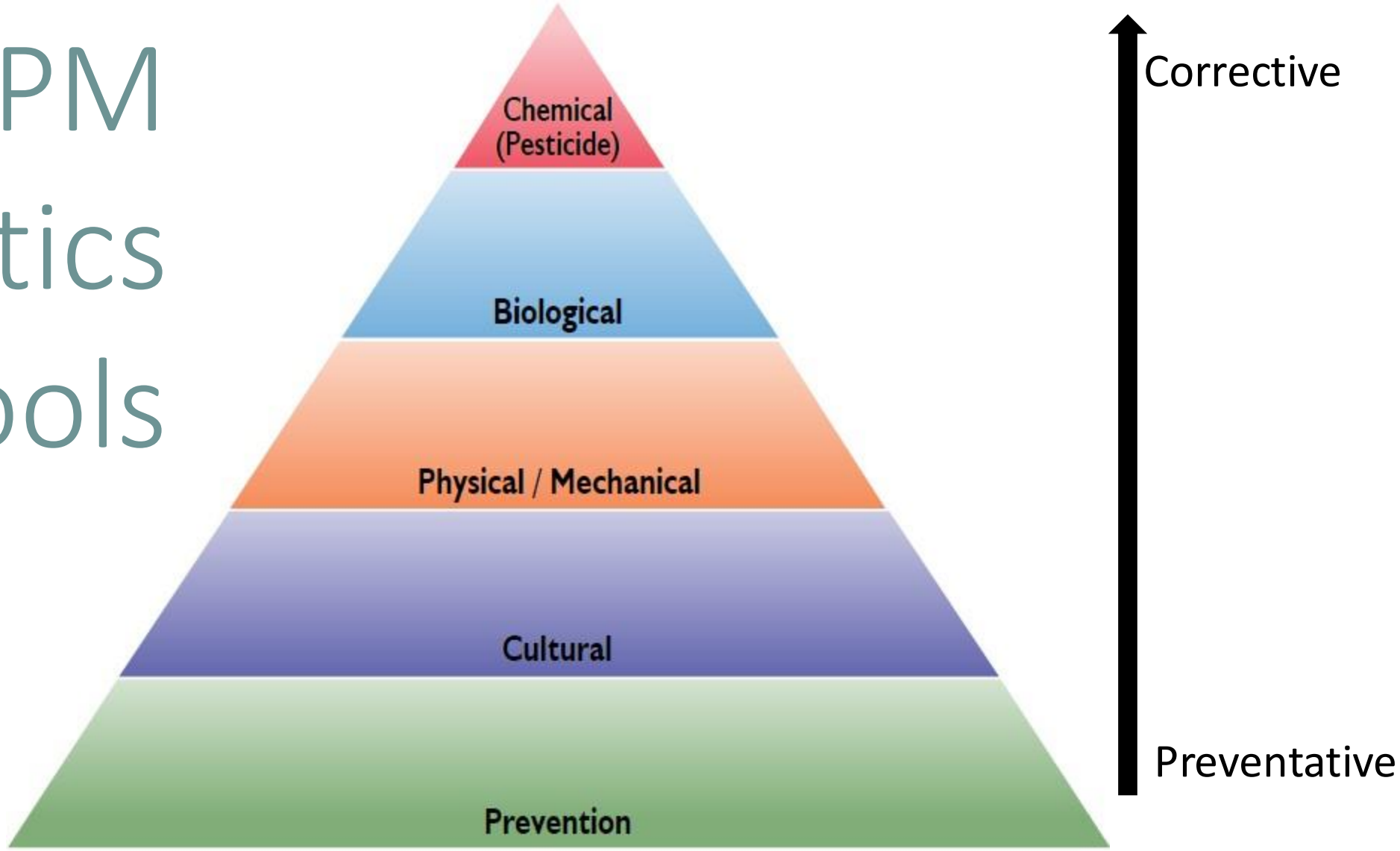
Topic Itinerary…

- What is cultural control? Physical control?
- Cultural and physical control tactics
- Highlights for different pest types
- Case studies

Integrated Pest Management (IPM)



IPM Tactics and Tools



QUESTION

IPM aims to...

A. Completely eliminate all pests
B. Keep pest populations below key economic or damage thresholds
C. Use knowledge of pest biology and crop-interactions to inform management decisions
D. B and C only

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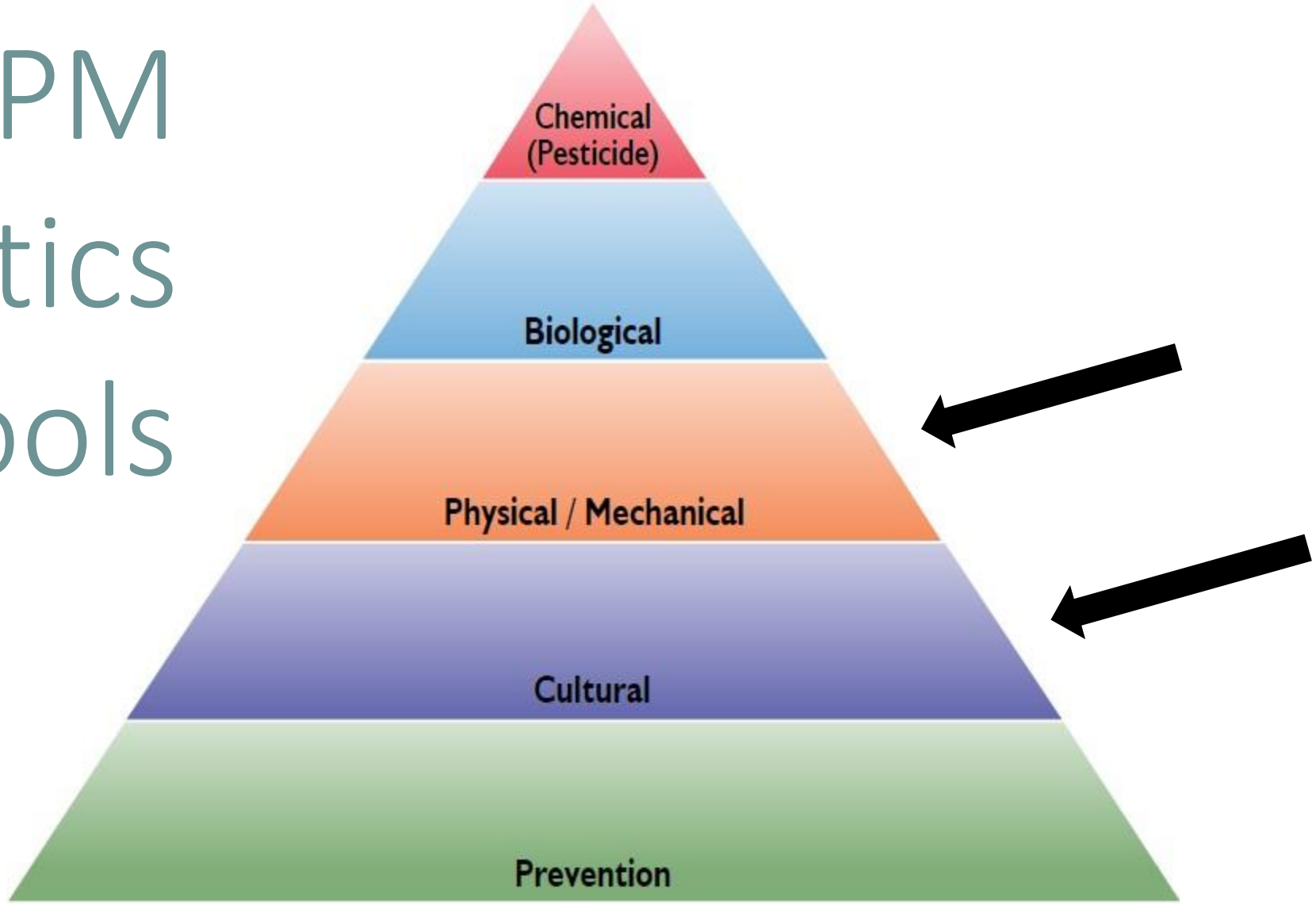

Cultural Control

- "Cultural control" is the deliberate alteration of the production system, either the cropping system itself or specific crop production practices, to reduce pest populations or avoid pest injury to crops (Ashdown, 1977). Methods include:
  - Tillage
  - Crop rotation
  - Water and fertility management
  - Etc.

Physical or Mechanical Control

- Physical pest control refers to the use of physical methods to prevent, repel, or eliminate pests. These methods include:
  - Barriers
  - Traps
  - Mechanical methods
  - Environmental modifications
  - Deterrents to colonization/location
  - Etc.

History of Cultural and Physical Control

- **Greece (c. 950 BC):**
    1. used fire to drive locusts into the sea
    2. drained marshes to combat malaria.
- **China (c. 300 BC)**
    1. timing the planting of a crop to avoid pest attacks

Quiz! Which type of control are these?

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Physical Control

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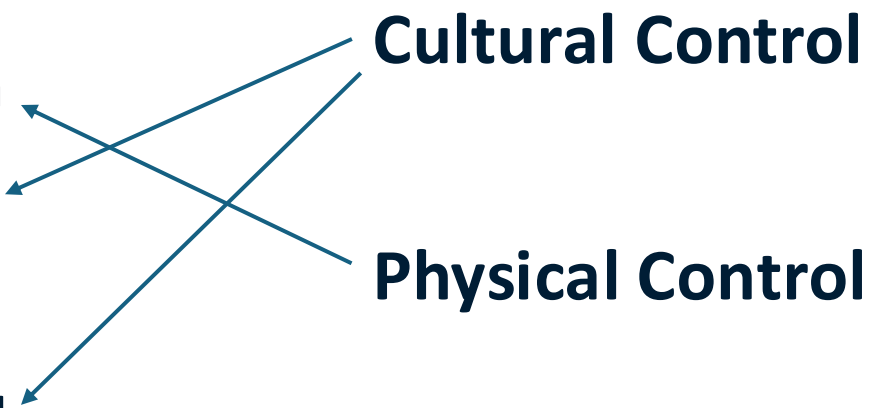


Tactic 1. Break the Pest Lifecycle

1.1) Remove habitat

- Remove habitat in season and/or for overwintering
  - Mowing
  - Plowing
  - Hoeing
  - Prunning
  - Removing crop debris

1.2) Remove Alternative Hosts

Weeds can host…

- Pest insects
- Diseases
- Viruses and/or their vectors
- Nematodes

Crop rotation

- Do not plant crop with similar susceptibility year after outbreak

1.3) Host plant resistance/tolerance

Resistance:

the host's ability to limit pathogen multiplication

Tolerance:

the host's ability to reduce the effect of infection on its fitness regardless of the level of pathogen multiplication

Tactic 2. Avoid Pest Presence During Key Periods

2.1) Planting/harvest time

- Plant to get crop through vulnerable stage before pest arrival/outbreak
- Plant after pest has peaked
- Remove crop before pest damage can reach unacceptable levels

What if having both the pest and the habitat are inevitable…

Tactic 3. Reduce favorability of conditions for the pest

- Planting density
- Fertility
- Drainage
- Planting date
- Sanitation
- Change temperature (e.g., storage)

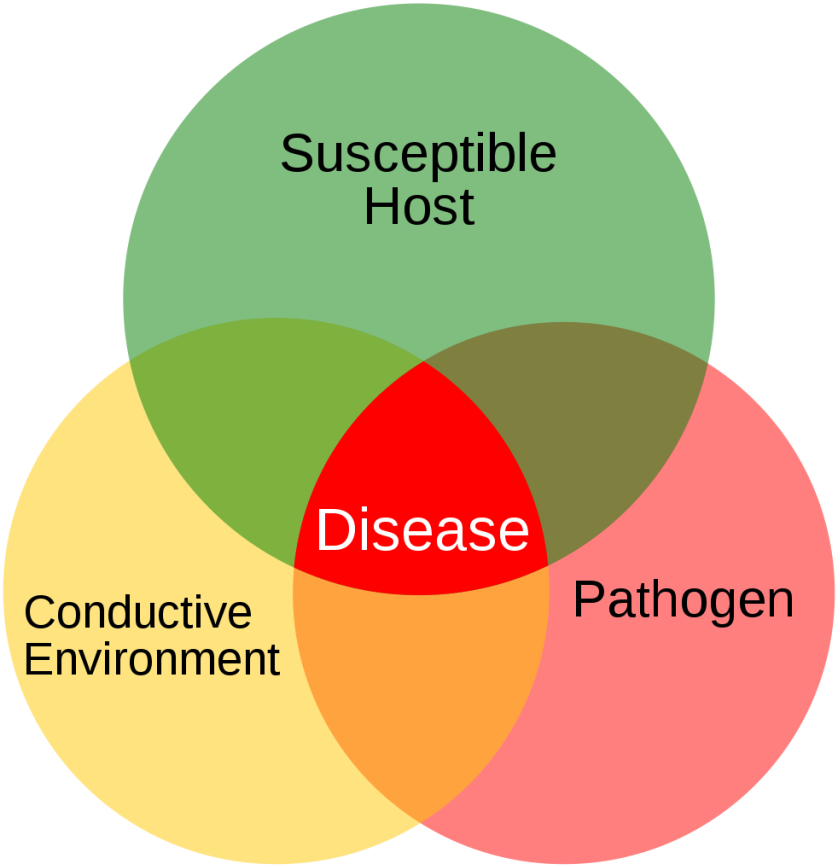
Tactic 4. Grow healthy, vigorous plants that can handle some pest damage

- Proper irrigation
- Adequate (not excessive) fertility
- Proper plant spacing
- Etc
- Etc
- Etc

Highlights for particular pest types

Cultural/Physical Control-Diseases

- Irrigation/moisture management
- Planting density
- Sanitation (remove inoculum)
- Weed management (reservoirs)
- Plant resistance host plants
- Crop rotation



Cultural/Physical Control-Weeds

- Mowing to avoid seed production
- Mulching
- Reduced tillage
- Get plants to grow large to shade out weeds
- Use clean seed and manure
- Clean equipment to avoid transport
- Crop rotation

Cultural/Physical Control-Vertebrates

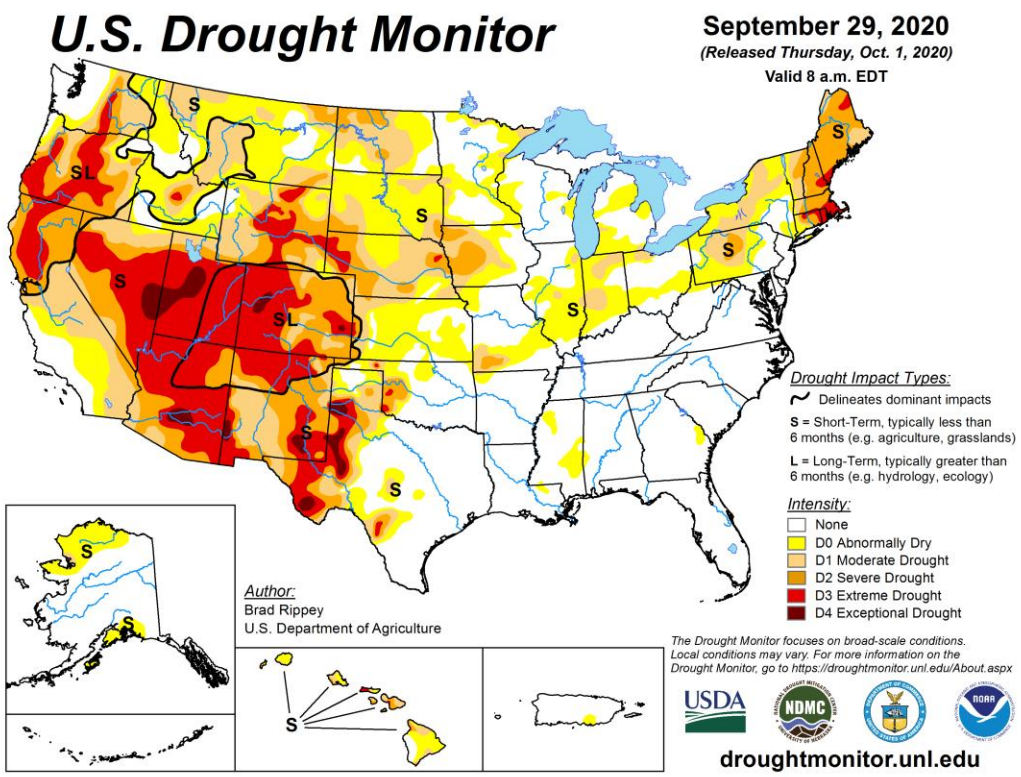
- Barriers (netting, fencing, etc.)
- Control weeds
- Plant unpalatable varieties
- Repellants (tactile, sound, visual)

Cultural/Physical Control-Insects

- Avoid excess nitrogen
- Trap cropping
- Deep fall tillage
- Crop rotation
- Row covers

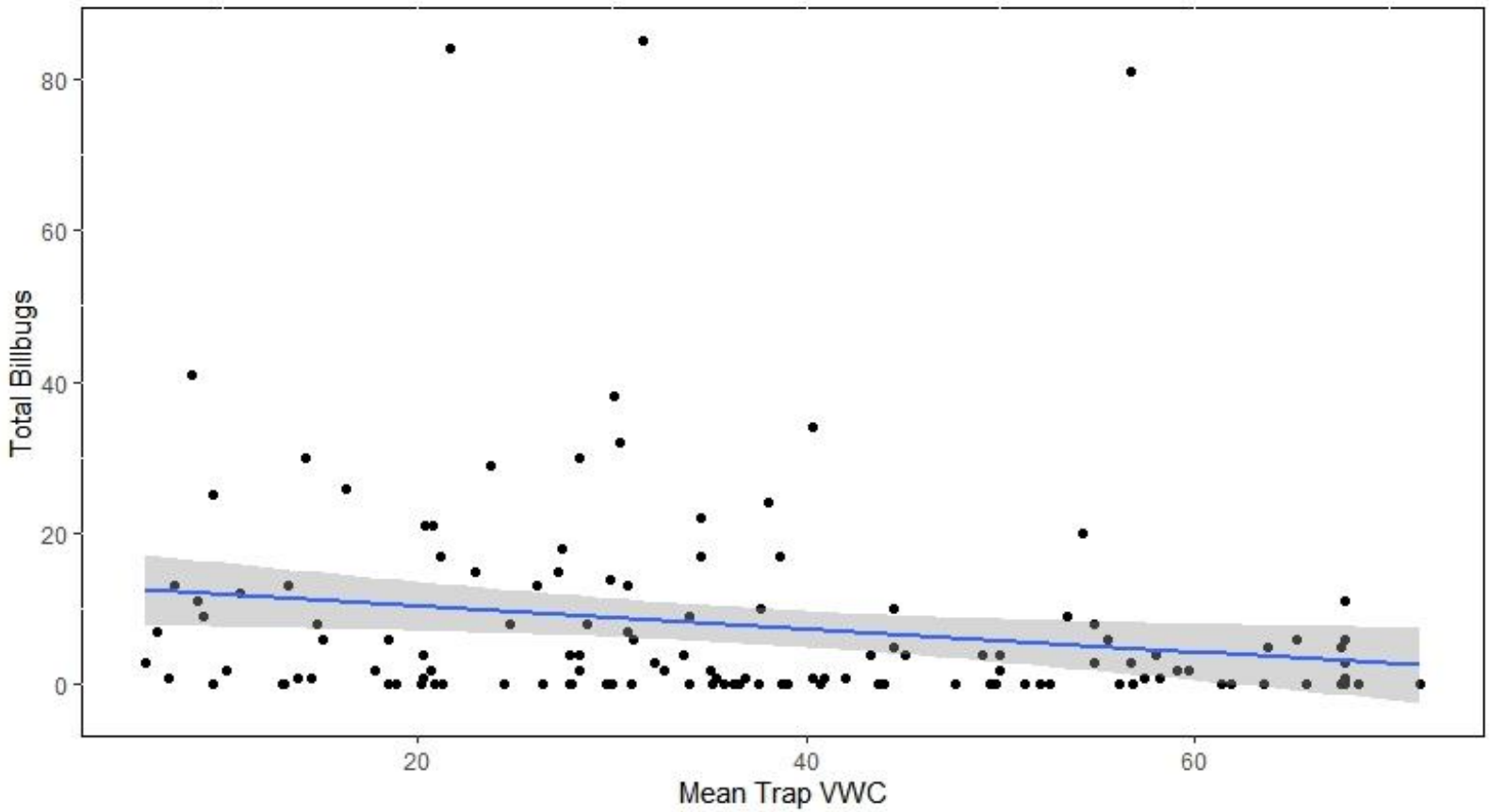
Case studies in cultural control

Billbugs and Drought Stress



Insects often outbreak under drought conditions

- Increased canopy temperatures
- Increased concentration of plant nutrition
- Decreased defenses (resources allocated to surviving drought)

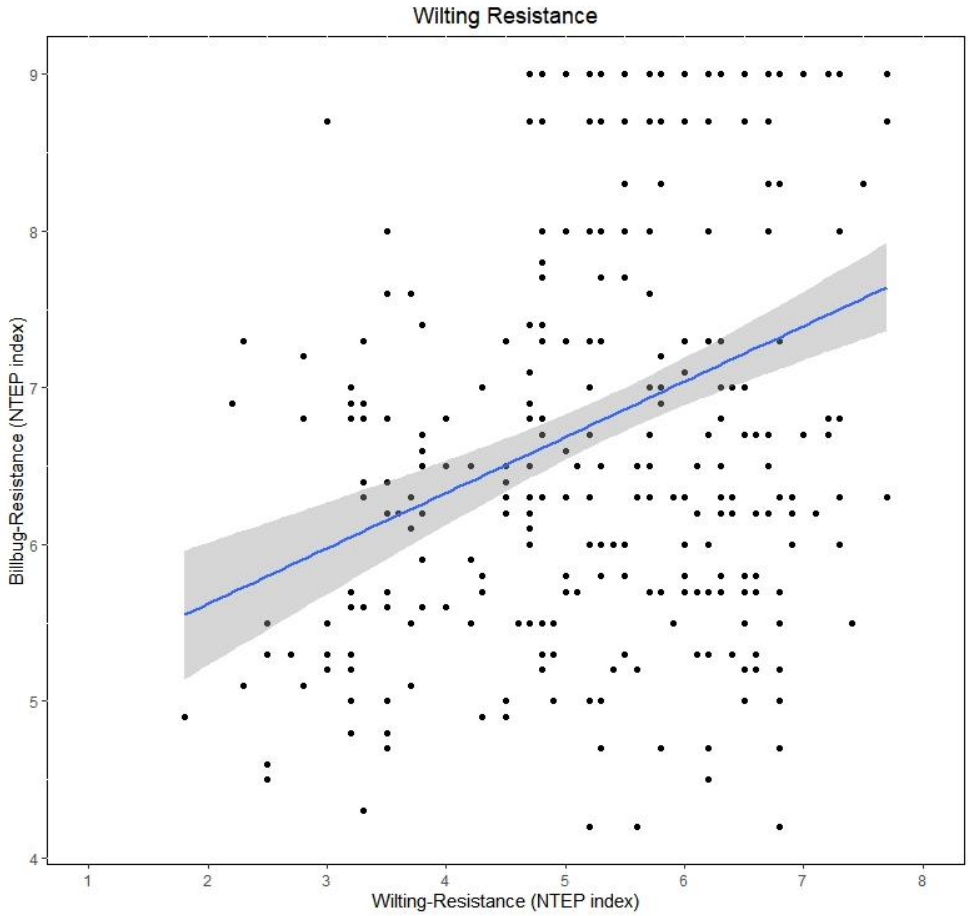


Soil moisture is a good predictor of adult billbug abundance

Cross Resistance Drought:Insects

- Tougher leaf tissue
- Thicker wax on leaves
- Accumulated defense chemicals

Billbug damage is generally worse in drought-susceptible cultivars



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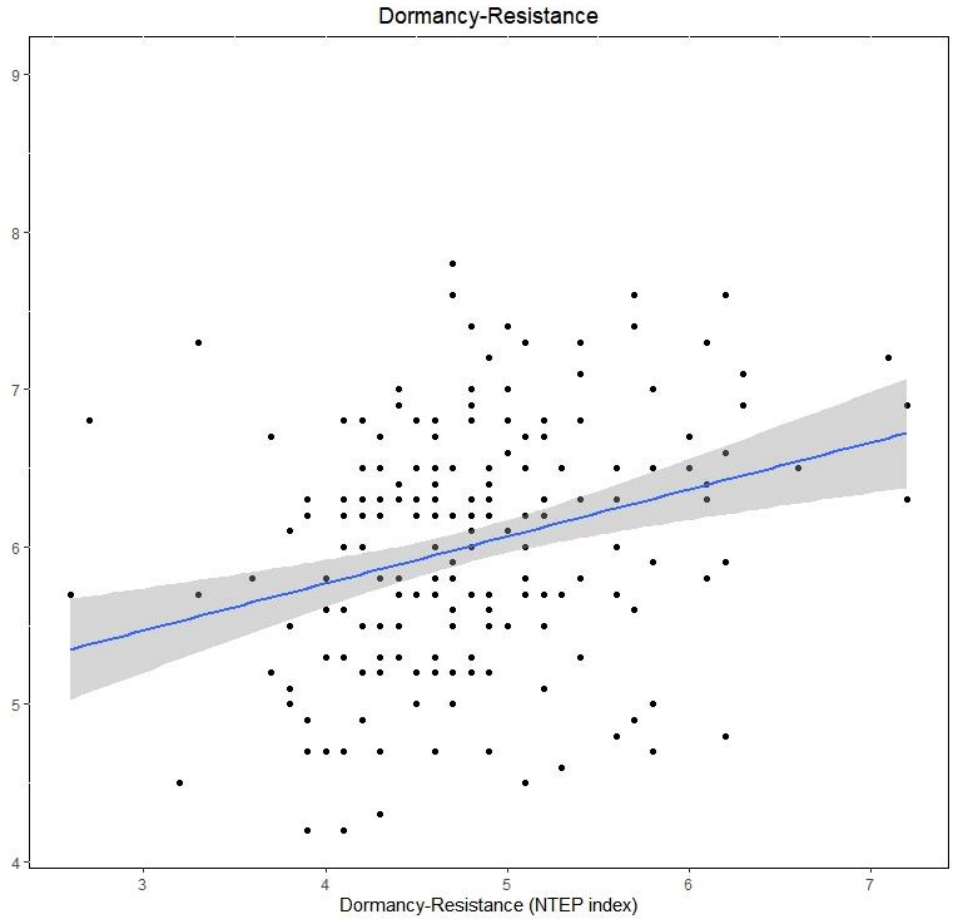

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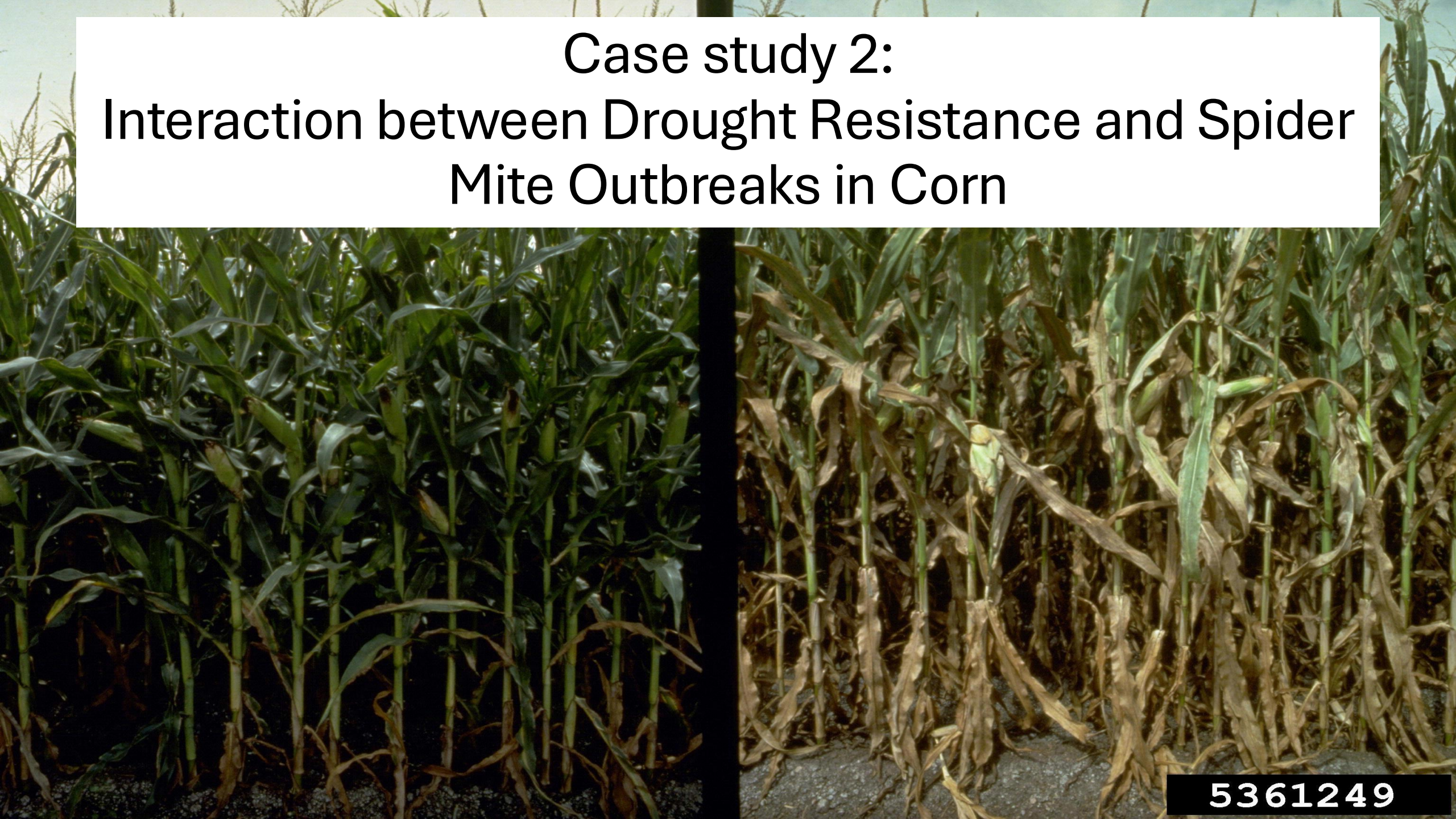
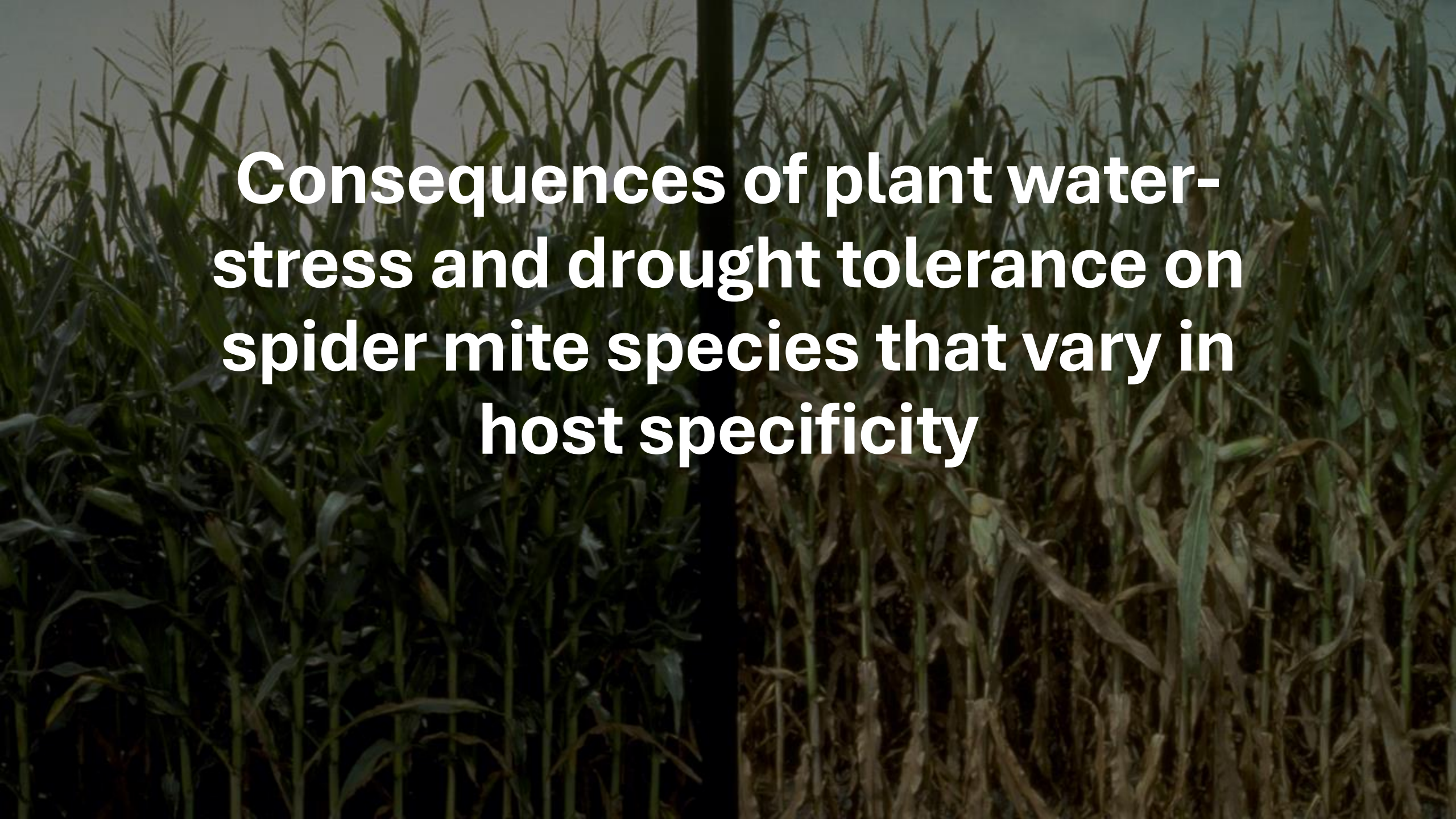
Case study 2:
Interaction between Drought Resistance and Spider Mite Outbreaks in Corn





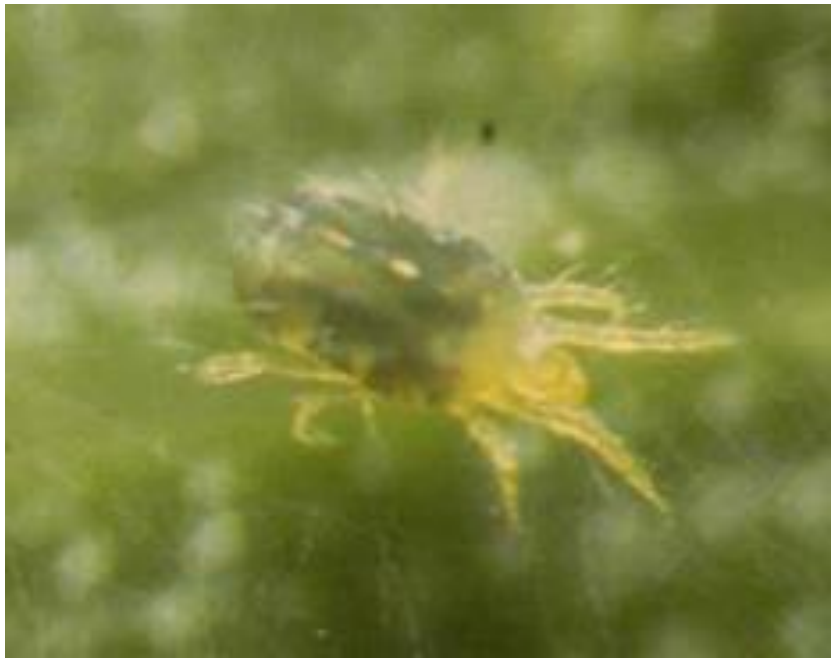
Consequences of plant water-stress and drought tolerance on spider mite species that vary in host specificity

Research Hypothesis

Increased drought tolerance + optimal irrigation

= Lower leaf temperatures

= Reduced Banks Grass Mite (BGM) abundance



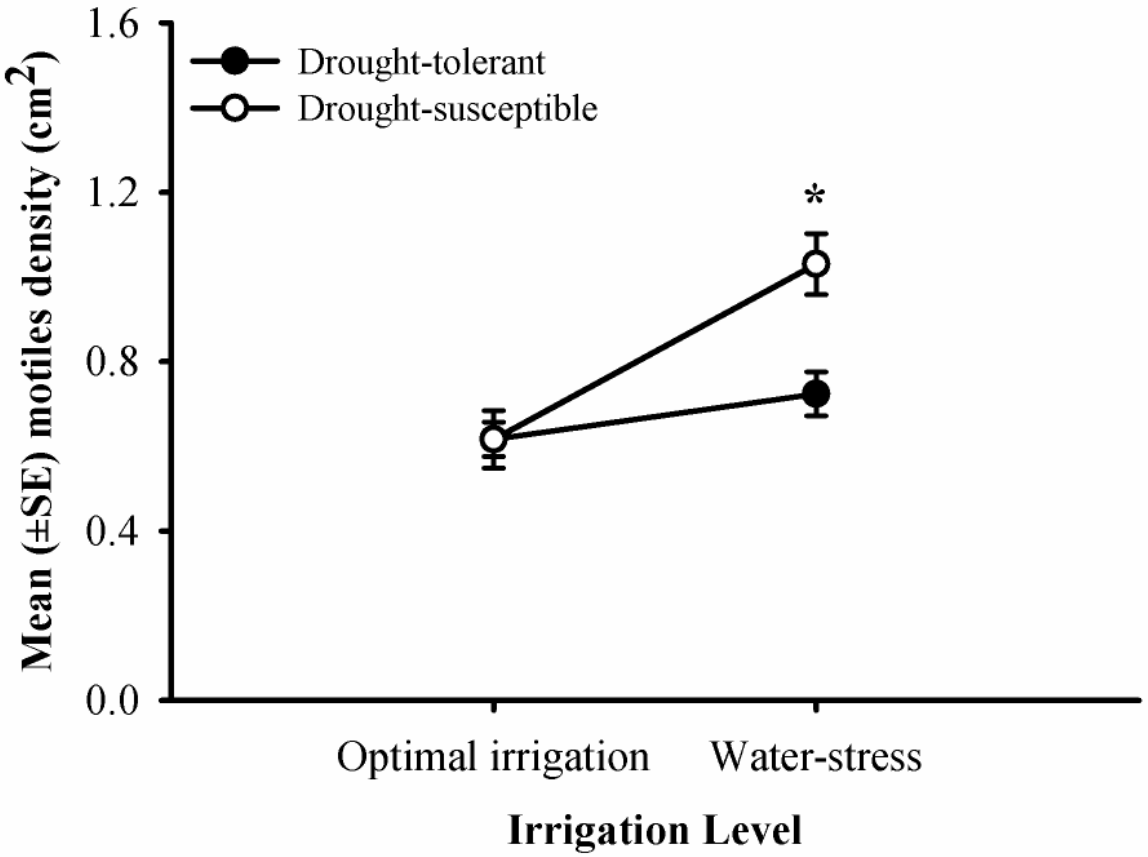
Treatments

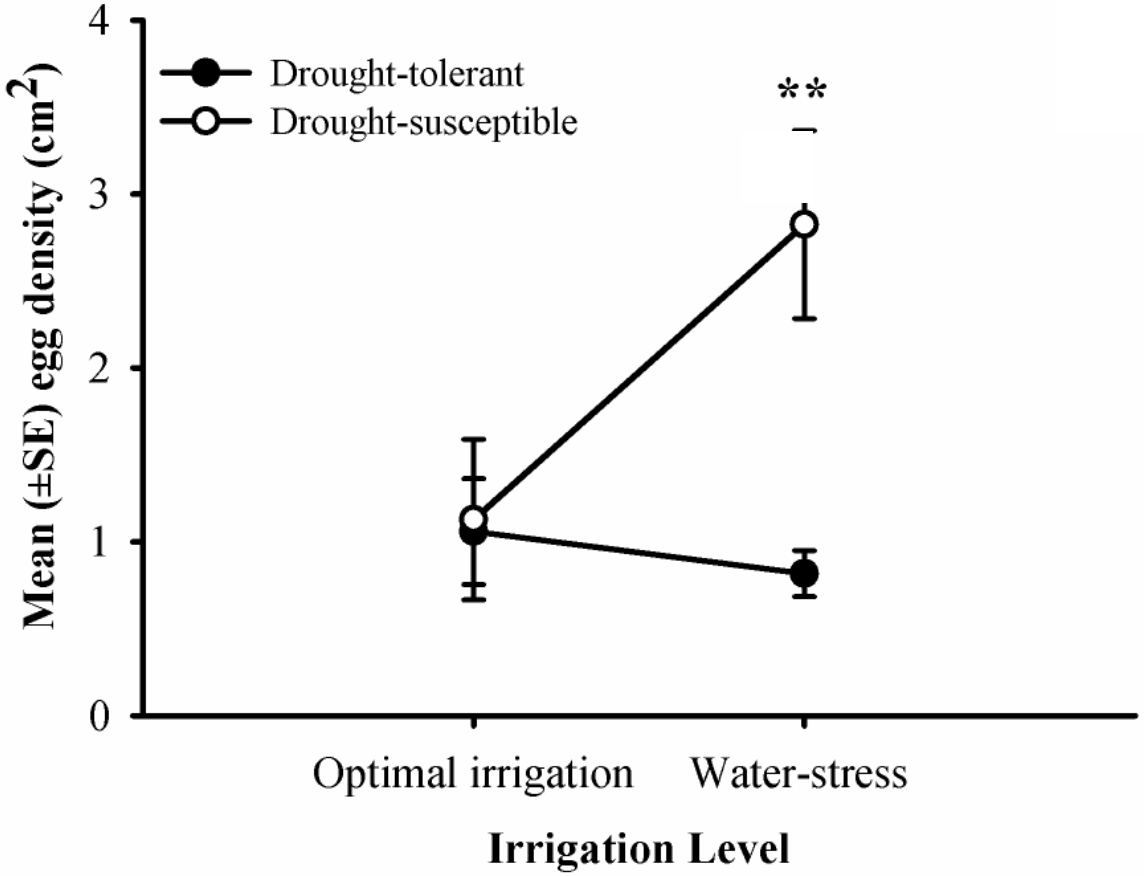
- Commercial crop companies: Monsanto, Pioneer, and Syngenta

- Corn drought tolerances: Drought-Tolerant and Susceptible

- Irrigation levels: Optimal and Water-Stressed

Results





Ruckert, Golec, Barnes, and Ramirez. 2022.

Take-Home Messages

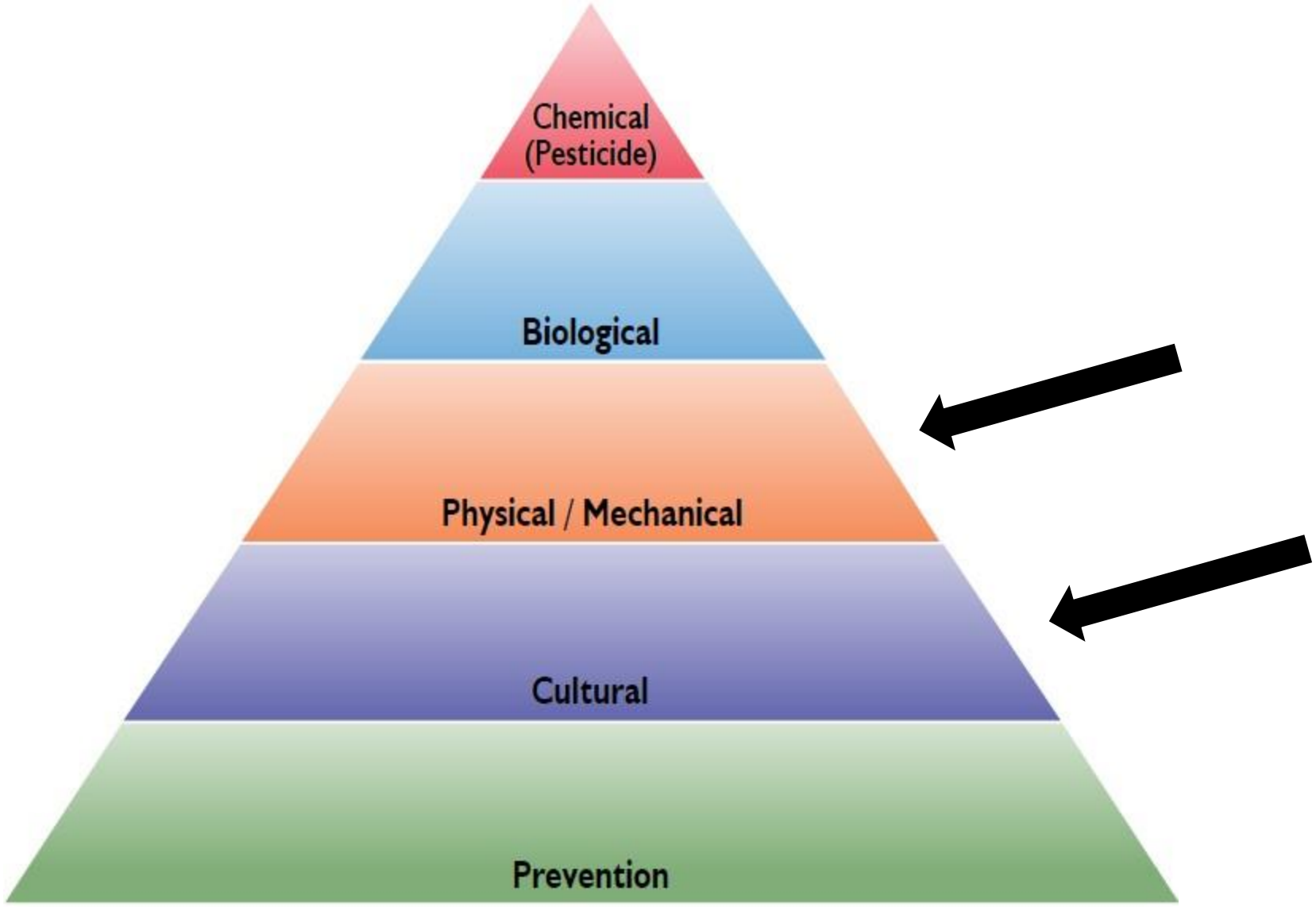
- Water-stressed drought-tolerant hybrids reduced outbreaks compared to drought-susceptible hybrids

- No difference in outbreaks between drought tolerant and drought susceptible plants under optimal irrigation

- Optimal irrigation reduced leaf temperature

≈ 2.5 °C

Cultural and Physical Control – Take Homes



Questions?