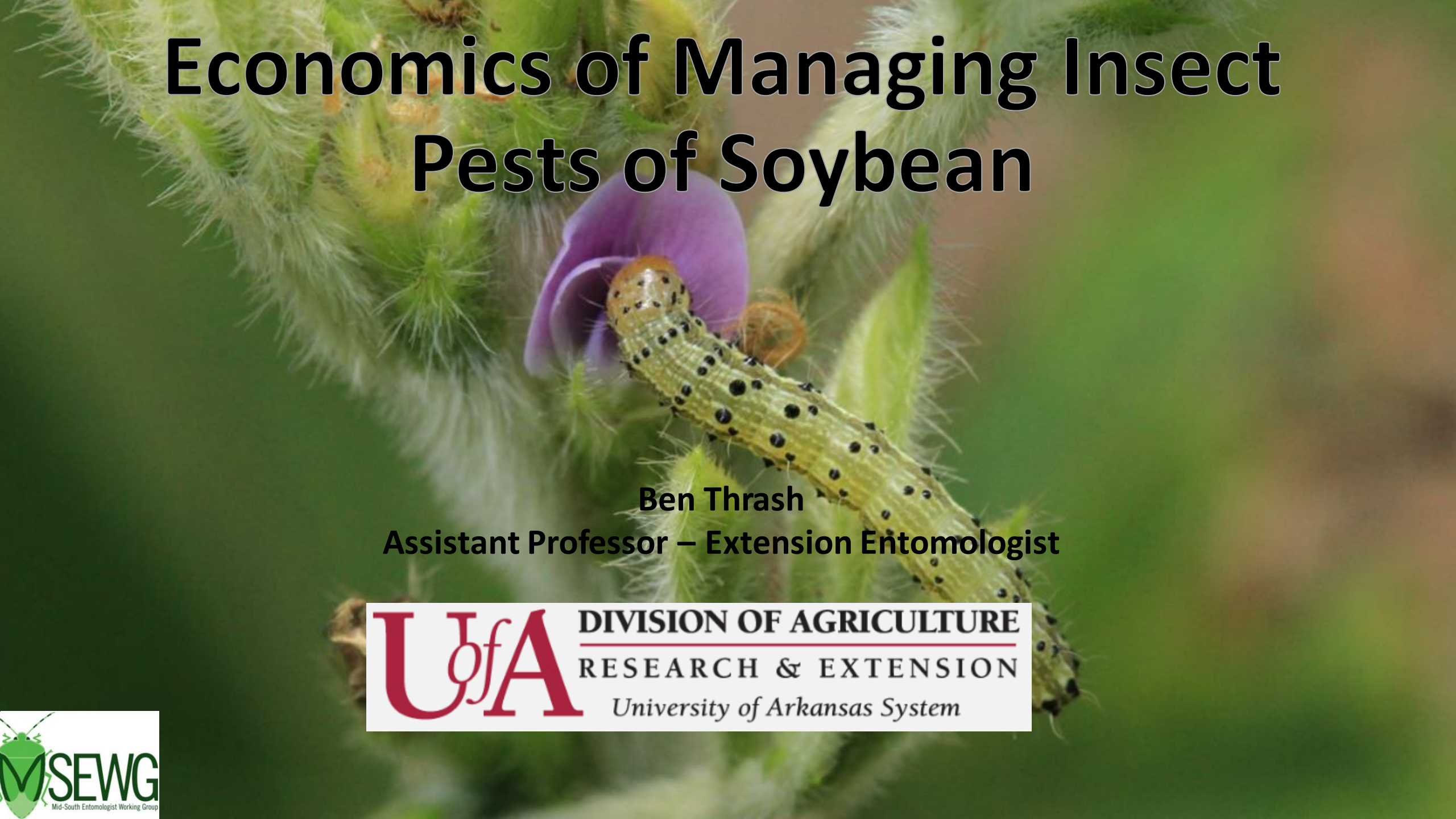
# Economics of Managing Insect Pests of Soybean



**Ben Thrash**
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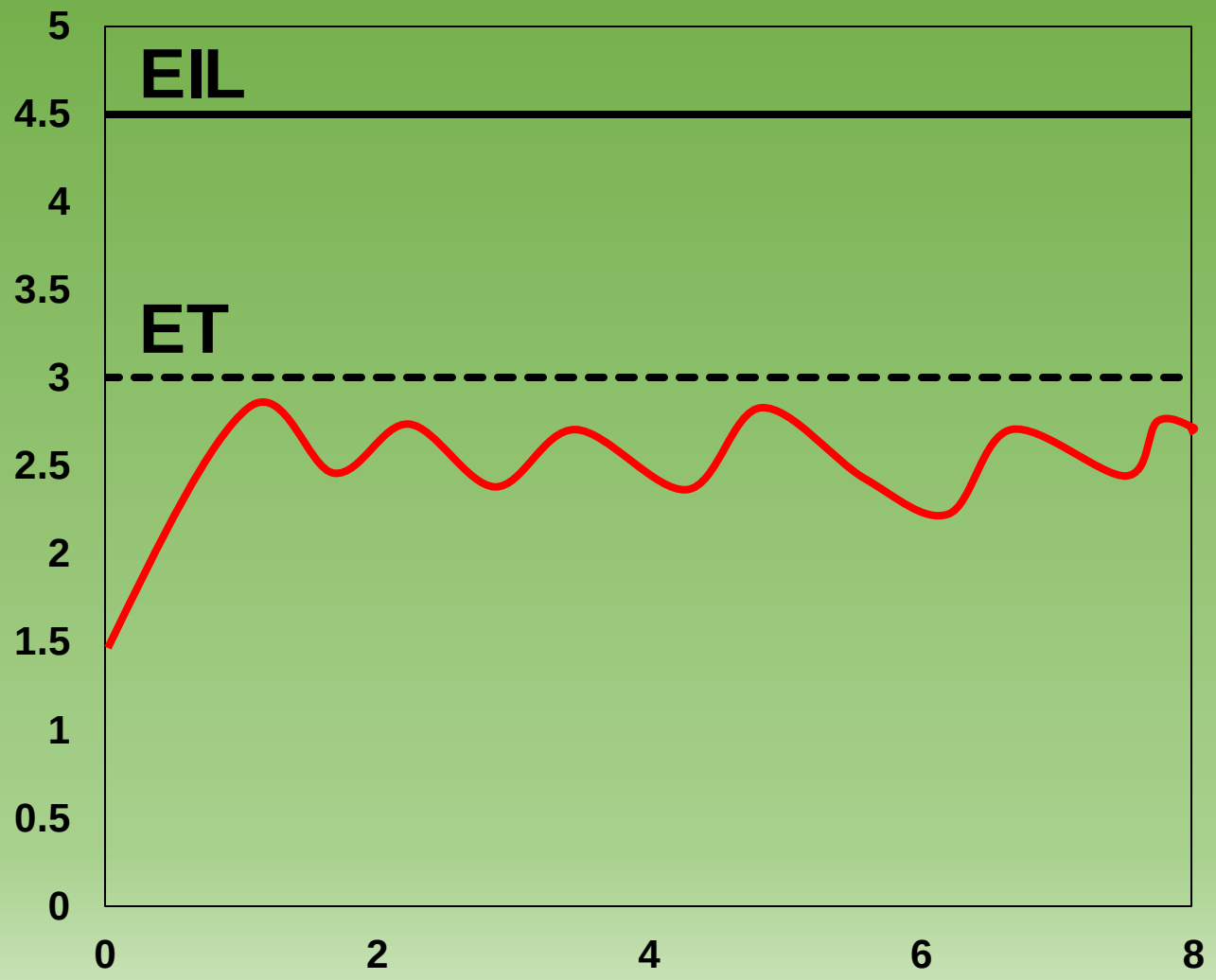
U of A DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

MSEWG
Mid-South Entomologist Working Group

# Problems with EIL's and ET's

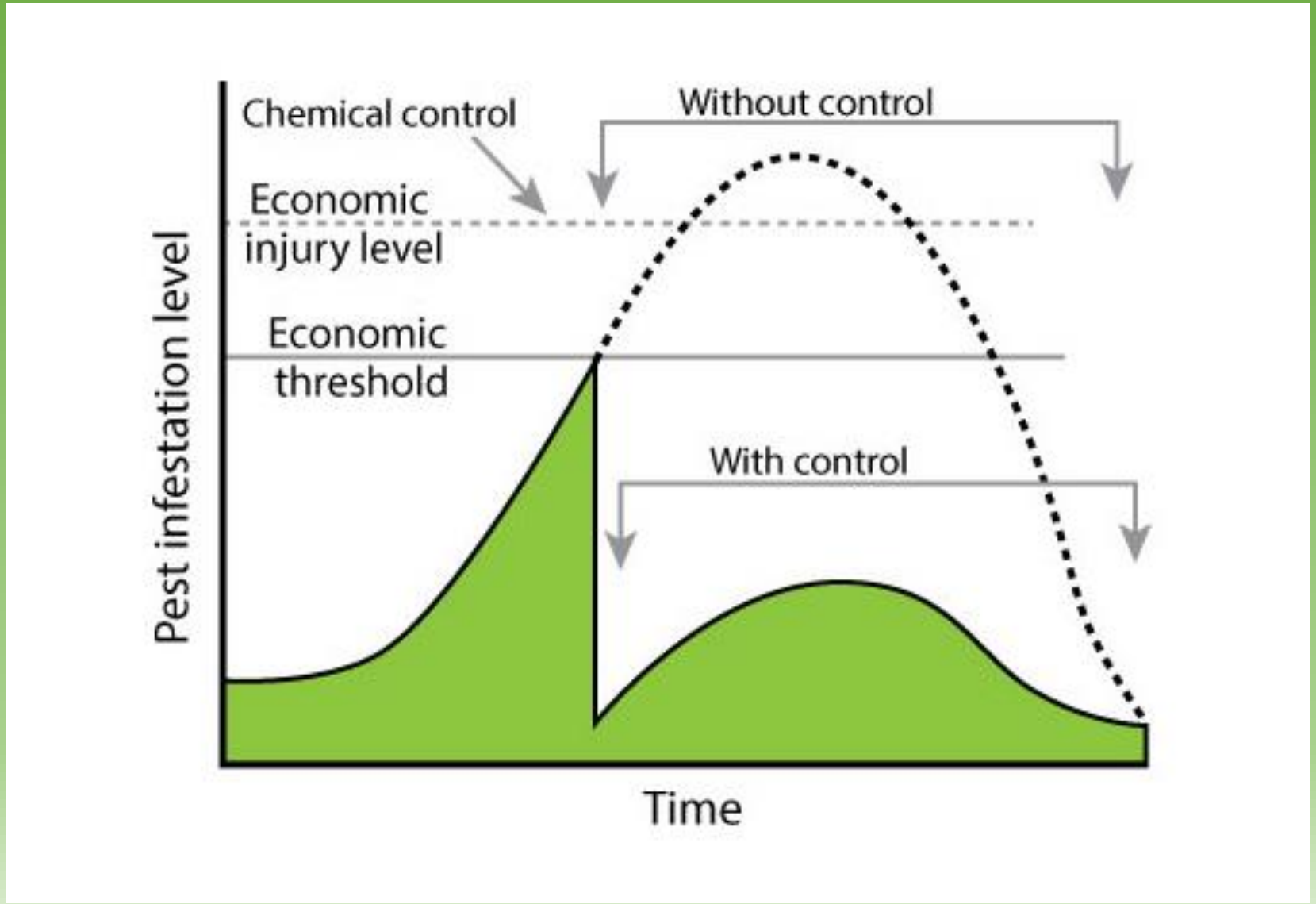
- **Most are not really based on economics**
- **They are static**
- **Sub-threshold populations over time?**



# Corn Earworm Threshold in Soybean

| | Larvae/25 sweeps | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Control costs ($/acre) | | | | | | | | |
| Crop value ($/bu) | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 6 | 6.5 | 8.2 | 9.8 | 11.4 | 13.1 | 14.7 | 16.3 | 17.9 | 19.5 |
| 7 | 5.6 | 7.0 | 8.4 | 9.8 | 11.2 | 12.6 | 14.0 | 15.4 | 16.8 |
| 8 | 5.0 | 6.1 | 7.4 | 8.6 | 9.8 | 11.0 | 12.3 | 13.5 | 14.7 |
| 9 | 5.0 | 5.4 | 6.5 | 7.6 | 8.7 | 9.8 | 10.9 | 12.0 | 13.1 |
| 10 | 5.0 | 5.0 | 5.9 | 6.9 | 7.8 | 8.8 | 9.8 | 10.8 | 11.8 |
| 12 | 5.0 | 5.0 | 5.0 | 5.7 | 6.5 | 7.4 | 8.2 | 9.0 | 9.8 |
| 13 | 5.0 | 5.0 | 5.0 | 5.3 | 6.0 | 6.8 | 7.5 | 8.2 | 8.9 |
| 15 | 5.0 | 5.0 | 5.0 | 5.0 | 5.2 | 5.9 | 6.5 | 7.1 | 7.7 |

# Thresholds


Chemical control
Without control
Economic injury level
Economic threshold
With control
Pest infestation level
Time

# Economic Injury Level

**E=C/VIDK**

E = Economic Injury Level

C = Cost of Control

V = Value

I = Injury units per pest

D = Damage per unit of insect injury

K = Reduction in injury by control

# Economic Injury Level

**E=C/VDK**

E = Economic Injury Level

C = Cost of Control ($/a)

V = Value ($/bu)

D = Damage per insect/25 sweeps (bu/a)

K = Reduction in injury by control (% control)

# Economic Injury Level

**Control costs**

**Value of crop * Damage per insect * % Control**

| Economic injury level | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control |
|---|---|---|---|---|
| 14.3 | 20 | 10 | 0.14 | 100 |
| 14.3 | 10 | 10 | 0.14 | 50 |

# Economic Injury Level

**Control costs**

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| Economic injury level | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control |
|---|---|---|---|---|
| 14.3 | 20 | 10 | 0.14 | 100 |
| 14.3 | 10 | 10 | 0.14 | 50 |

# Economic Injury Level

**Control costs**

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|---|---|---|---|---|
| 14.3 | 20 | 10 | 0.14 | 100 |
| 14.3 | 10 | 10 | 0.14 | 50 |

# Economic Injury Level

**Control costs**

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| Economic injury level | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control |
|---|---|---|---|---|
| 14.3 | 20 | 10 | 0.14 | 100 |
| 14.3 | 10 | 10 | 0.14 | 50 |

# Economic Injury Level

**Control costs**

**Value of crop * Damage per insect * % Control**

| Economic injury level | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control (worms left) |
|---|---|---|---|---|
| 14.3 | 20 | 10 | 0.14 | 100 (0) |
| 14.3 | 10 | 10 | 0.14 | 50 (7) |

**$20 Costs**

**$0 Loss**

# Economic Injury Level

**Control costs**

**Value of crop * Damage per insect * % Control**

| Economic Injury Level | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control (worms left) |
|---|---|---|---|---|
| 14.3 | 20 | 10 | 0.14 | 100 |
| 14.3 | 10 | 10 | 0.14 | 50 (7) |

**$10 Costs**

**$10 Loss**

# Corn Earworm Threshold in Soybean

| | Larvae/25 sweeps | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Control costs ($/acre) | | | | | | | | |
| Crop value ($/bu) | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 6 | 6.5 | 8.2 | 9.8 | 11.4 | 13.1 | 14.7 | 16.3 | 17.9 | 19.5 |
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| 9 | 5.0 | 5.4 | 6.5 | 7.6 | 8.7 | 9.8 | 10.9 | 12.0 | 13.1 |
| 10 | 5.0 | 5.0 | 5.9 | 6.9 | 7.8 | 8.8 | 9.8 | 10.8 | 11.8 |
| 12 | 5.0 | 5.0 | 5.0 | 5.7 | 6.5 | 7.4 | 8.2 | 9.0 | 9.8 |
| 13 | 5.0 | 5.0 | 5.0 | 5.3 | 6.0 | 6.8 | 7.5 | 8.2 | 8.9 |
| 15 | 5.0 | 5.0 | 5.0 | 5.0 | 5.2 | 5.9 | 6.5 | 7.1 | 7.7 |

# More worms

| Worms | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control (worms left) |
|---|---|---|---|---|
| 28 | 20 | 10 | 0.14 | 100 (0) |
| 28 | 10 | 10 | 0.14 | 50 (14) |

**# of worms prespray**

# More worms

| Worms | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control (worms left) |
|---|---|---|---|---|
| 28 | 20 | 10 | 0.14 | 100 (0) |
| 28 | 10 | 10 | 0.14 | 50 (14) |

# More worms

| Worms | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control (worms left) |
|---|---|---|---|---|
| 28 | 20 | 10 | 0.14 | 100 (0) |
| 28 | 10 | 10 | 0.14 | 50 (14) |

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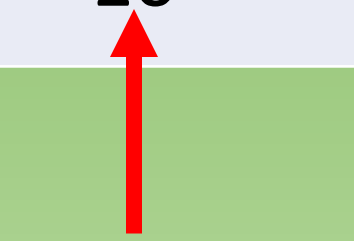
|---|---|---|---|---|
| 28 | 20 | 10 | 0.14 | 100 (0) |
| 28 | 10 | 10 | 0.14 | 50 (14) |

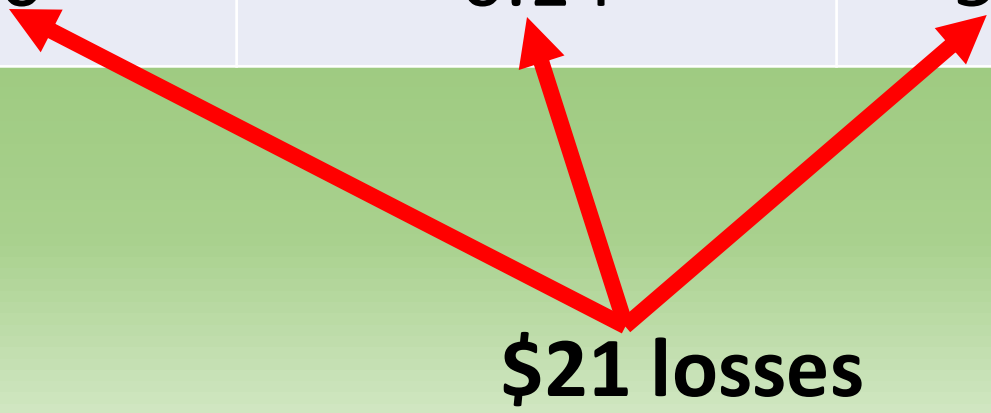
**$20 costs**

**$0 losses**

# More worms

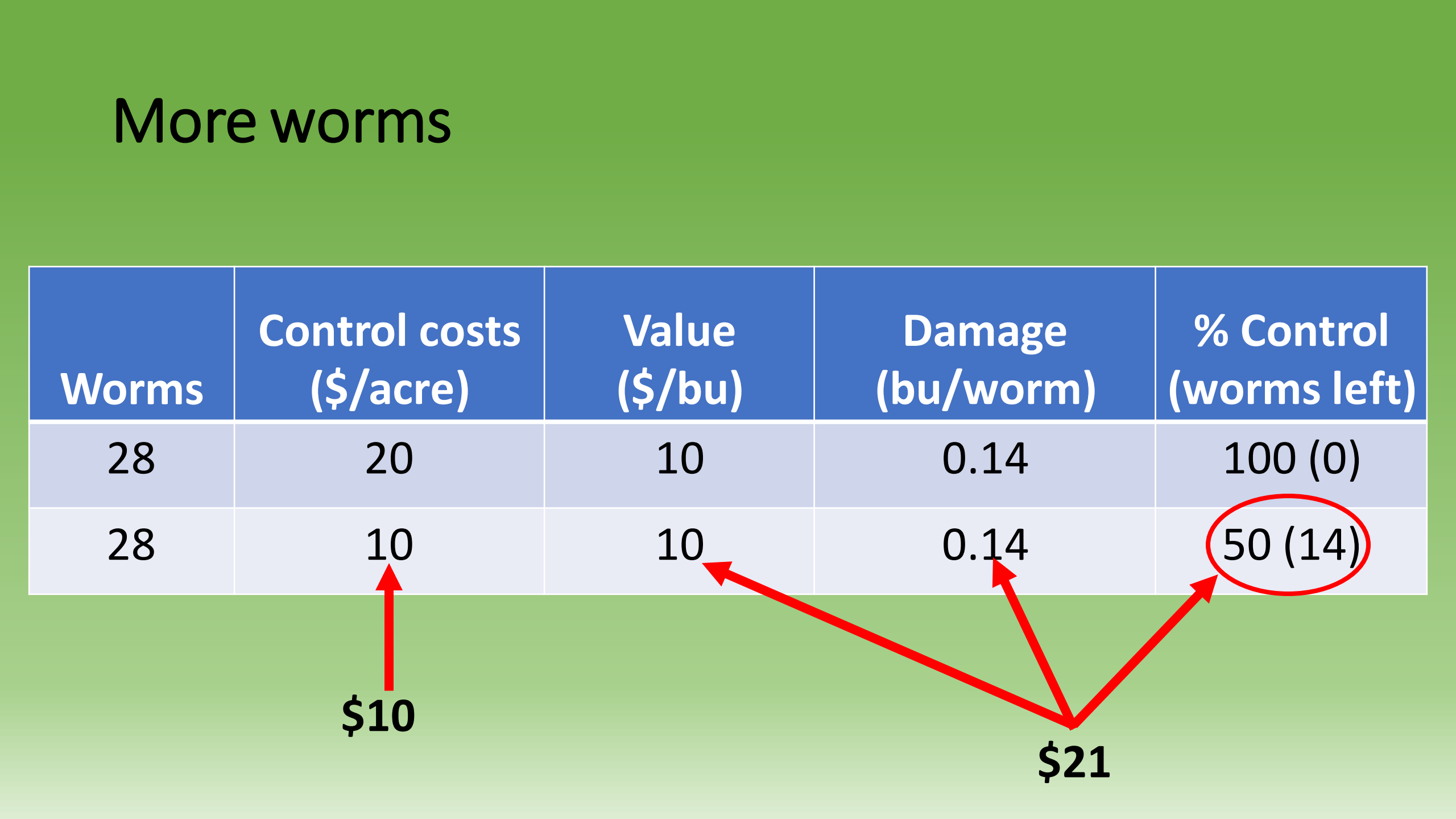
| Worms | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control (worms left) |
|---|---|---|---|---|
| 28 | 20 | 10 | 0.14 | 100 (0) |
| 28 | 10 | 10 | 0.14 | 50 (14) |



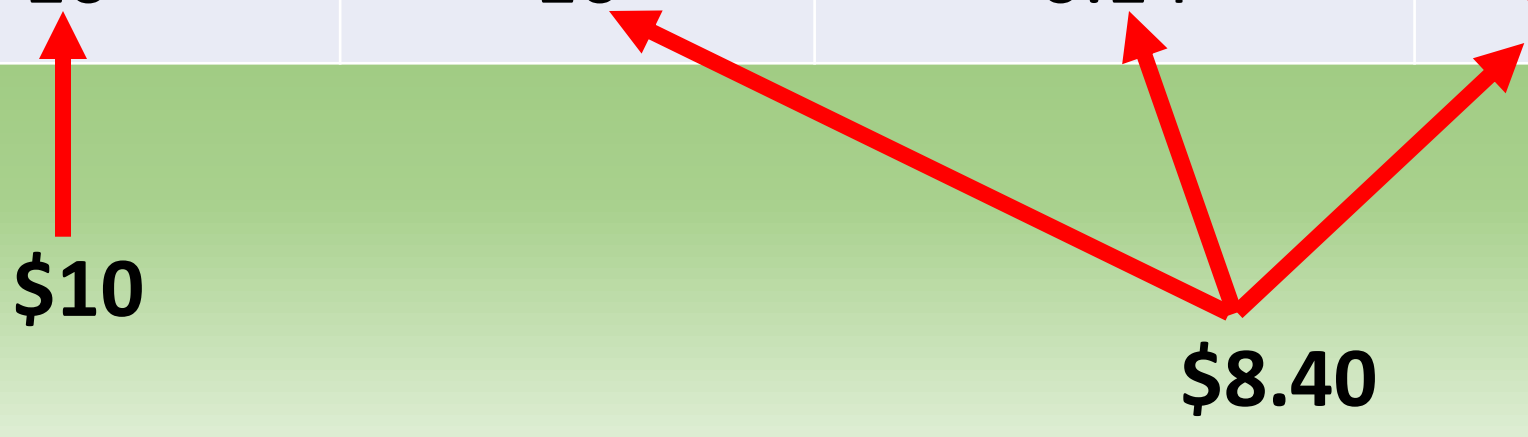
# More worms

| Worms | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control (worms left) |
|---|---|---|---|---|
| 28 | 20 | 10 | 0.14 | 100 (0) |
| 28 | 10 | 10 | 0.14 | 50 (14) |



# Improved control

| Worms | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control (worms left) |
|---|---|---|---|---|
| 28 | 20 | 10 | 0.14 | 100 (0) |
| 28 | 10 | 10 | 0.14 | 80 (6) |

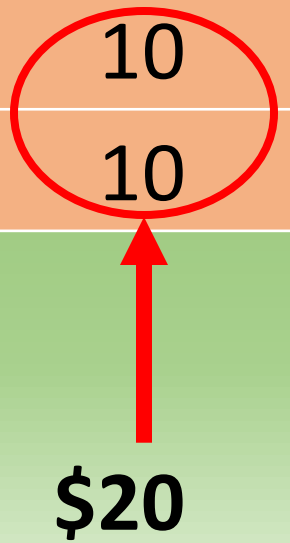


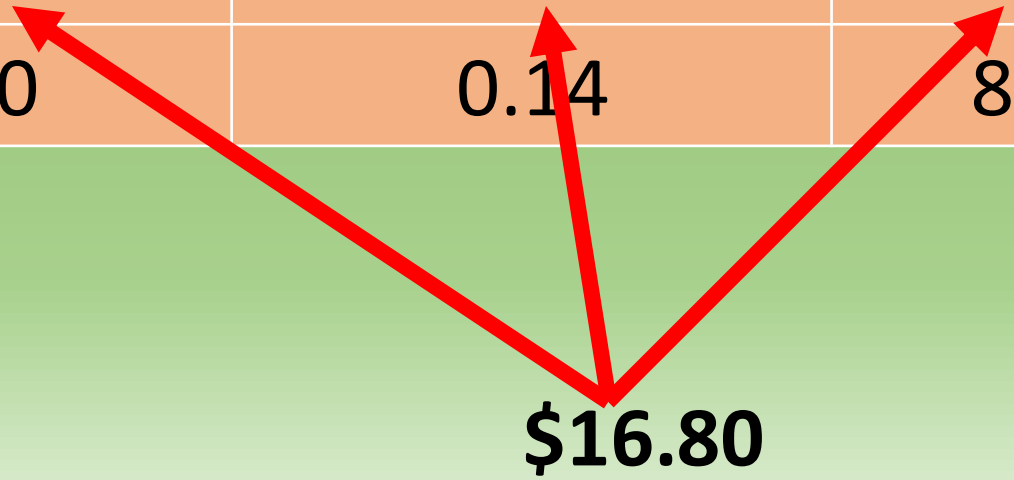
# Soybean value goes up

| Worms | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control (worms left) |
|---|---|---|---|---|
| 28 | 20 | 12 | 0.14 | 100 (0) |
| 28 | 10 | 12 | 0.14 | 80 (6) |

# Repeat application

| Worms | Control costs ($/acre) | Value ($/bu) | Damage (bu/worm) | % Control (worms left) |
|---|---|---|---|---|
| 28 | 20 | 10 | 0.14 | 100 (0) |
| 28 | 10 | 10 | 0.14 | 80 (6) |
| 28 | 10 | 10 | 0.14 | 80 (1) |



# Corn Earworm Threshold in Soybean

| | Larvae/25 sweeps | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Control costs ($/acre) | | | | | | | | |
| Crop value ($/bu) | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 6 | 6.5 | 8.2 | 9.8 | 11.4 | 13.1 | 14.7 | 16.3 | 17.9 | 19.5 |
| 7 | 5.6 | 7.0 | 8.4 | 9.8 | 11.2 | 12.6 | 14.0 | 15.4 | 16.8 |
| 8 | 5.0 | 6.1 | 7.4 | 8.6 | 9.8 | 11.0 | 12.3 | 13.5 | 14.7 |
| 9 | 5.0 | 5.4 | 6.5 | 7.6 | 8.7 | 9.8 | 10.9 | 12.0 | 13.1 |
| 10 | 5.0 | 5.0 | 5.9 | 6.9 | 7.8 | 8.8 | 9.8 | 10.8 | 11.8 |
| 12 | 5.0 | 5.0 | 5.0 | 5.7 | 6.5 | 7.4 | 8.2 | 9.0 | 9.8 |
| 13 | 5.0 | 5.0 | 5.0 | 5.3 | 6.0 | 6.8 | 7.5 | 8.2 | 8.9 |
| 15 | 5.0 | 5.0 | 5.0 | 5.0 | 5.2 | 5.9 | 6.5 | 7.1 | 7.7 |

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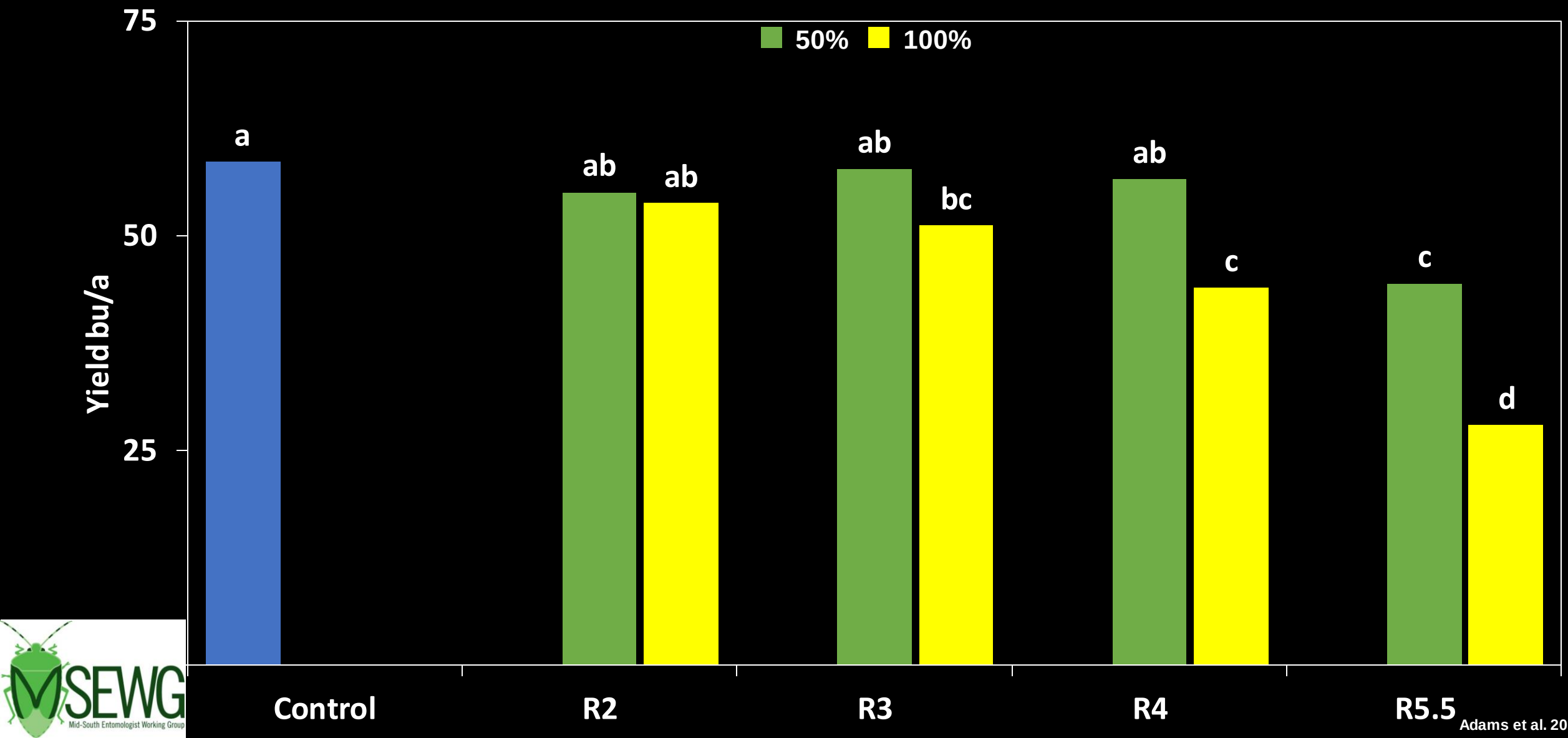
# Impact of Fruit Loss on Soybean Yield

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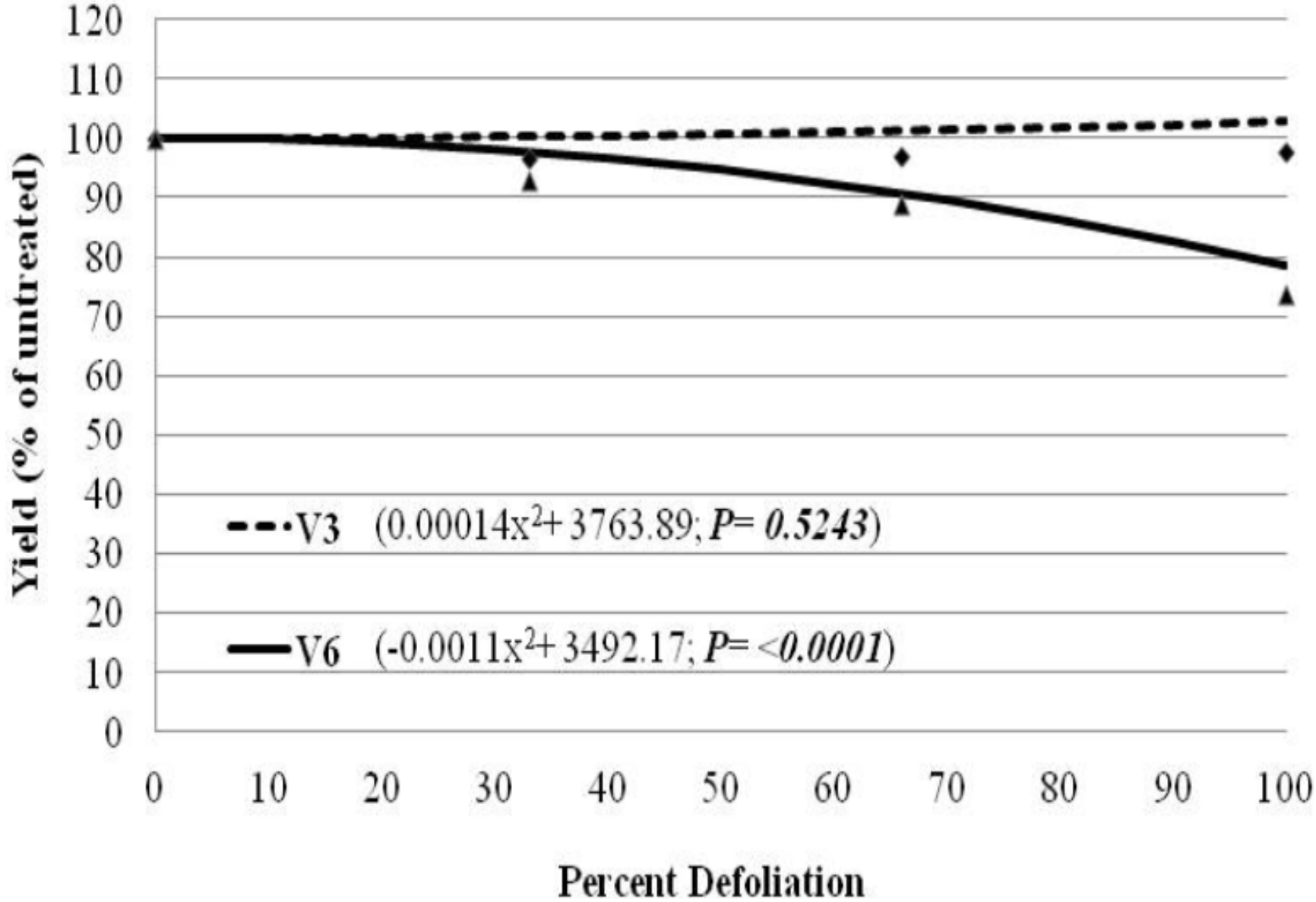
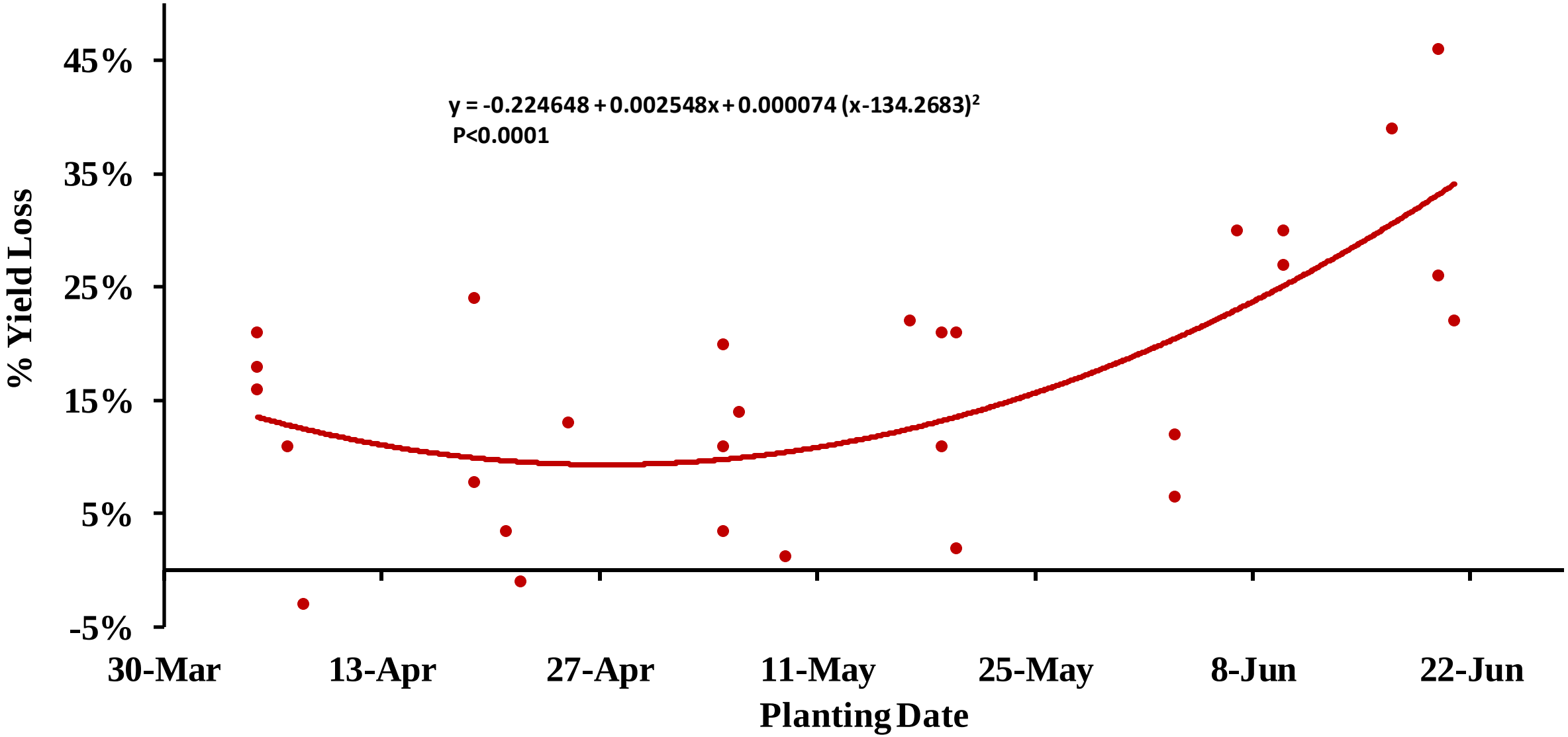
Adams et al. 2015

# Yield Loss from Vegetative Defoliation

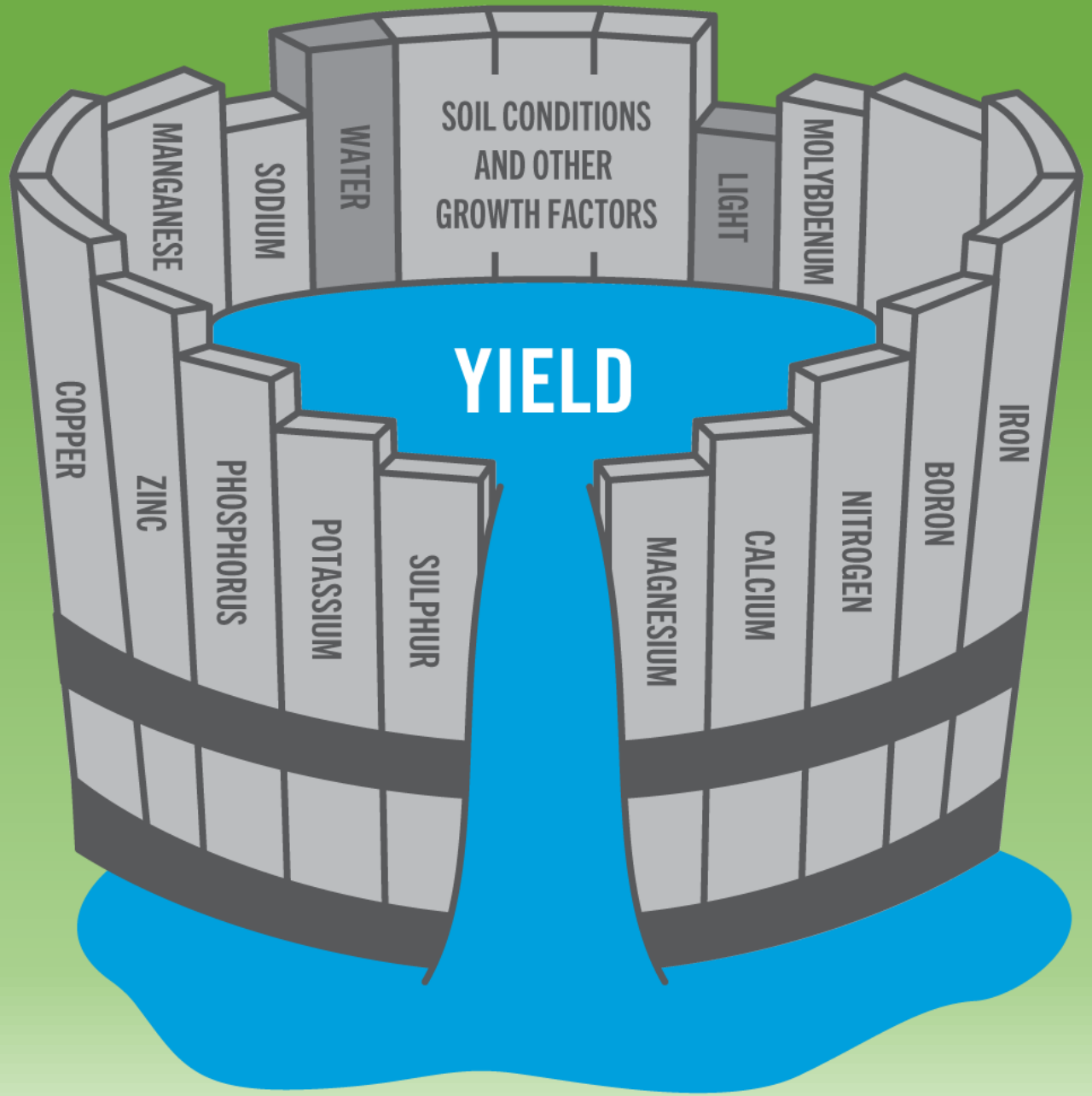


# Yield loss from 100% V4 defoliaton

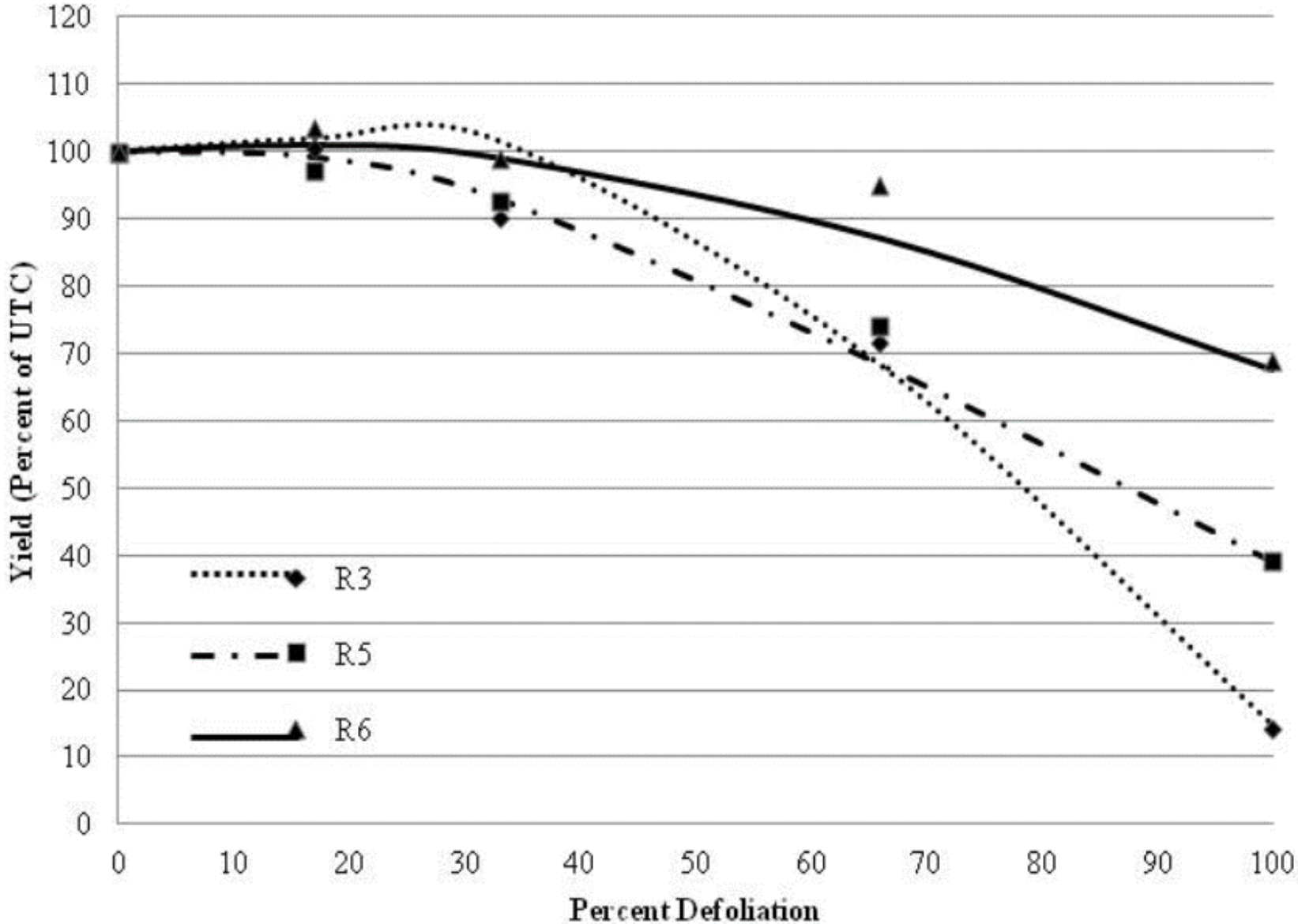


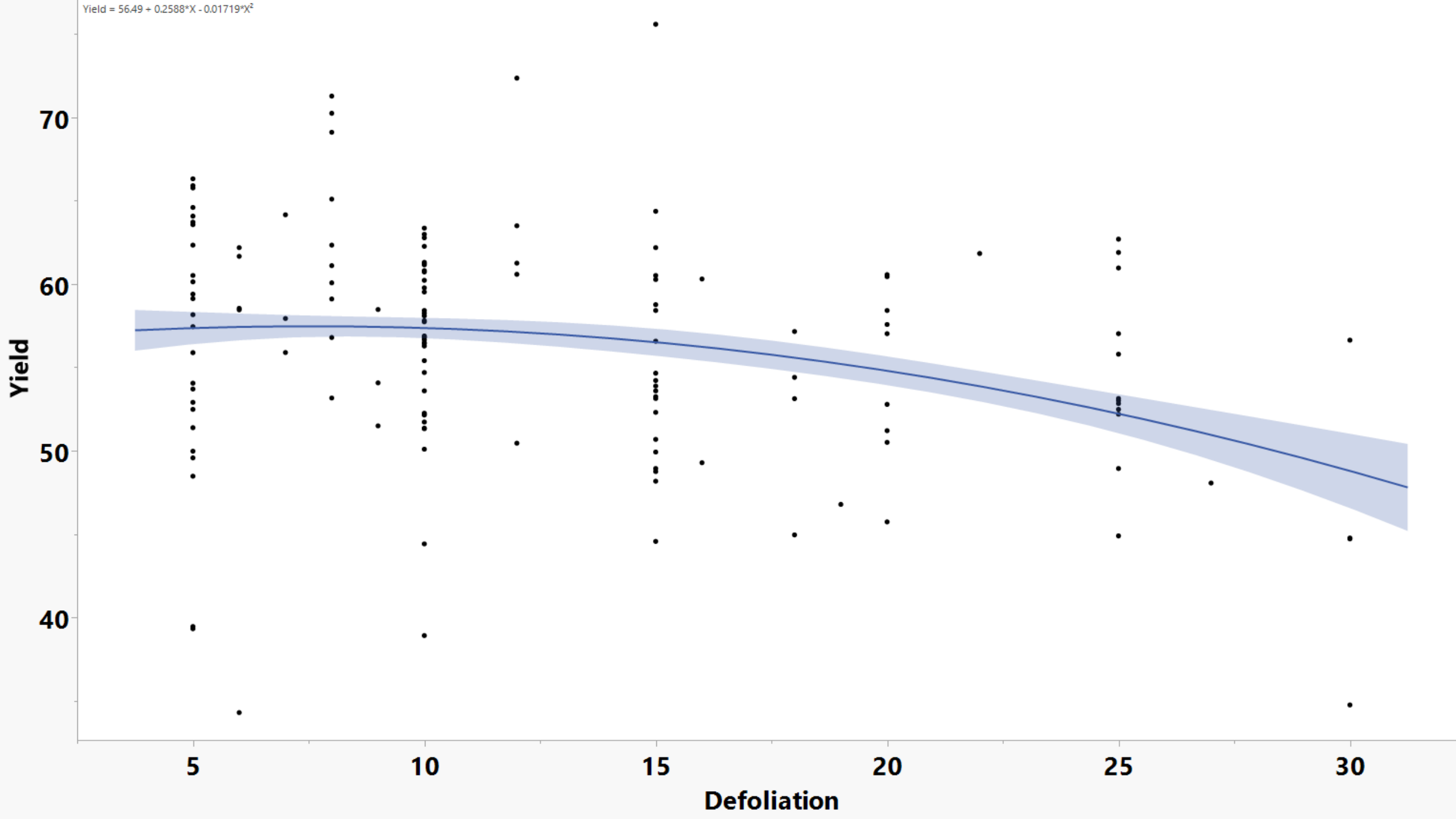
# Losses from V4 Defoliation

| Yield Potential %Yield loss | Planting Date (Julian Date) | | | | | |
|---|---|---|---|---|---|---|
| | Early Apr | Late Apr | Early May | Late May | Early June | Late June |
| 37.2 | -9% | -12% | -10% | -3% | 11% | 29% |
| 52.0 | 2% | -1% | 1% | 6% | 16% | 29% |
| 66.9 | 8% | 6% | 7% | 11% | 19% | 29% |
| 81.8 | 12% | 10% | 11% | 15% | 21% | 29% |
| 96.7 | 14% | 13% | 14% | 17% | 22% | |
| 111.5 | 16% | 15% | 16% | 18% | | |


SOIL CONDITIONS AND OTHER GROWTH FACTORS
WATER
SODIUM
MANGANESE
LIGHT
MOLYBDENUM
IRON
BORON
NITROGEN
CALCIUM
MAGNESIUM
SULPHUR
POTASSIUM
PHOSPHORUS
ZINC
COPPER
YIELD

# Yield Loss from Reproductive Defoliation



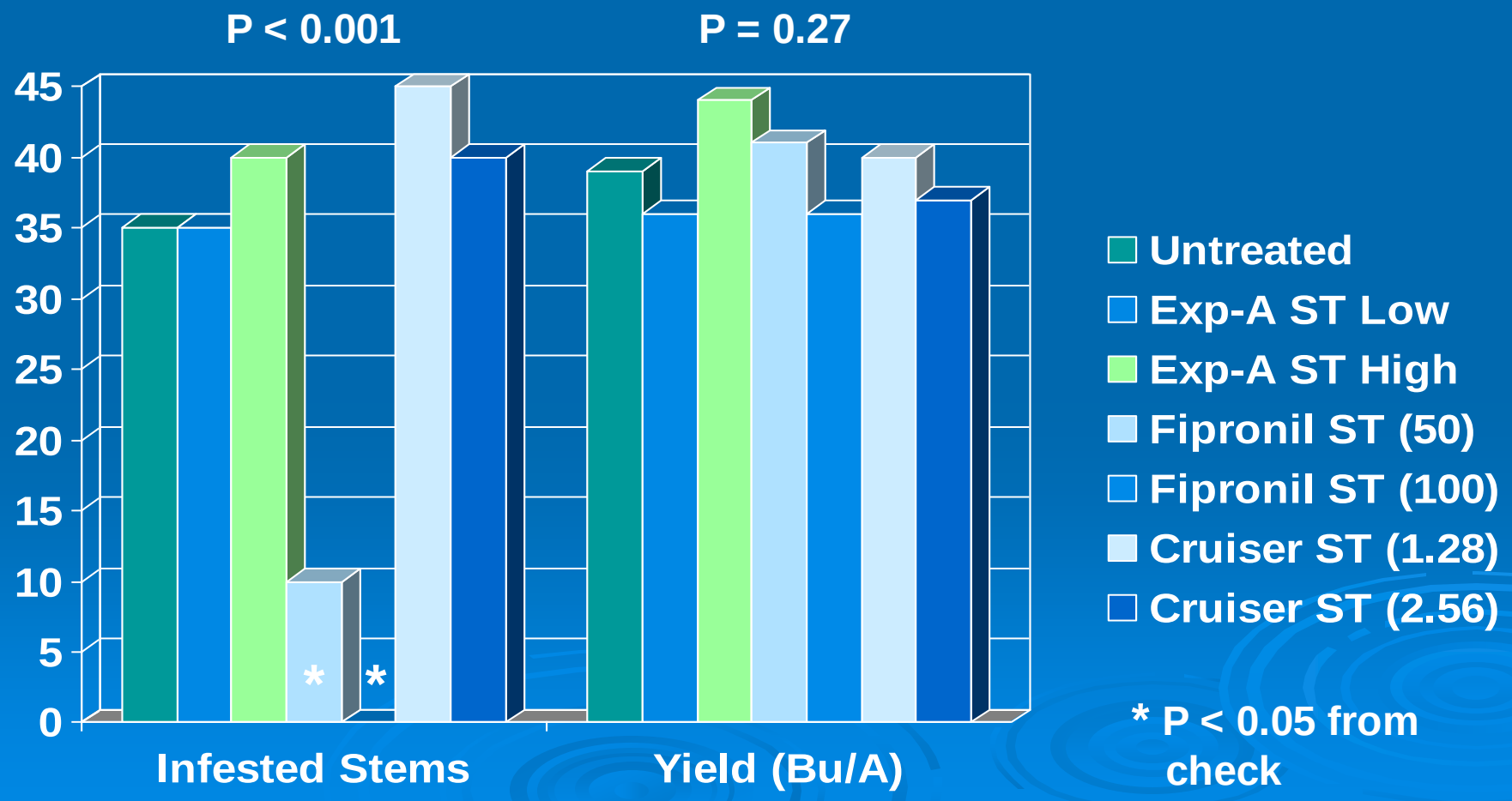

Yield = 56.49 + 0.2588*X - 0.01719*X²
Yield
70
60
50
40
5
10
15
20
25
30
Defoliation

# Don’t spray things that don’t need spraying

# Seed Treatments

## *Dectes* Tunnels per 50 Plants and Yield

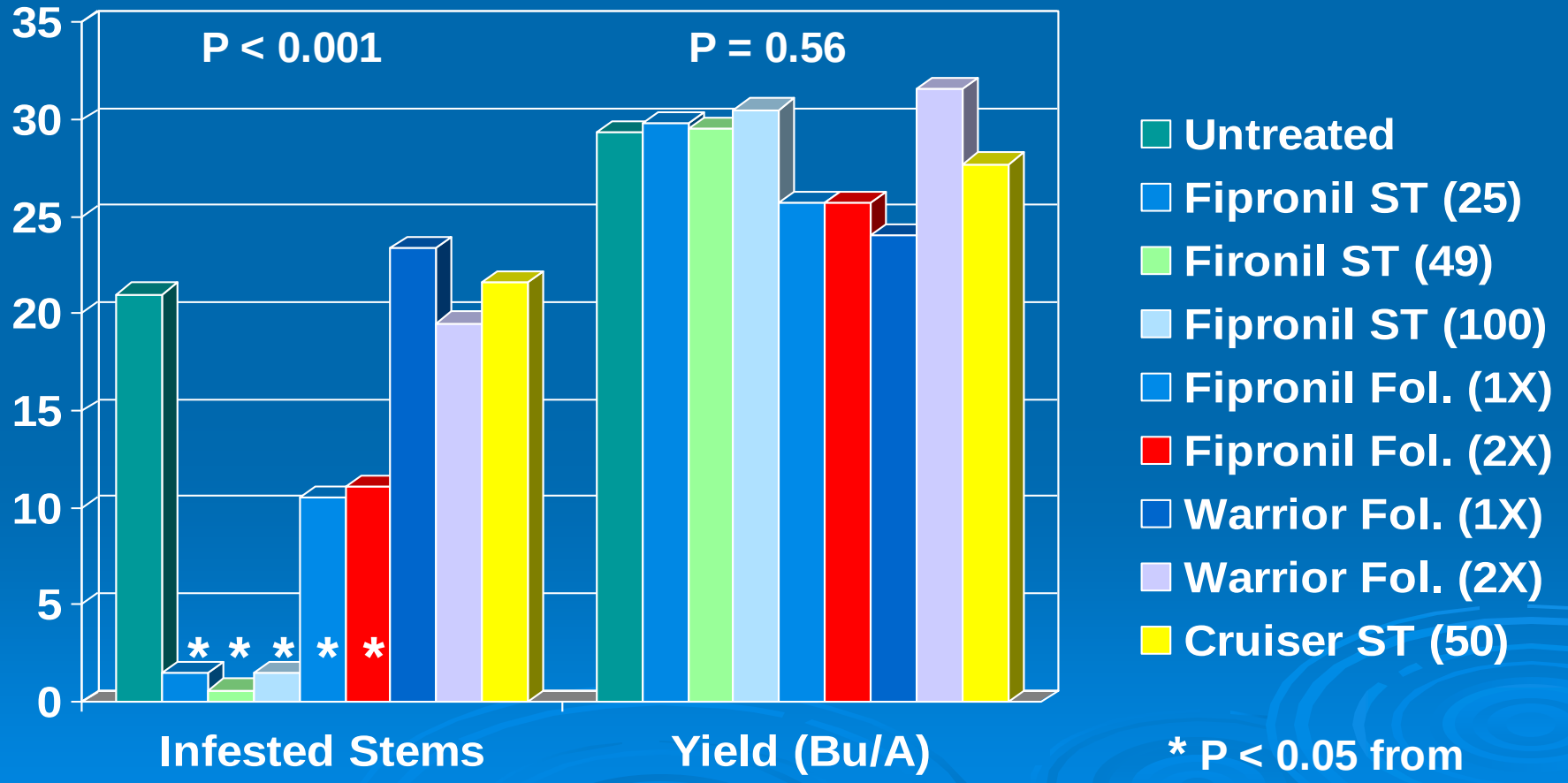
### Proctor, AR (Gus Lorenz), Group V Planted in Early June



# Seed Treatments and Foliar Sprays

## *Dectes* Tunnels per 30 Plants and Yield

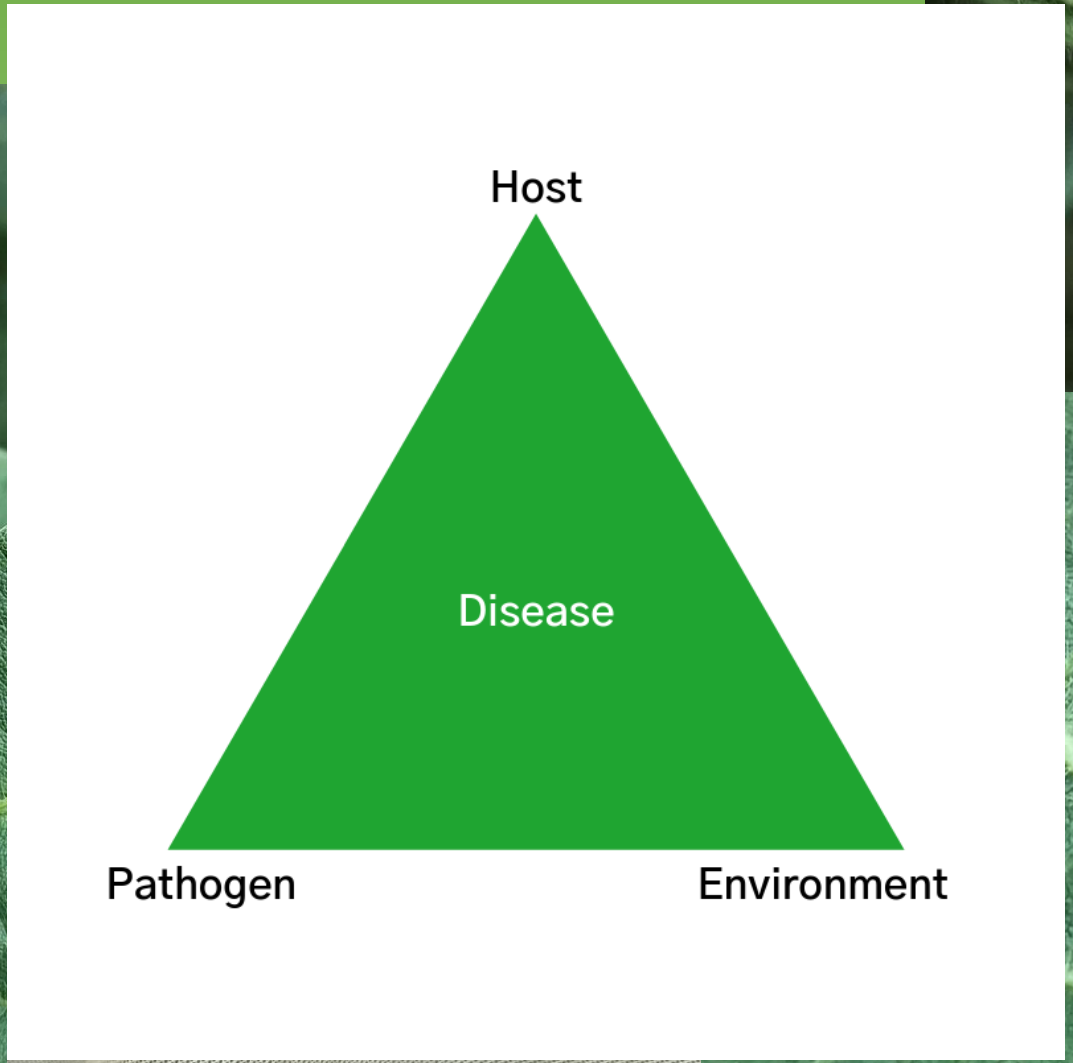
Princeton, KY (Doug Johnson), Group 3.9 Planted May 18



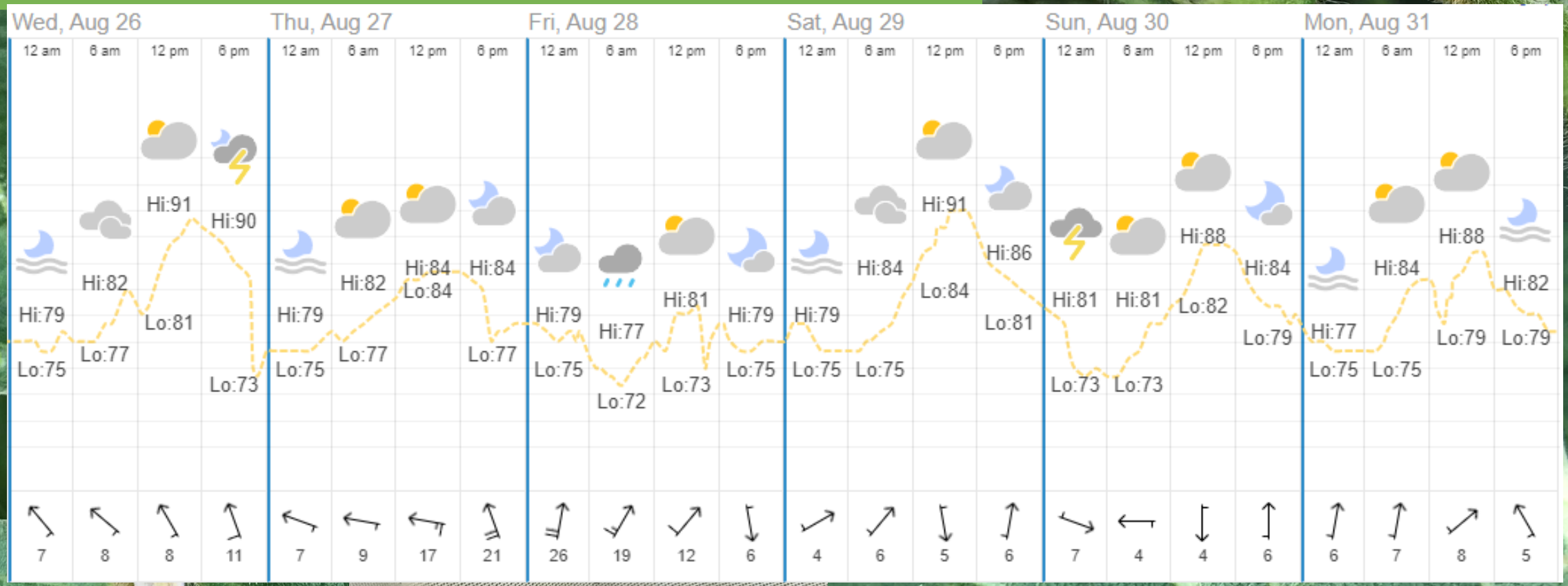

* P < 0.05 from check

# Take advantage of Natural Enemies

# Take advantage of Natural Enemies



# Take advantage of Natural Enemies



# RBSB 2024??

# Weather Effects on RBSB

## Direct exposure studies

7 hours at 20° kills 90% of population

7 days at 32° kills 95% of population

### Weather Data 12/7/17-1/7/18

| Location | Hours ≤ 32° | Hours ≤ 20° | Consecutive Hours ≤ 20° |
|---|---|---|---|
| Jonesboro | 337 | 122 | 58 |
| Stuttgart | 277 | 56 | [illegible] |
| McGhee | 187 | 34 | 17 |

### Weather Data 12/7/22-1/7/23

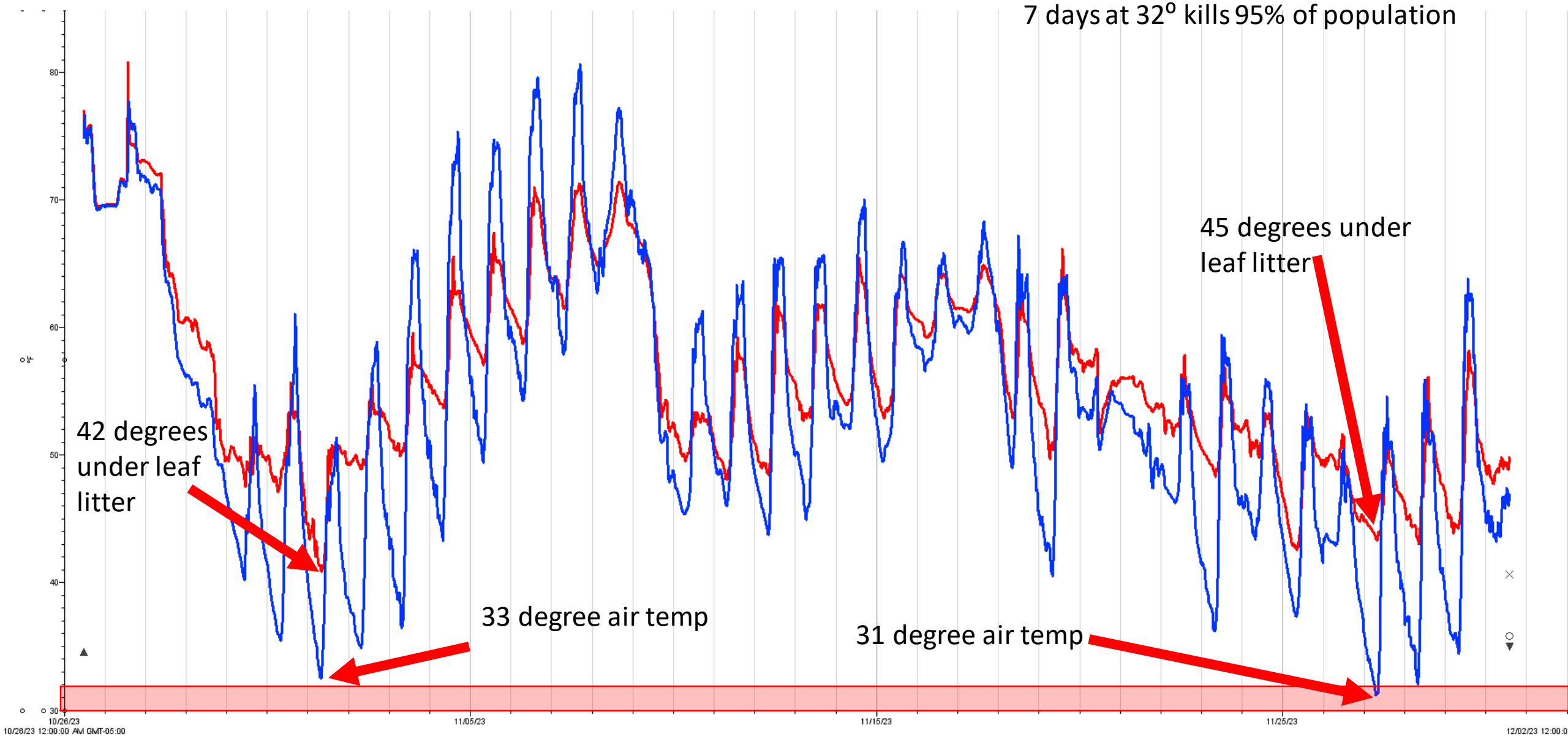
| Location | Hours ≤ 32° | Hours ≤ 20° | Consecutive Hours ≤ 20° |
|---|---|---|---|
| Jonesboro | 169 | 52 | 48 |
| Stuttgart | 113 | 39 | 39 |
| McGhee | 104 | 23 | 23 |

# Temperatures in leaf litter

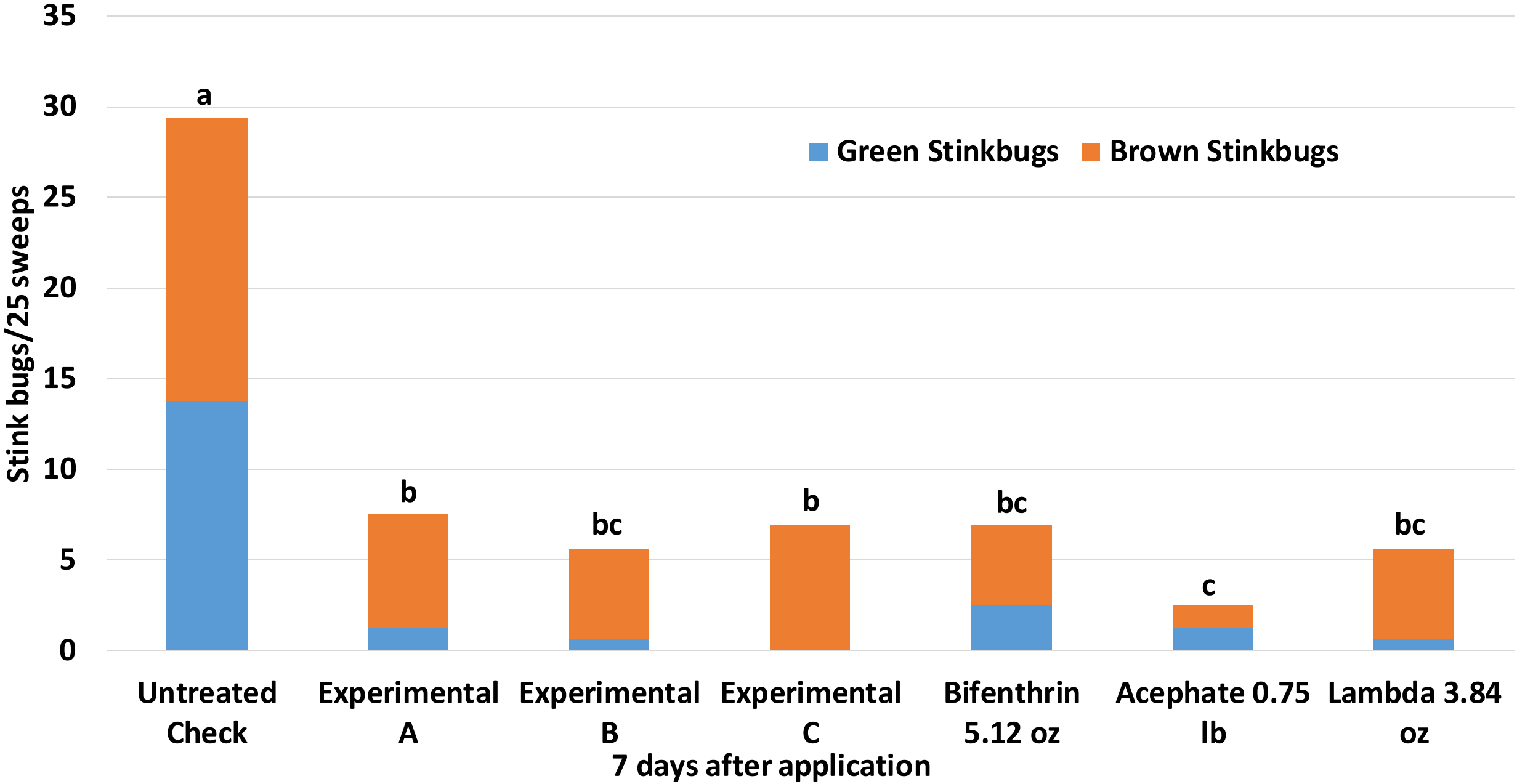
**Direct exposure studies**

7 hours at 20° kills 90% of population

7 days at 32° kills 95% of population



# Don’t waste money, use the right insecticide for the job



| | Prevathon 0.43 lb ai/gal | Vantacor 5 lb ai/gal | Elevest 0.89 lb ai/gal | Besiege 0.835 lb ai/gal | Shenzi 3.33 lb ai/gal |
|---|---|---|---|---|---|
| oz/acre product equivalent | 14.0 | 1.2 | 6.8 | 7.2 | 1.8 |
| | 20.0 | 1.7 | 9.6 | 10.3 | 2.6 |

# How much pyrethroid do I need to add?

| Besiege rate | Additional product needed to get to 1 gal/70 acres lambda |
|---|---|
| 7.2 oz/a | 0.39 oz/a of Warrior II or 0.78 oz/1 lb lambda |
| 10.3 oz/a | none |

| Elevest rate | Additional product needed to get to 1 gal/20-25 acres bifenthrin |
|---|---|
| 6.8 oz/a | 1.5-1.9 oz/a |
| 9.6 oz/a | none |

Besiege®

ELEVEST™ INSECT CONTROL

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**NEREC-Keiser**
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