Insect pest management in hemp

Louisiana State University

November 12, 2019

Kadie Britt and Tom Kuhar

Virginia Tech Department of Entomology

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Questions?

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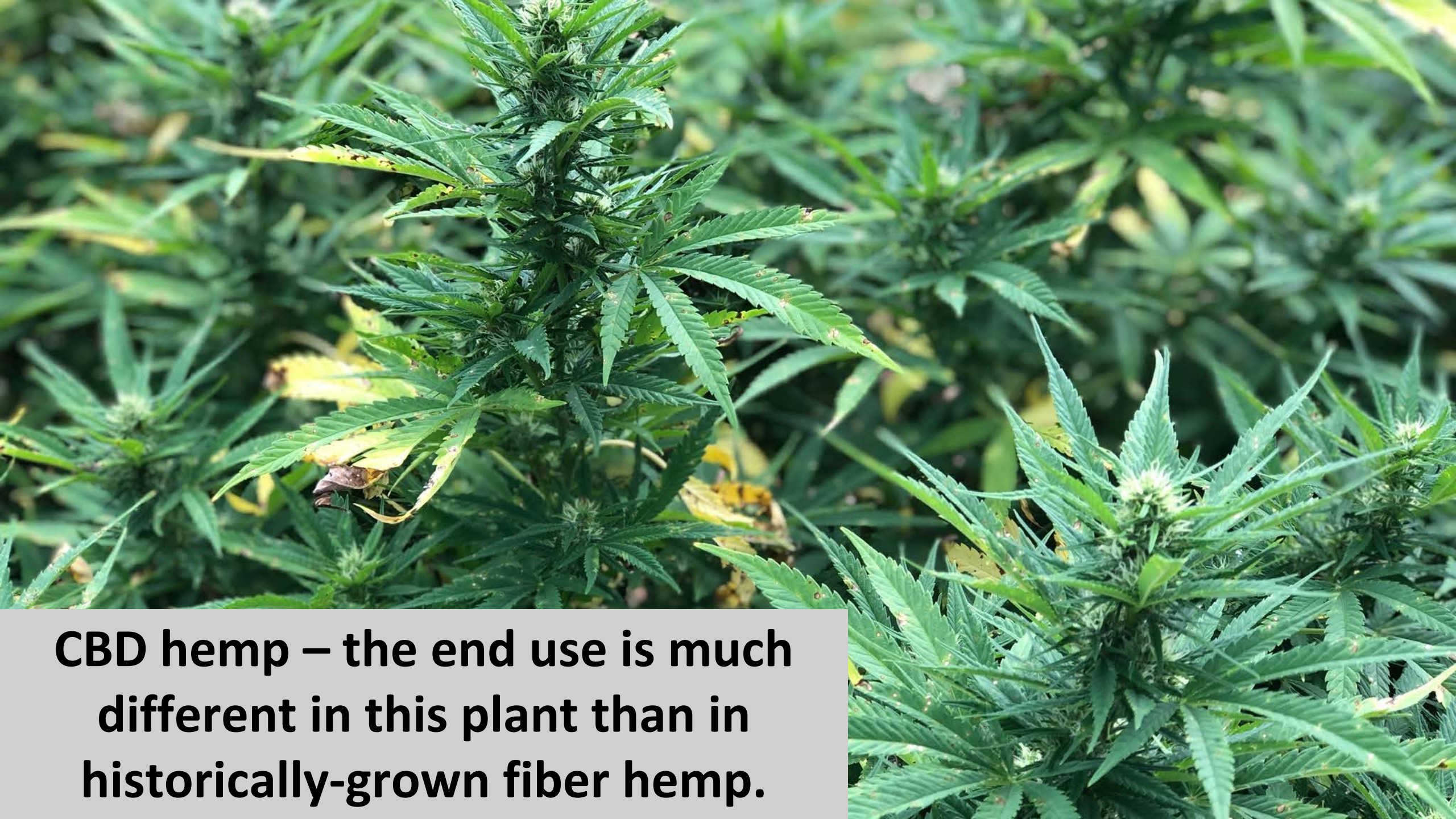
Outline

- Introduction
- Pesticide use on hemp in Virginia
- Insect pests present in hemp
- Insecticide studies
- Hemp defoliation project

Hemp was historically grown in the United States for fiber production and was not grown in such a wide range of locations like it is right now. We are now mainly growing for CBD production and this has not occurred on the scale in which it currently exists. There is information left over from the historical period of hemp, but it is not directly applicable to current conditions.



CBD hemp – the end use is much different in this plant than in historically-grown fiber hemp.

Pesticide use on hemp in Virginia

<u>Hemp that will not be consumed</u>:

1. **The label lists “hemp” as a use site, or the label language is sufficiently broad to include hemp and does not specifically prohibit its use on hemp;**
2. **The pesticide is registered by the EPA or exempted from registration; and**
3. **The pesticide is registered by VDACS.**

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Pesticide use on hemp in Virginia

<u>Hemp that will be consumed</u>:

1. **The active ingredient is exempt from the requirements of a tolerance on all food crops (i.e., auxins, select biopesticides, copper, cytokinins, gibberellins, petroleum oil, phosphorous acid, pyrethrins, soap, sulfur, common consumer food commodities, edible fats, and oils). Information regarding food tolerances for pesticide ingredients may be found here.**
2. **The label has directions for use on unspecified food crops (e.g., bedding plants);**
3. **The pesticide is registered by the EPA or exempted from registration;**
4. **The pesticide is registered by VDACS; and**
5. **The label language is sufficiently broad to include hemp and does not specifically prohibit its use on hemp.**

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Pesticide use on hemp in Virginia

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5. **The label language is sufficiently broad to include hemp and does not specifically prohibit its use on hemp.**

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generalist

specialist

chewing

piercing-sucking

Tarnished plant bug

Stink bugs

Cannabis aphid

Pest complex – sucking pests

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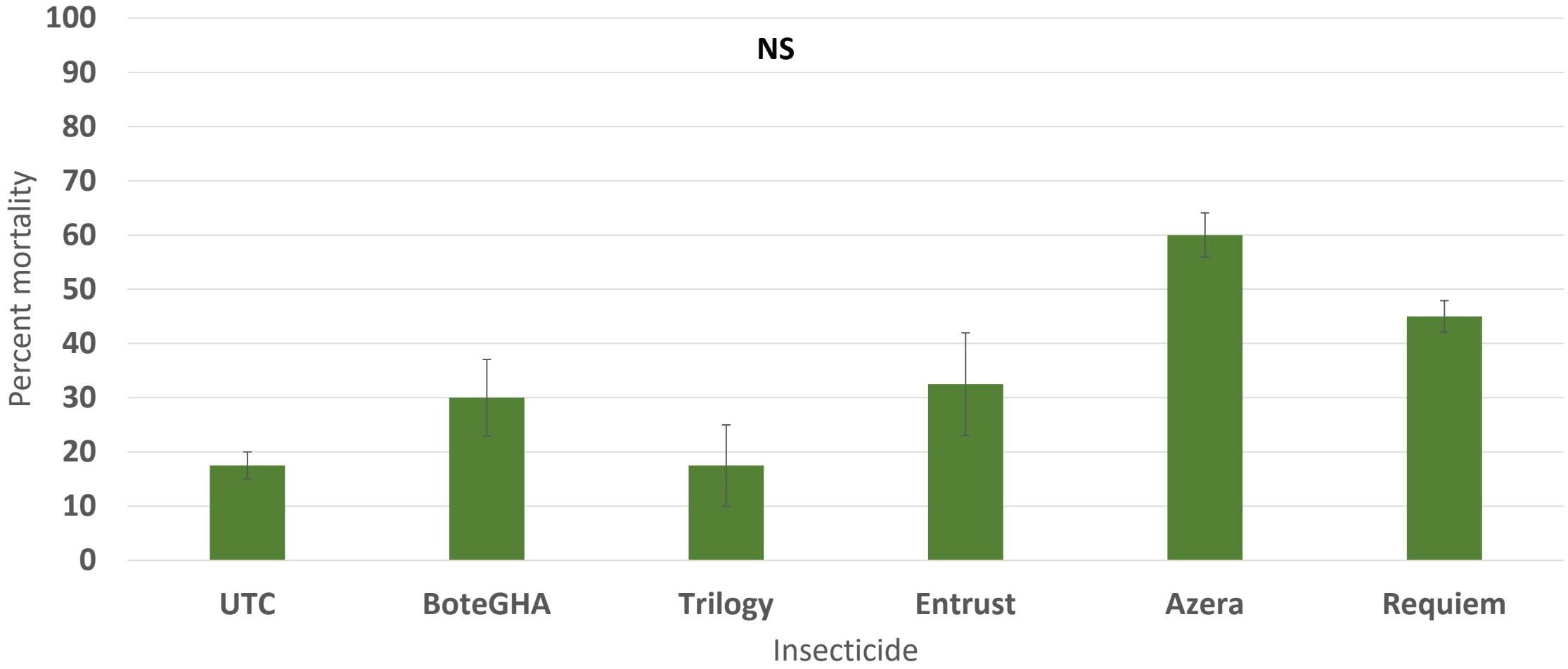
Adult brown stink bugs

Stink bug egg mass

Later stage stink bug nymph

Brown marmorated stink bug mortality, lab bioassay, 2019



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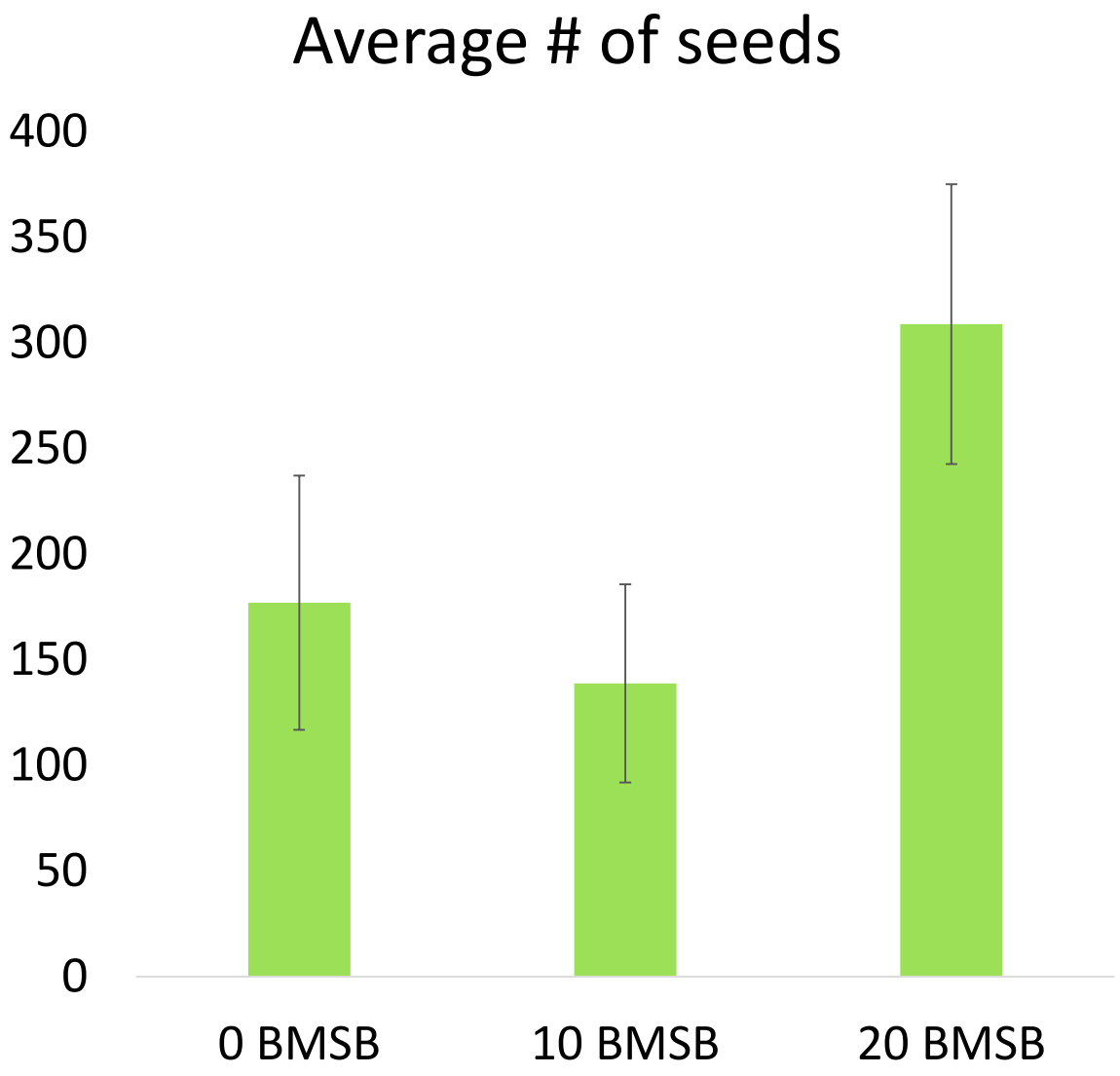
Hancock Forest Management
VIRGINIA
TECH VT
Hokies


Average # of seeds
400
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250
200
150
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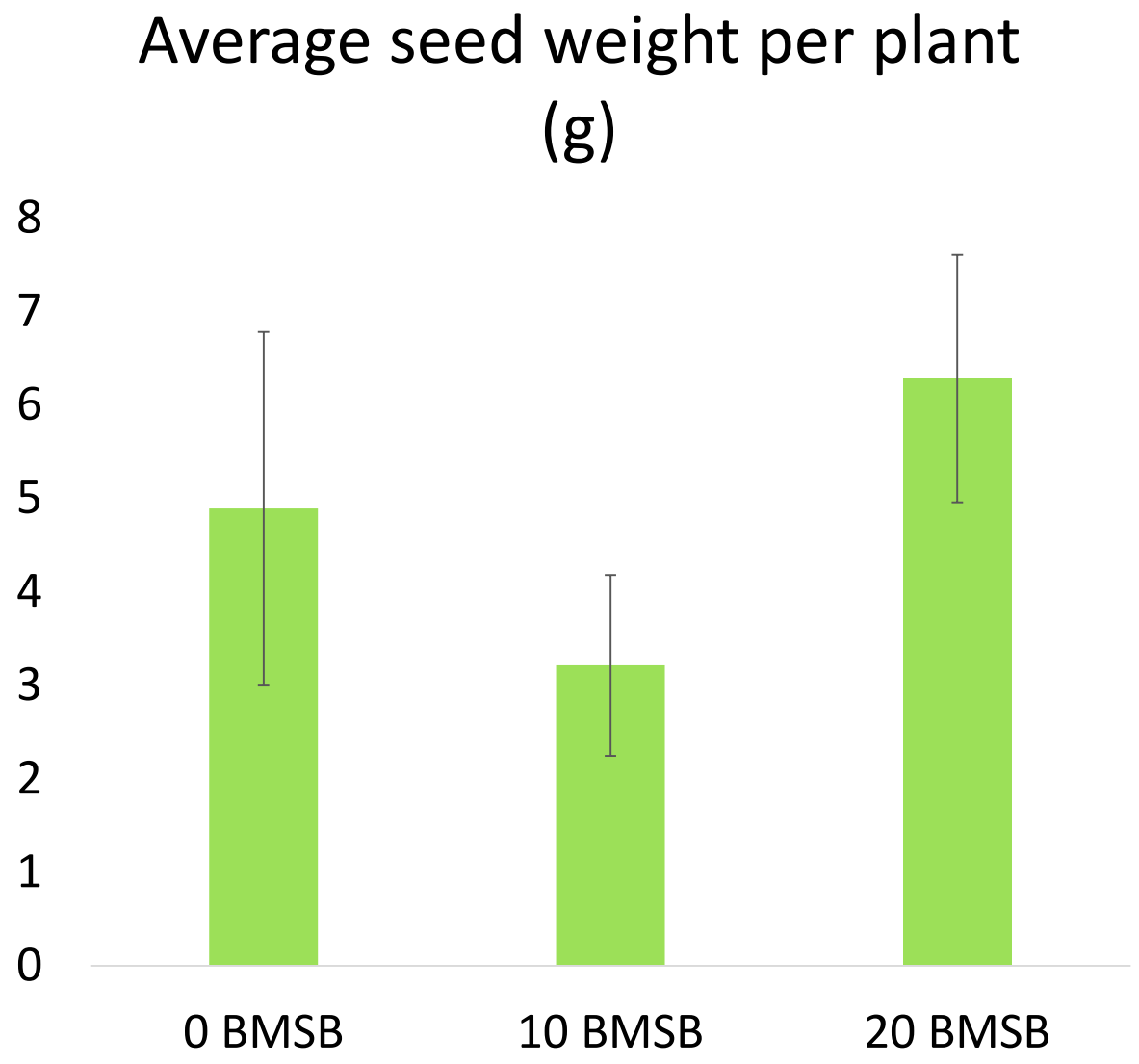
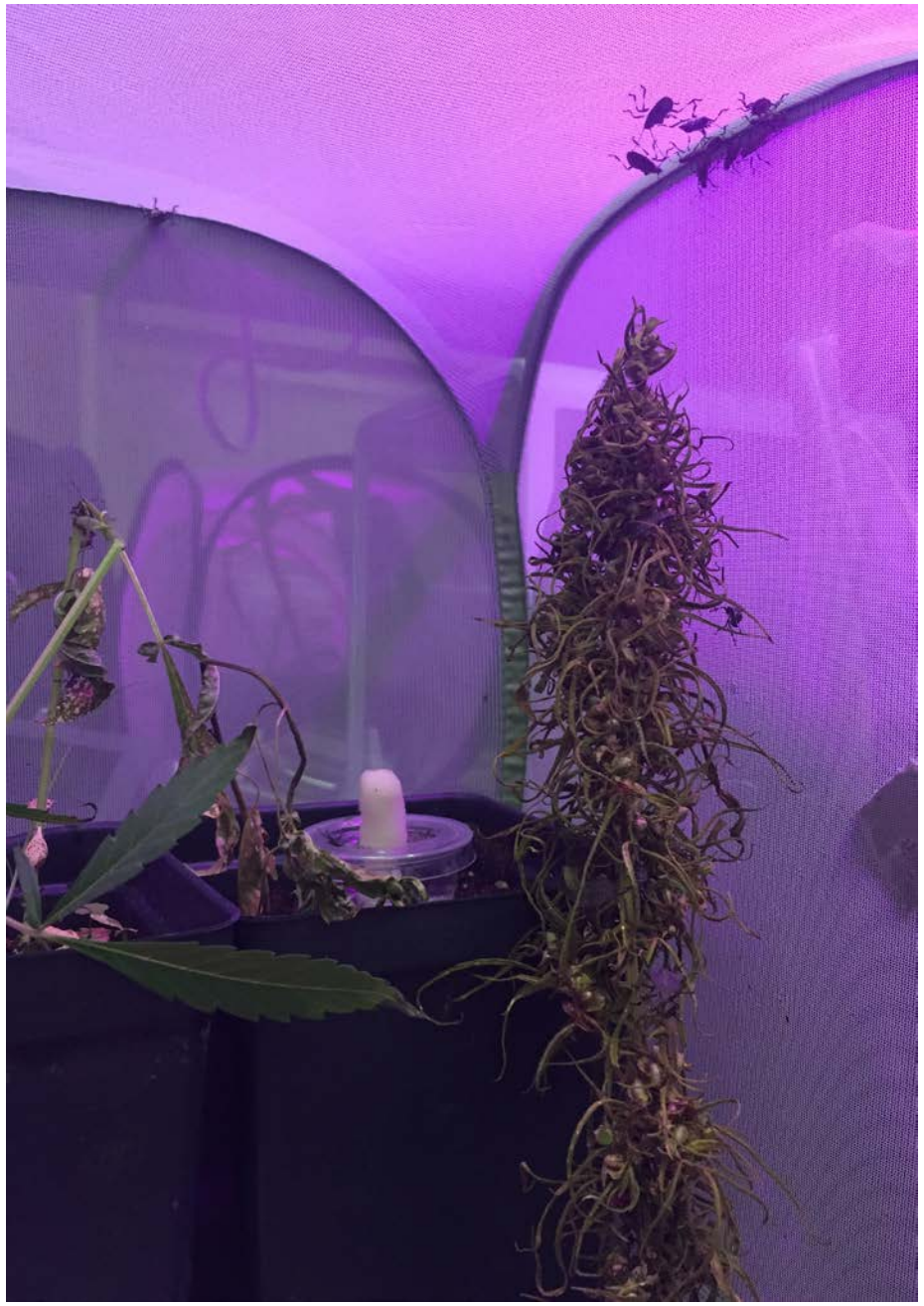
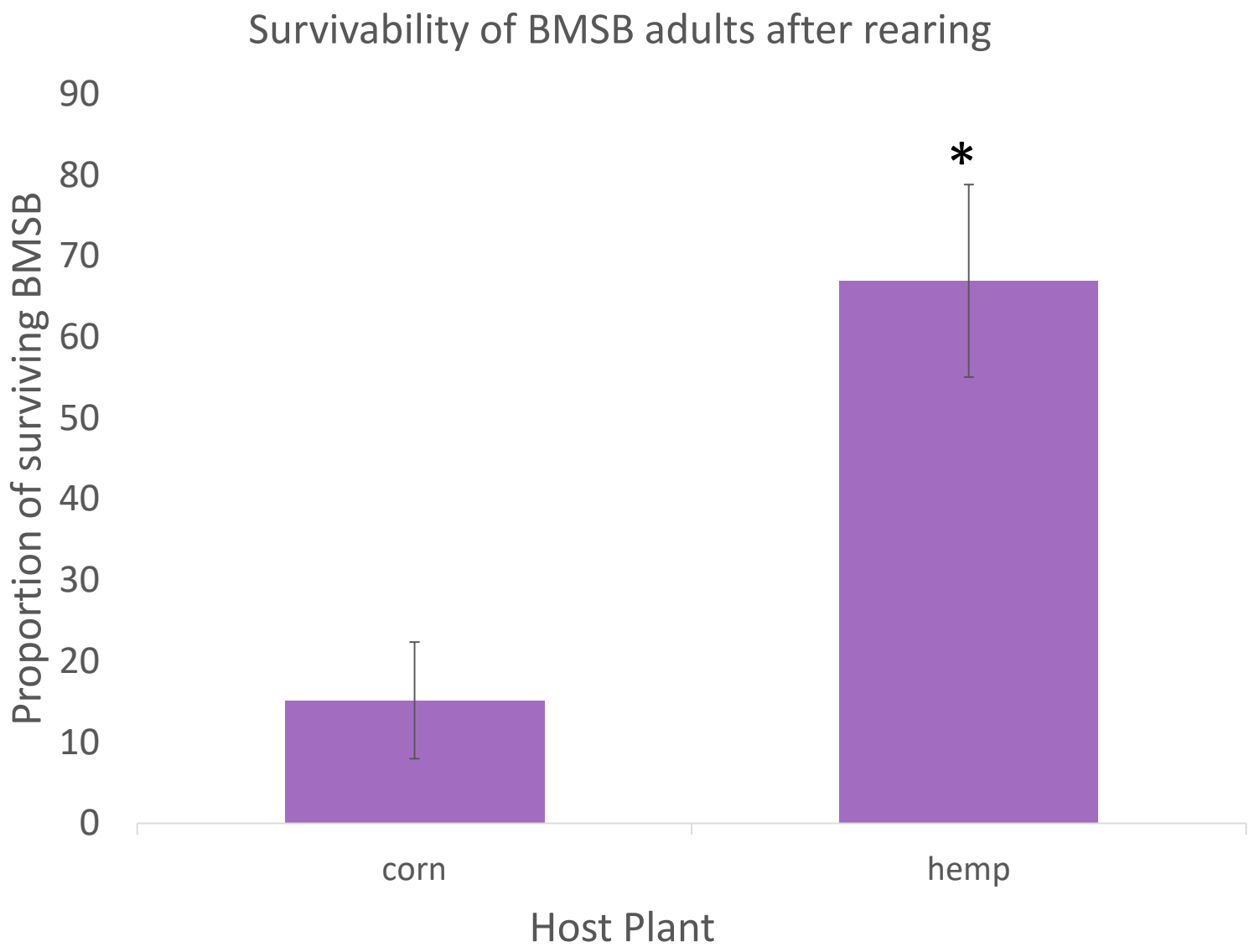
0 BMSB
10 BMSB
20 BMSB


Average seed weight per plant (g)
8
7
6
5
4
3
2
1
0
0 BMSB
10 BMSB
20 BMSB





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Although stink bugs are heavily present in hemp fields, currently, we do not believe that they are damaging plants. More research is needed. (link)

First Report of Brown Marmorated Stink Bug (Hemiptera: Pentatomidae) Associated With *Cannabis sativa* (Rosales: Cannabaceae) in the United States

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Subject Editor: Boris Castro

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Abstract

Brown marmorated stink bug, *Halyomorpha halys* (Stål), is a highly polyphagous pest in North America and Europe. Herein, we report our observations of this invasive stink bug on grain hemp (*Cannabis sativa*) in Virginia, which to our knowledge, is the first published report of *H. halys* associated with that crop. Effects of damage to hemp plants from this insect are unknown, so studies were initiated in 2018 to investigate further. Bugs were caged in varying densities for several weeks on seed heads of grain variety industrial hemp in field plots to document damage appearance and yield effects. Seeds were removed from plants in the laboratory, counted, and weighed to assess differences between treatments. In another study, bugs were reared on hemp seed heads in a lab setting from the second instar stage to adulthood. We found that bugs developed successfully to adulthood. Although further studies are needed, it appears that at this time, *H. halys* may not be a threat to yield and quality of industrial hemp.

Key words: stink bug, first report, industrial hemp

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Cannabis aphid – mummies, winged, and non-winged

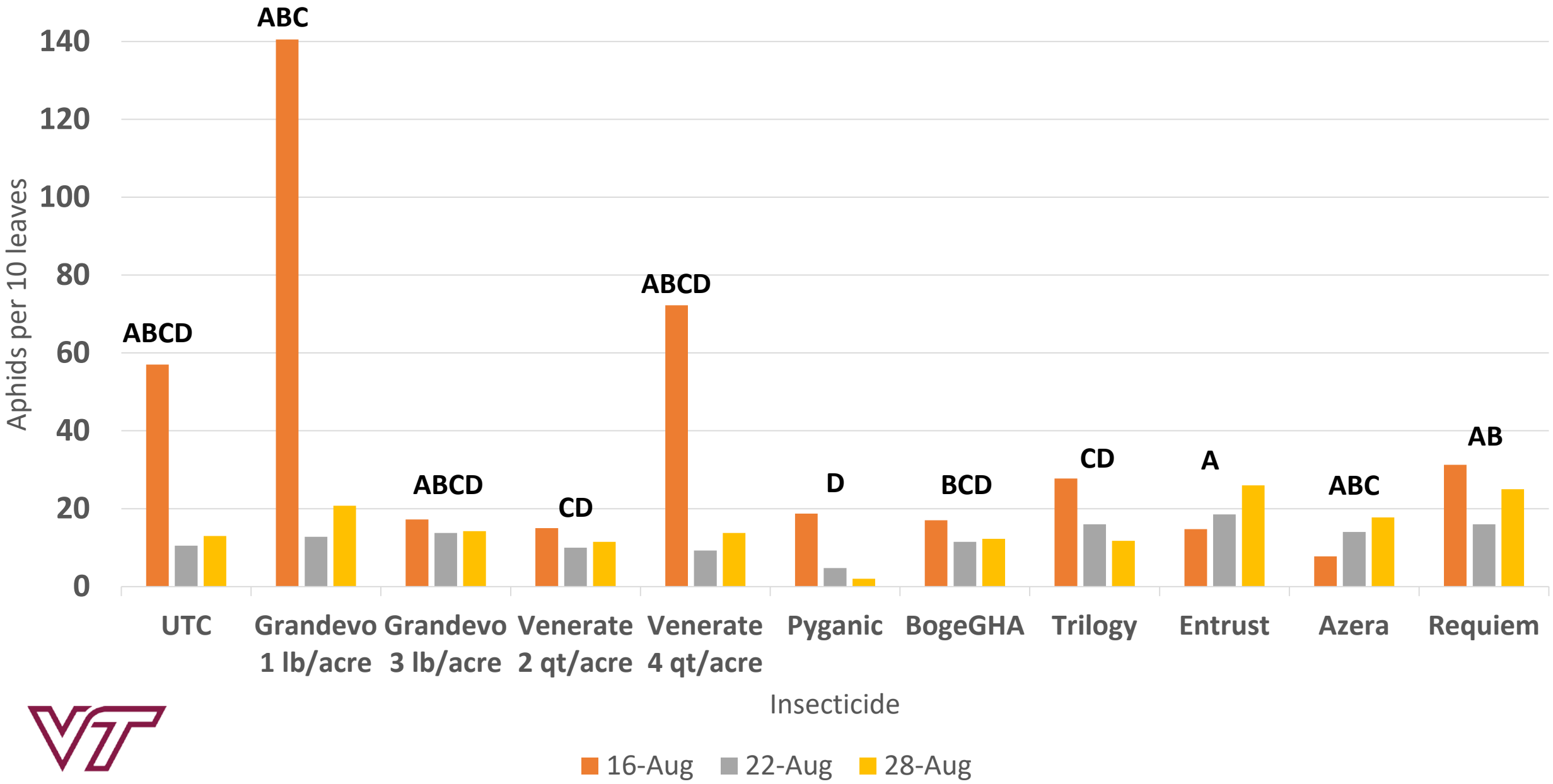
Cannabis aphid infestation on CBD hemp leaf

Cannabis aphid infestation on CBD hemp stem

Cannabis aphid infestation on CBD hemp – cast skins and sooty mold development from honeydew

This could be problematic during processing

Cannabis aphid in hemp (CBD) 2019



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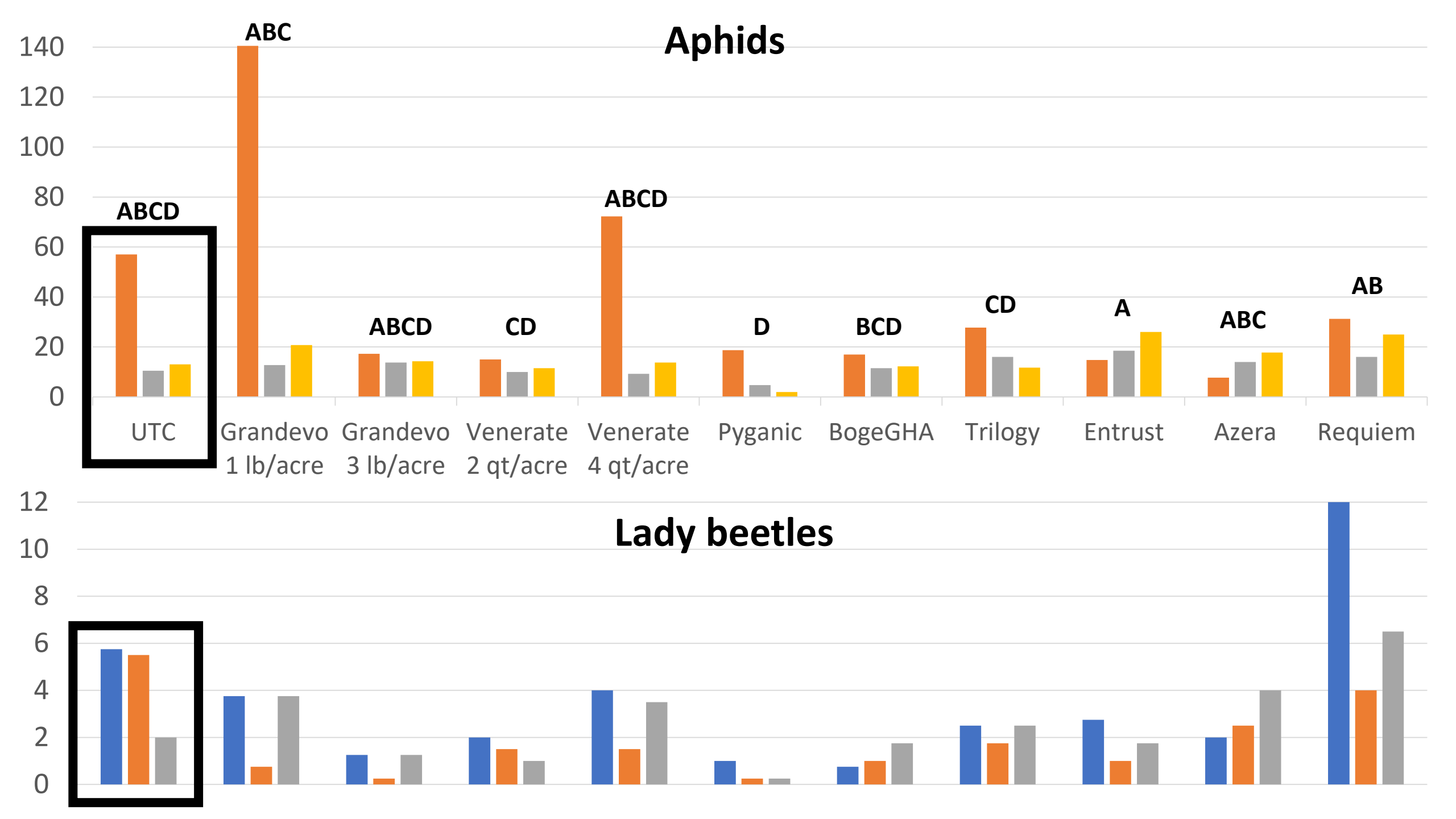
Aphids
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ABC
ABCD
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ABC
AB
UTC
Grandevo 1 lb/acre
Grandevo 3 lb/acre
Venerate 2 qt/acre
Venerate 4 qt/acre
Pyganic
BogeGHA
Trilogy
Entrust
Azera
Requiem
Lady beetles
12
10
8
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0

Leafhoppers – present in hemp, but are they causing damage or yield loss?
(Left image – hop leaf with 'hopperburn' from leafhopper feeding;
Right image – leafhoppers present in CBD hemp bud)

Spotted cucumber beetle

Grasshopper

Japanese beetle, Green June beetle

Pest complex – chewing pests



Frequently, generalist plant-feeding insects are present in hemp. Their presence is fleeting. Although damage may occur, yield is usually not affected.

Pest complex – chewing pests

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Corn earworm – feeds on seeds and buds of hemp

Yellowstriped armyworm – usually feeds on hemp foliage

Pest complex – chewing pests

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Yellowstriped armyworm (and other armyworms) has an inverted Y shape on the head capsule

Corn earworm

Early instar larva

Adult moths

Later instar larvae – color is not always an identifying factor

Seeds consumed by corn earworm

Seeds damaged by corn earworm

Corn earworm frass (poop!) on white plastic

Worms blend in when plants are dense. It is not always easy to locate them on plants. If growing on white plastic, this is a way to determine their presence.

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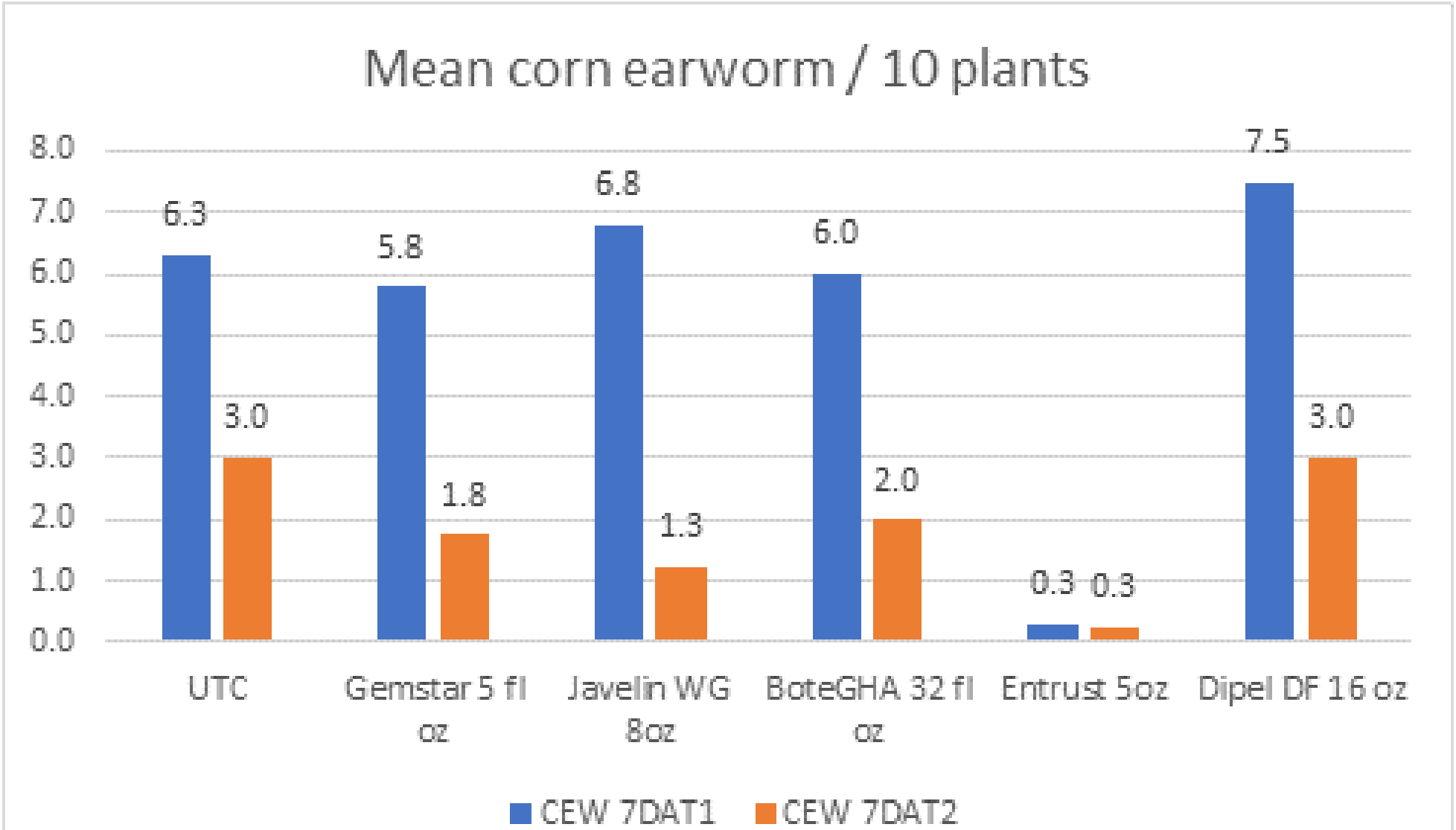

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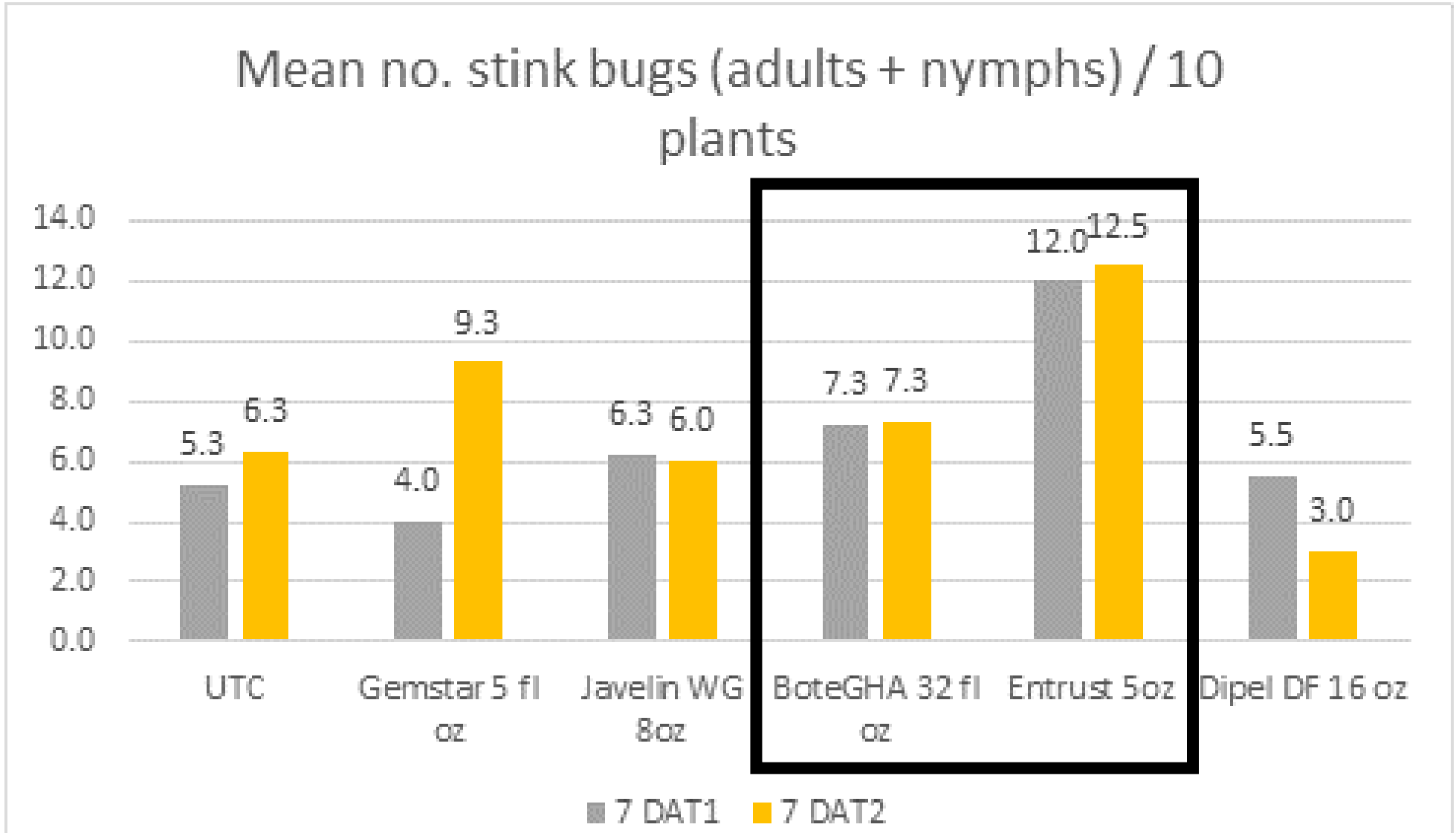

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1
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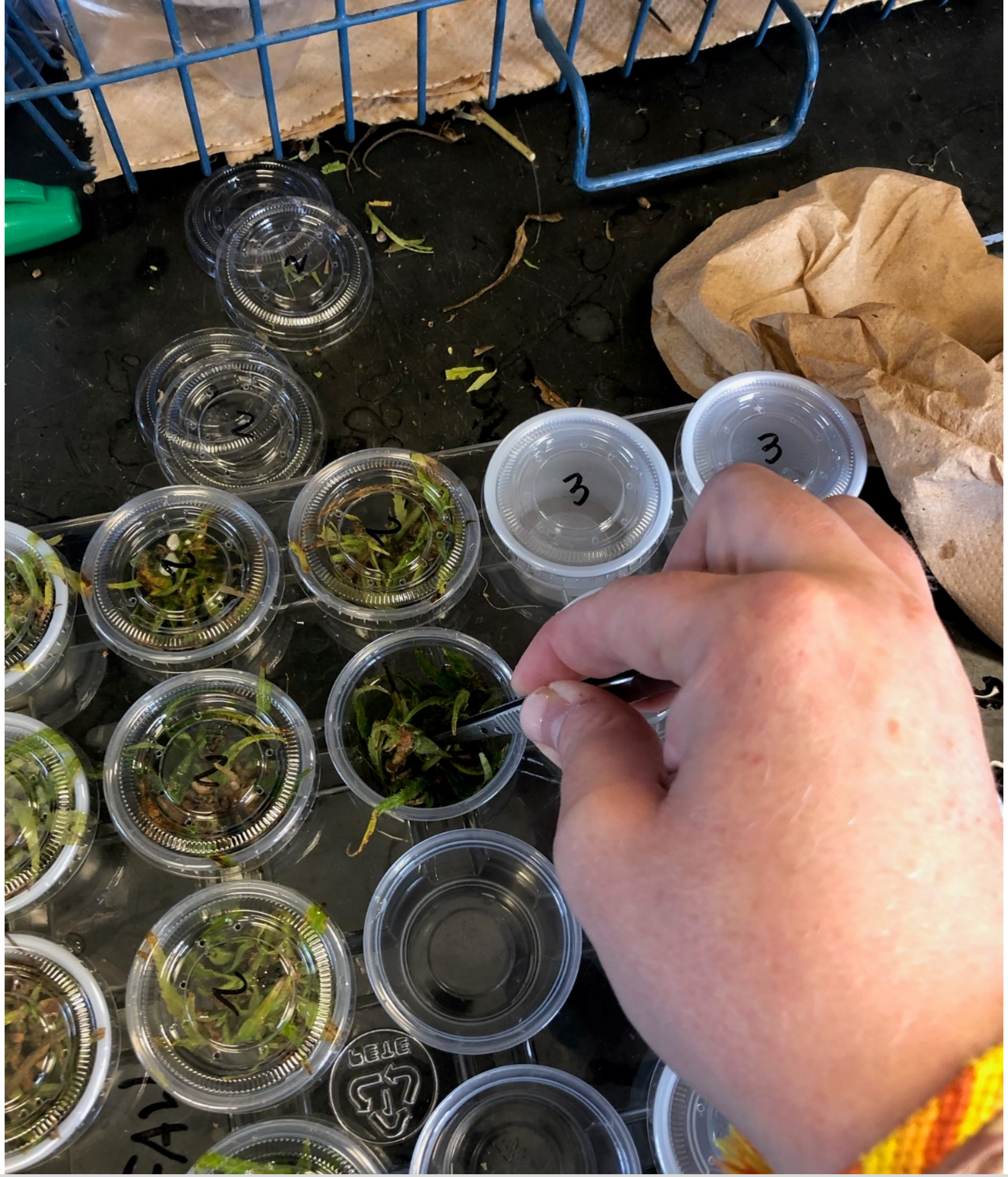
FAU

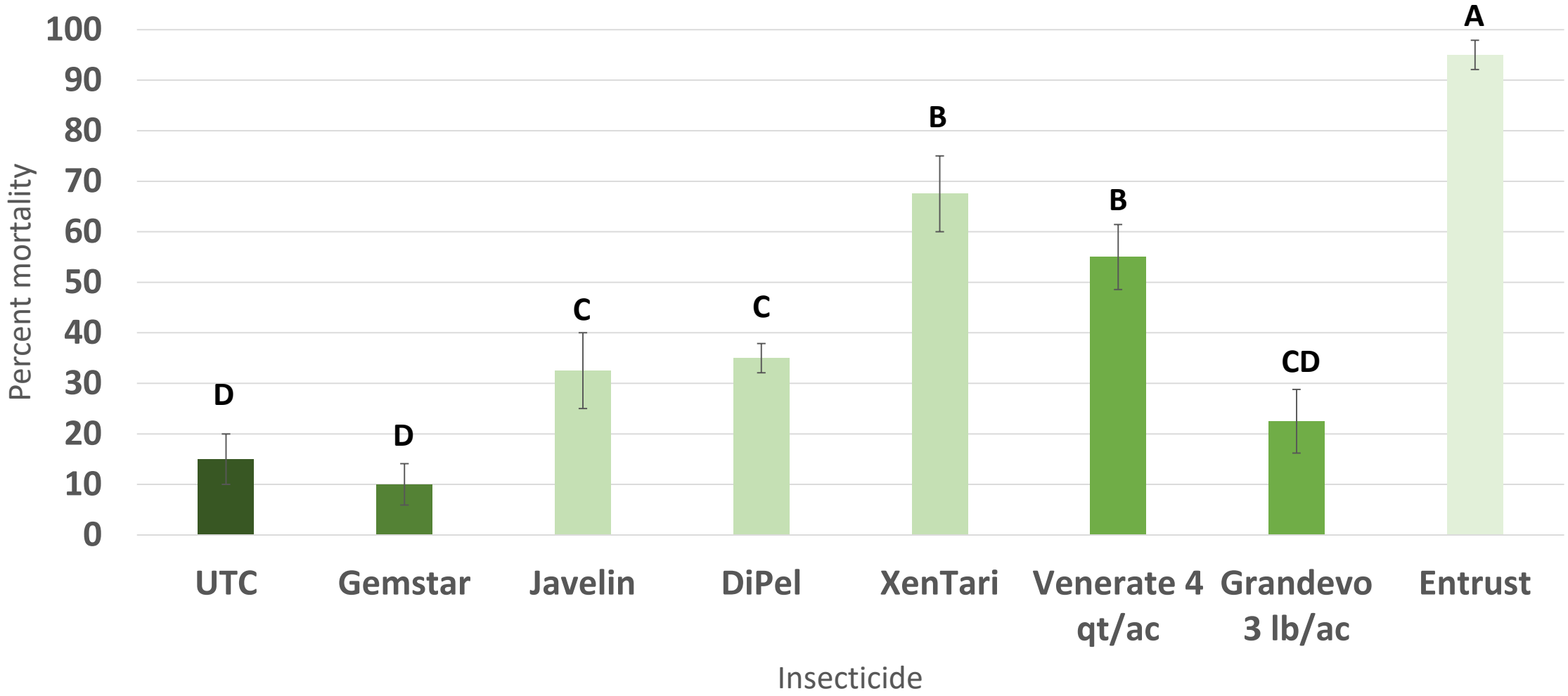

3
PYREX
12.5" X 6.5
No. 3140


3
3

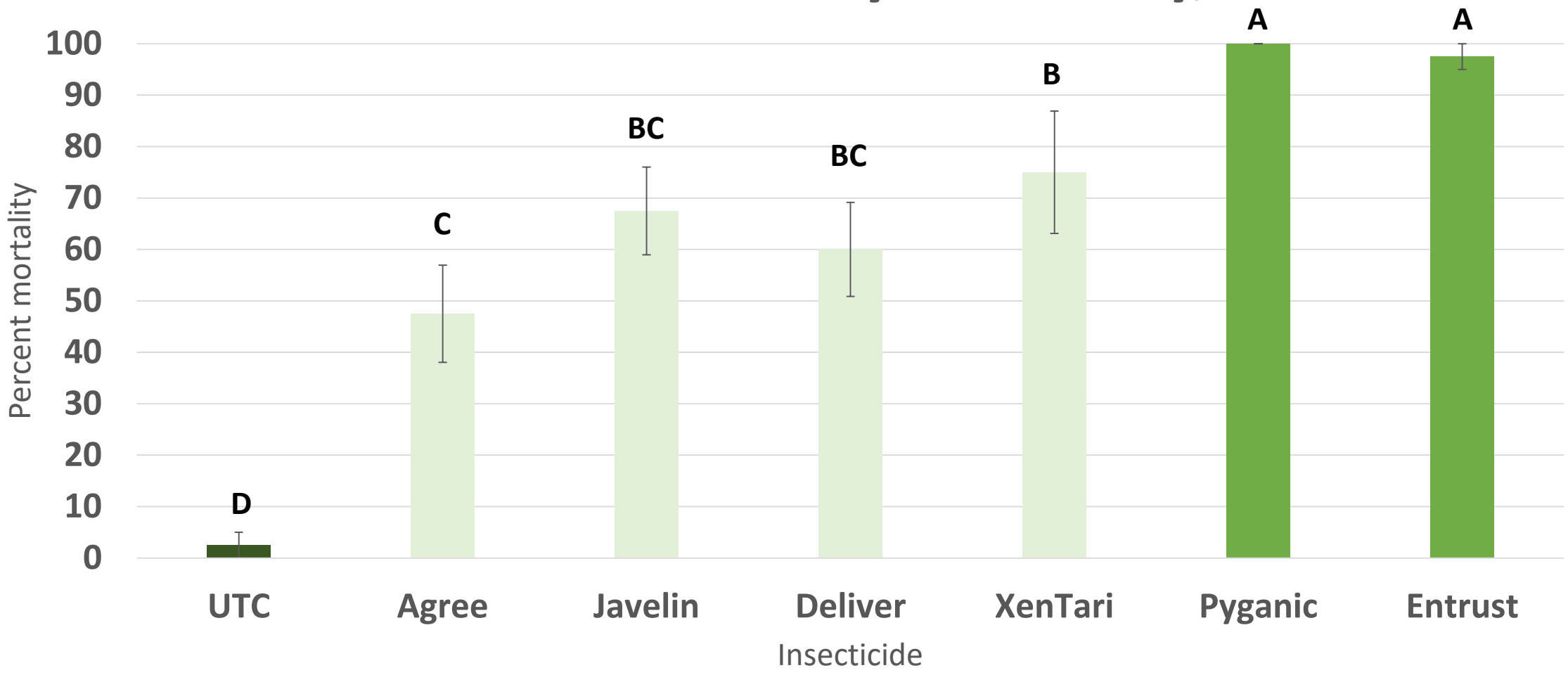

3



Corn earworm mortality – lab assay, field



Corn earworm mortality - lab assay, lab*



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Virus-infected corn earworm (*Helicoverpa zea*) on hemp

Virus-infected corn earworm (*Helicoverpa zea*) on hemp

Larva tunneling into stem

Larva tunneling into stem

Adult moth

European corn borer – tunnels into stem

European corn borer – tunnels into stem

European corn borer – tunnels into stem

Hemp russet mite damage leads to stunted, smaller plants.
Once physical symptoms are noticed, irreparable damage has already occurred.
Hemp russet mite is a cannabis specialist and feeds exclusively on cannabis plants.

Upward curling of leaves is a physical symptom of hemp russet mite damage.

Mites are not visible with the naked eye – must have magnification to determine presence.

Looks like potential pathogen damage – this is hemp russet mite damage

Bronze sections on top leaf are a result of hemp russet mite feeding damage. This is called ‘russeting’

Russet mite damage can lead to a drastic decrease in bud density

Hemp russet mite damage?

Use microscopy to confirm hemp russet mite presence.

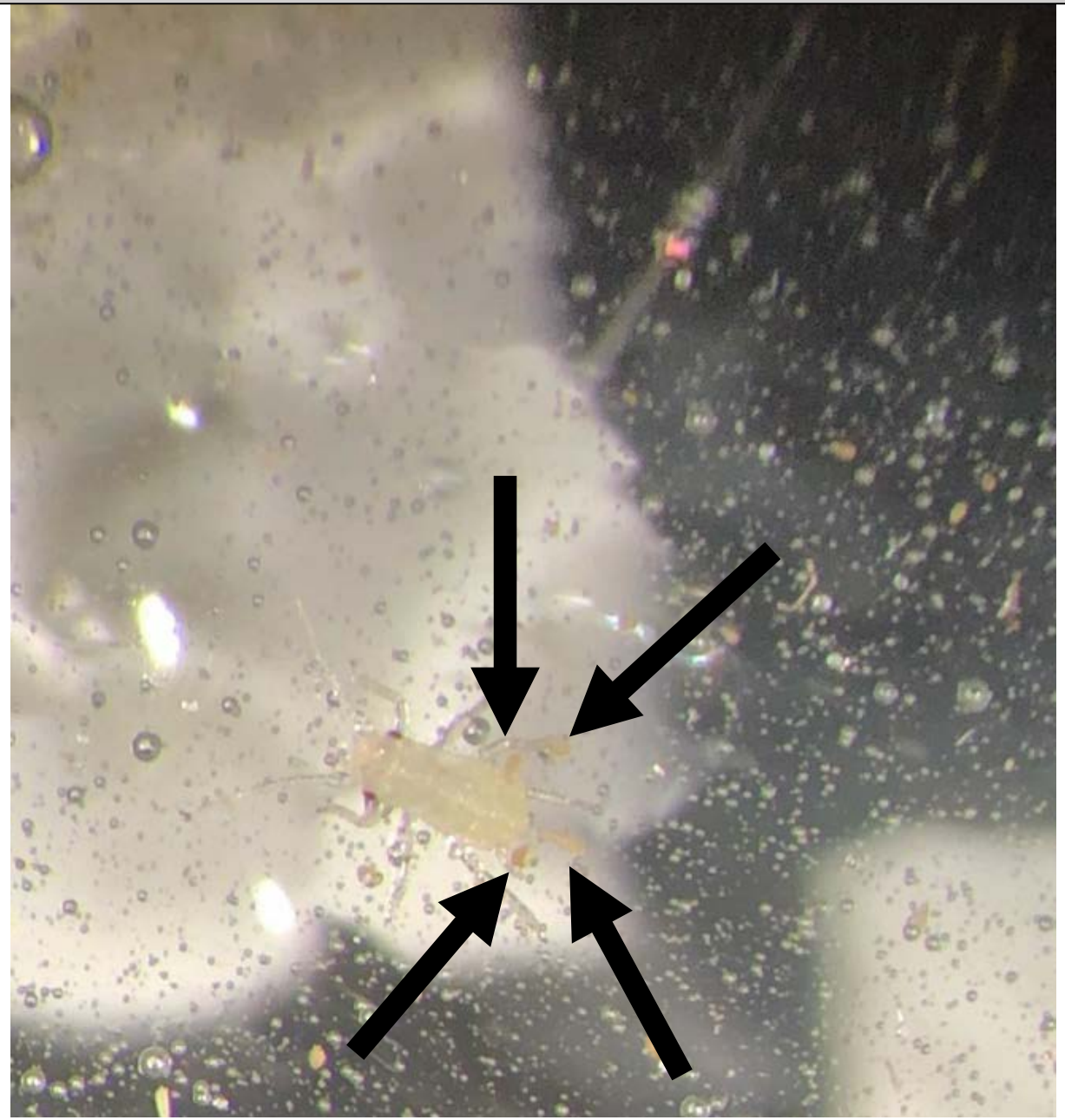
Hemp russet mite appearance under the microscope

Microscopy is necessary to diagnose hemp russet mite presence on plants

Hemp russet mite appearance under the microscope

Microscopy is necessary to diagnose hemp russet mite presence on plants

Hemp russet mite is so small that it can hitchhike on aphids



Two spotted spider mite appearance under the microscope

Two spotted spider mite damage causes stippling on leaves

Beneficial insect predators found in hemp

Lady beetle adults

Lady beetle pupae

Lady beetle larva

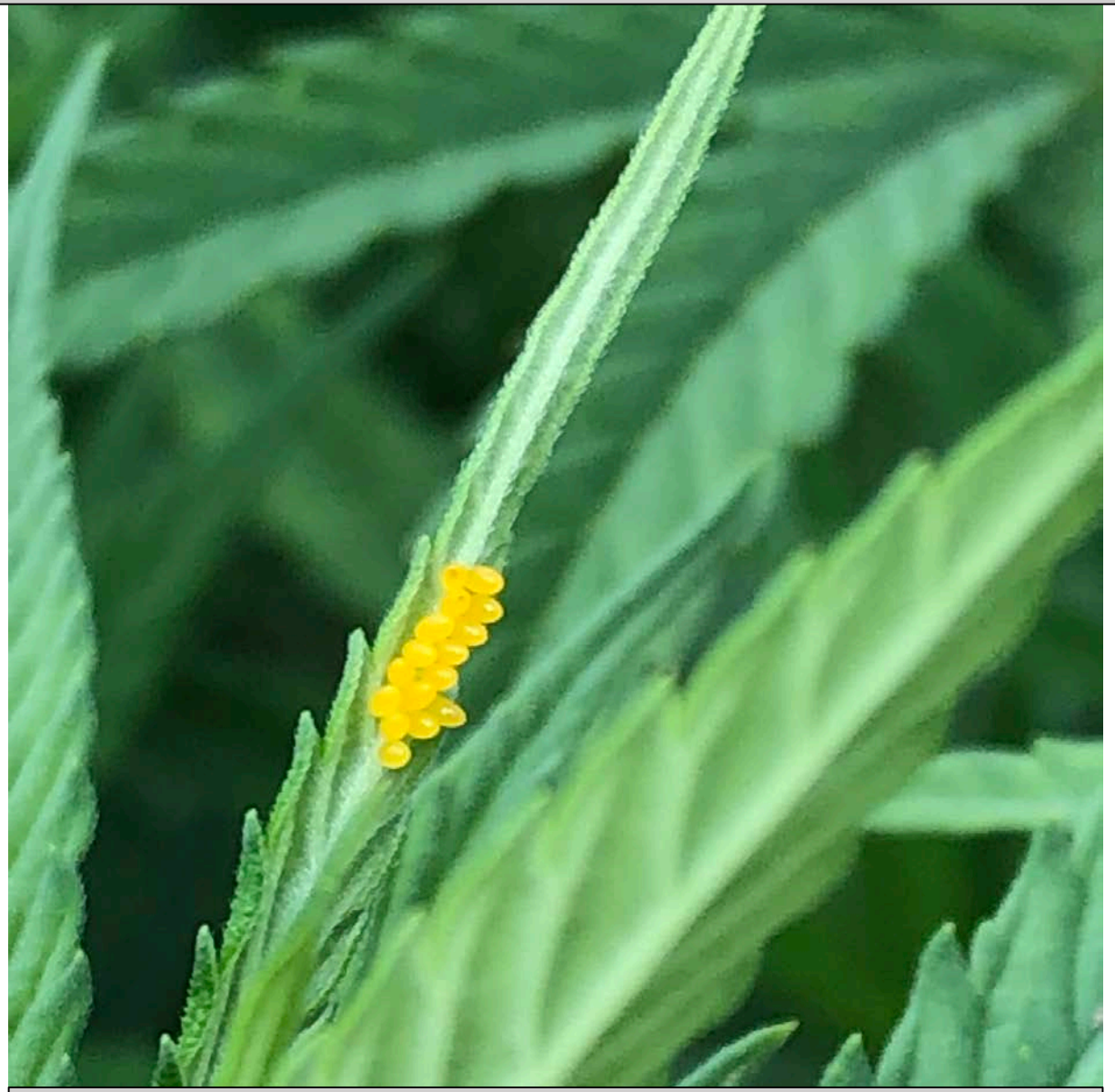
Green lacewing adult

Green lacewing larva

Damsel bug adult

Beneficial insect predators found in hemp

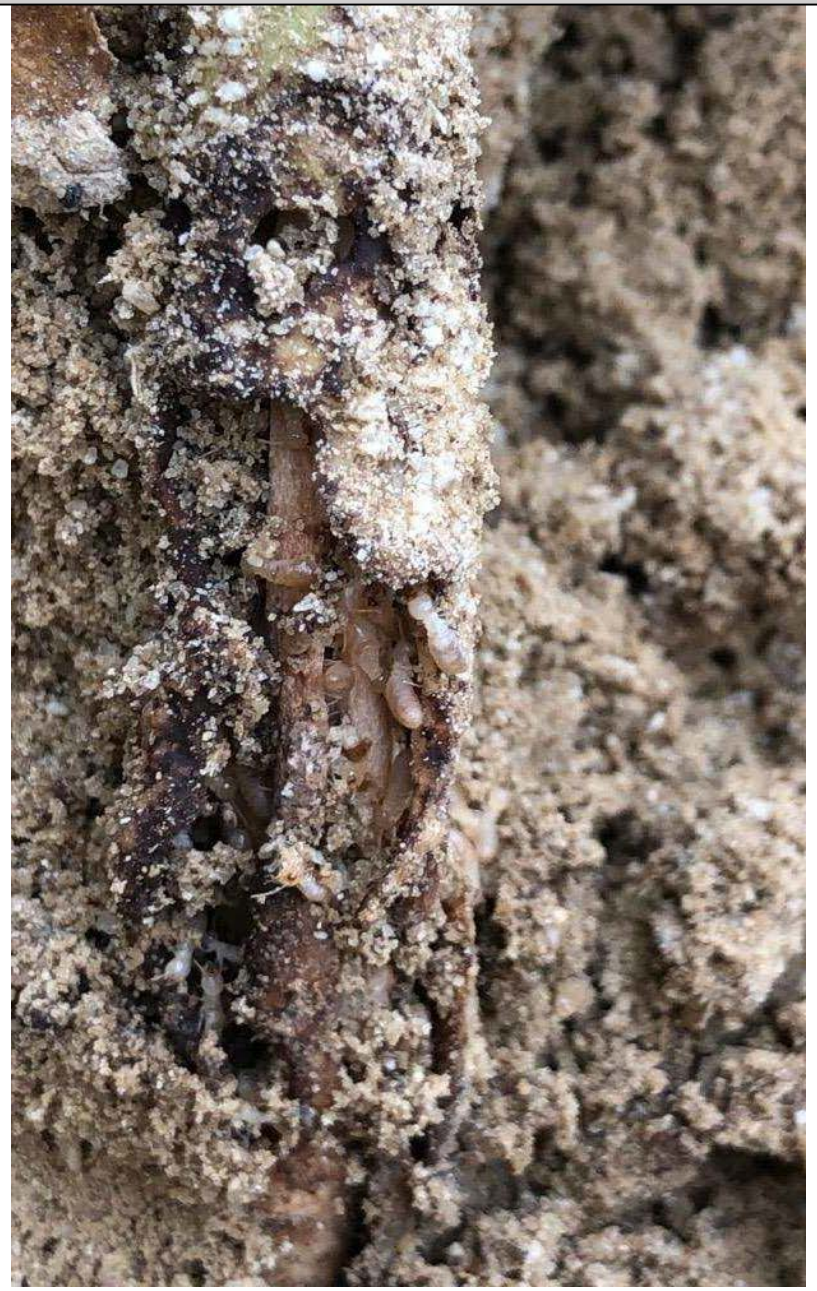
Lady beetle adults

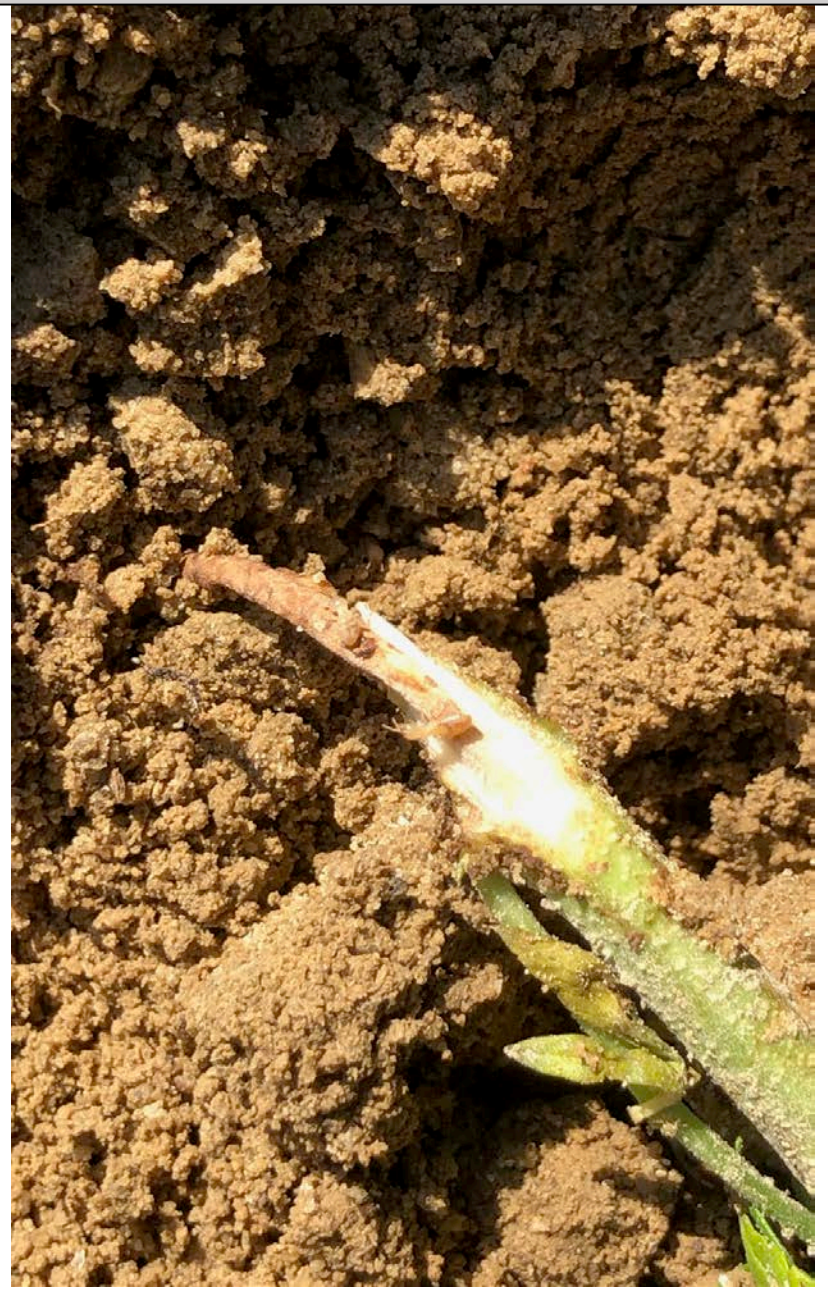


Lady beetle eggs

Fire ant damage to hemp

Termites and damage to hemp





Wireworms in soil of hemp field

Journal of Integrated Pest Management, (2019) XX(XX): XX; 1–11
doi: 10.1093/jipm/pmz023
Profile

OXFORD

Developing Insect Pest Management Systems for Hemp in the United States: A Work in Progress

Whitney Cranshaw,[1,5] Melissa Schreiner,[1] Kadie Britt,[2] Thomas P. Kuhar,[2,] John McPartland,[3] and Jerome Grant[4]

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Subject Editor: Carlos Bogran

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Abstract

Hemp (*Cannabis sativa* L.) is now being grown within the United States over a much broader geographic area and for different uses than during its last period of significant production that ended after World War II. Within the past 3 yr, a large number of arthropod species have been documented to feed on hemp in the United States. Among key pest species, corn earworm, *Helicoverpa zea* (Boddie) (Lepidoptera: Noctuidae), has demonstrated greatest potential for crop injury, being particularly damaging to flower buds. Hemp russet mite, *Aculops cannibicola* (Farkas), and cannabis aphid, *Phorodon cannabis* Passerini, are the two species observed most damaging among those that suck plant fluids. Eurasian hemp borer, *Grapholita delineana* Walker, is widely present east of the Rocky Mountains and appears to have potential to significantly damage both flower buds and developing seeds. Numerous species of caterpillars, grasshoppers, and beetles chew hemp foliage; the severity of these defoliation injuries appears to be minimal, but needs further study. Similarly, numerous seed feeding hemipterans, most notably stink bugs and

Virginia Tech is one of the universities working to address insect pest management in hemp. This article will be especially useful to those in Colorado, Tennessee, and Virginia. (link)

Spotted cucumber beetle

Grasshopper

Japanese beetle, Green June beetle

Pest complex – chewing pests



Frequently, generalist plant-feeding insects are present in hemp. Their presence is fleeting. Although damage may occur, yield is usually not affected.

Pest complex – chewing pests

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Defoliation

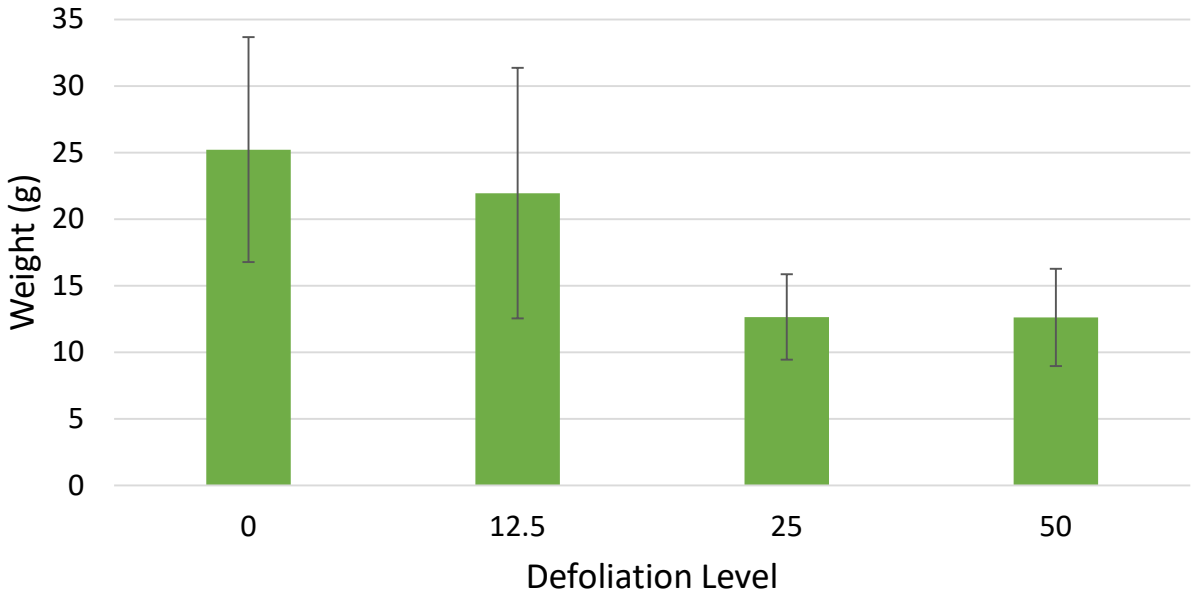
Defoliation

What is hemp plant yield response to insect defoliation?

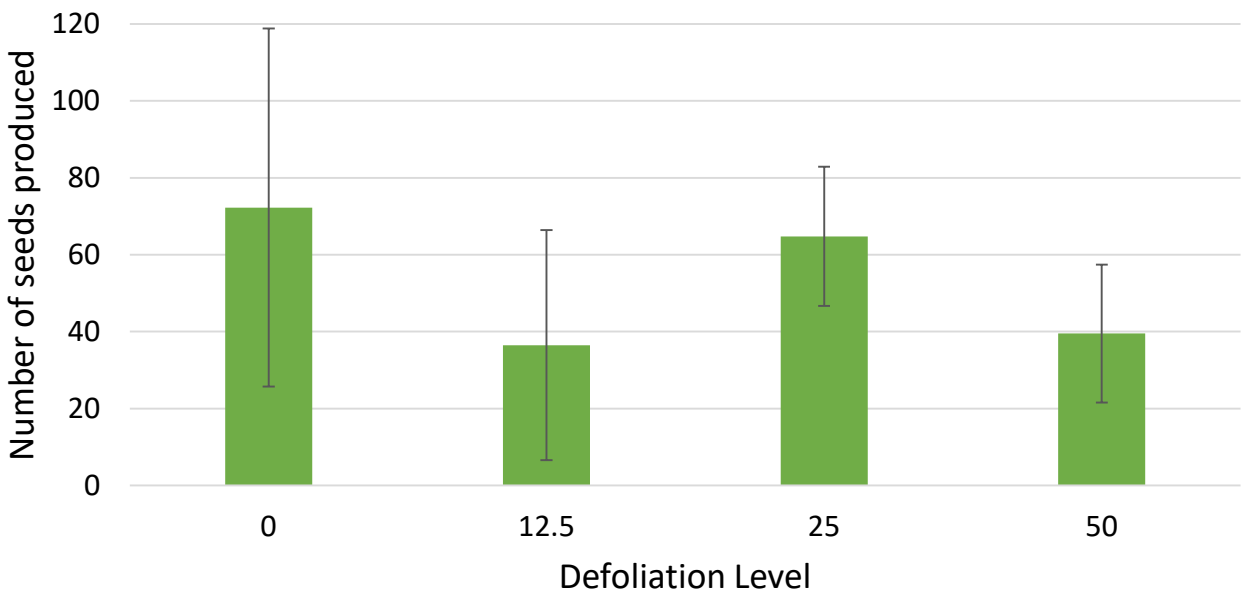
Defoliation studies in other crops

Artificial Defoliation

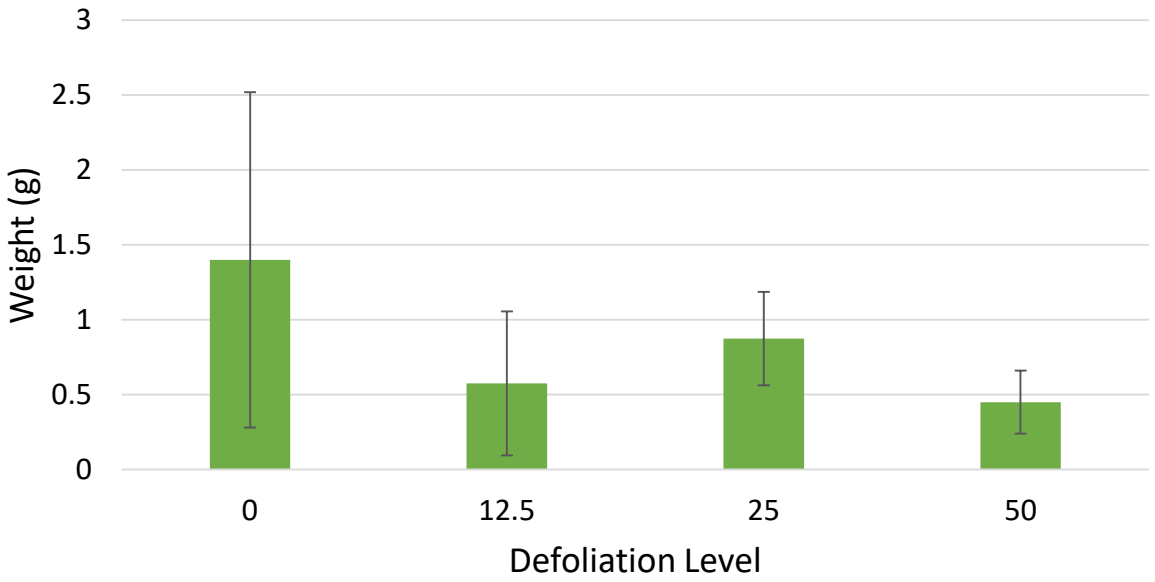
Mean Overall Plant Weight (g)



Number of Seeds Produced



Seed Dry Weight (g)



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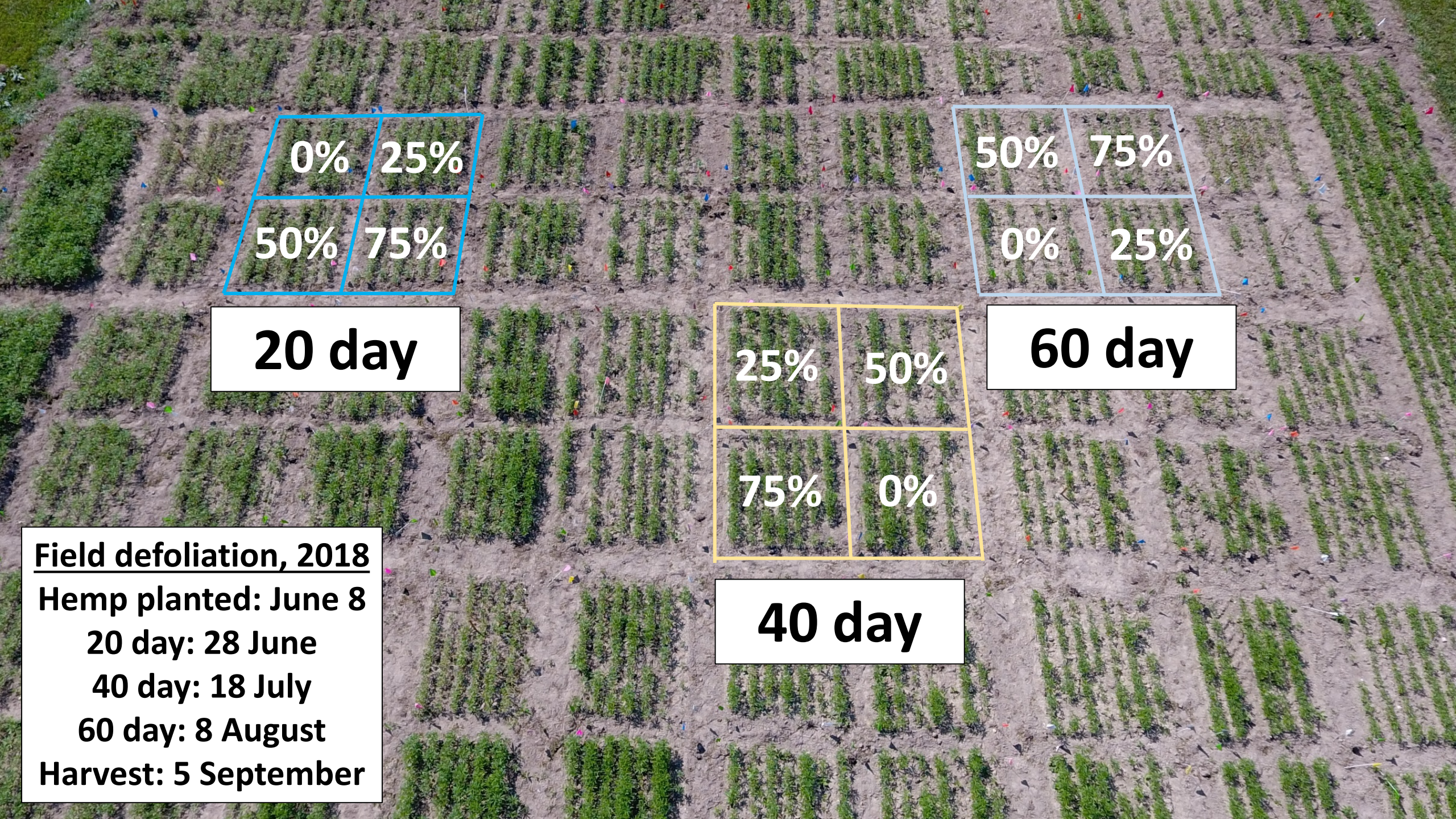
What is plant yield response to defoliation?

- Field study
- Manual defoliation of hemp plants to simulate insect herbivory
- Treatments
  - Timing of damage: 20, 40, and 60 days post-planting
    - Early, mid, late-season damage
  - Amount of damage: 0, 25%, 50%, and 75% removal of leaf surface area
    - No, low, medium, and high levels of damage
  - ~90 day growing season


Field defoliation, 2018
Hemp planted: June 8
20 day: 28 June
40 day: 18 July
60 day: 8 August
Harvest: 5 September


0%
25%
50%
75%
20 day
25%
50%
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40 day
50%
75%
0%
25%
60 day
Field defoliation, 2018
Hemp planted: June 8
20 day: 28 June
40 day: 18 July
60 day: 8 August
Harvest: 5 September


Field defoliation, 2019
Hemp planted: 31 May
20 day: 19 June
40 day: 11 July
60 day: 1 August
Harvest: 4 September
2019 Plots


1


2


3


4


VT

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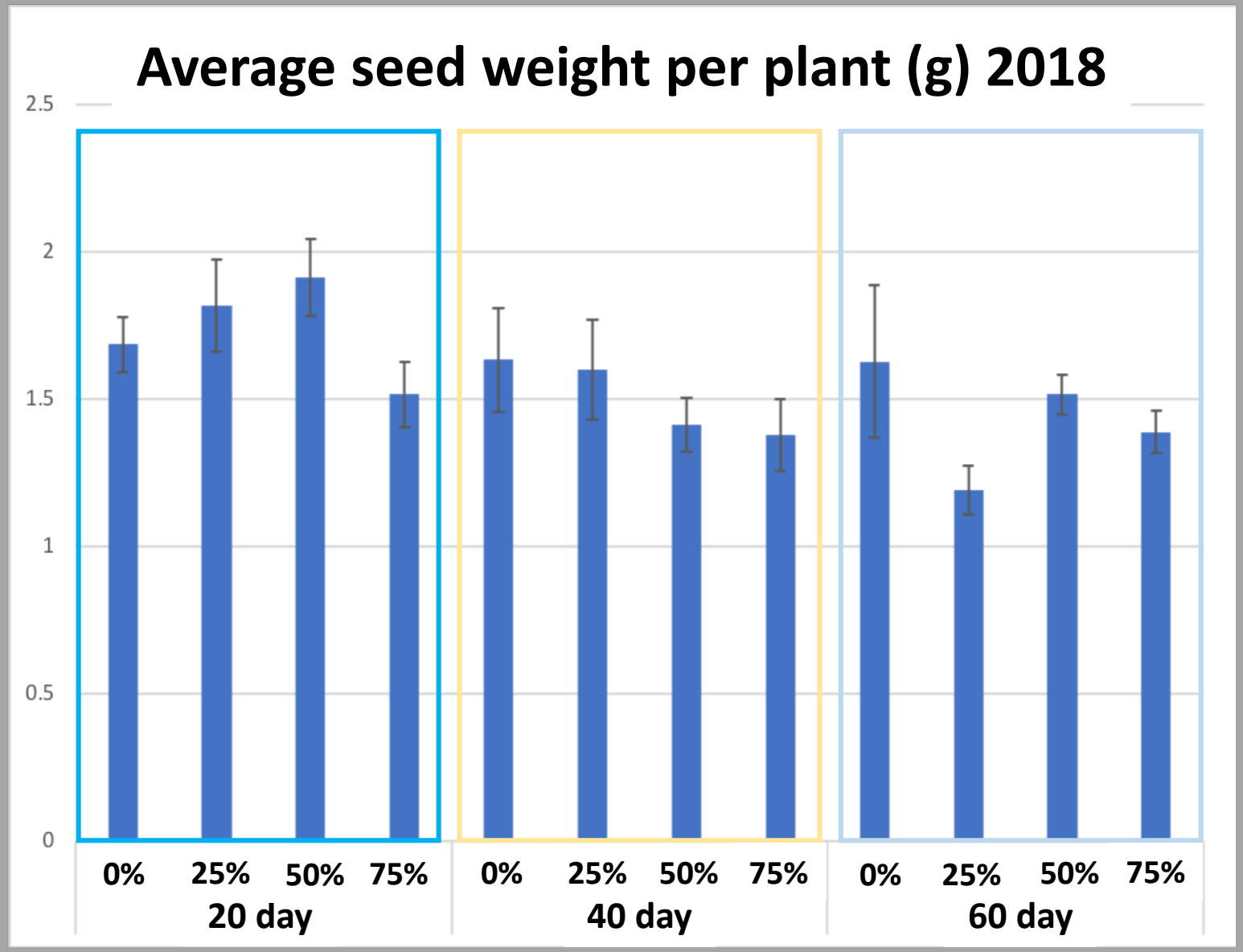
WARNING
AVISO
AVERTISSEMENT



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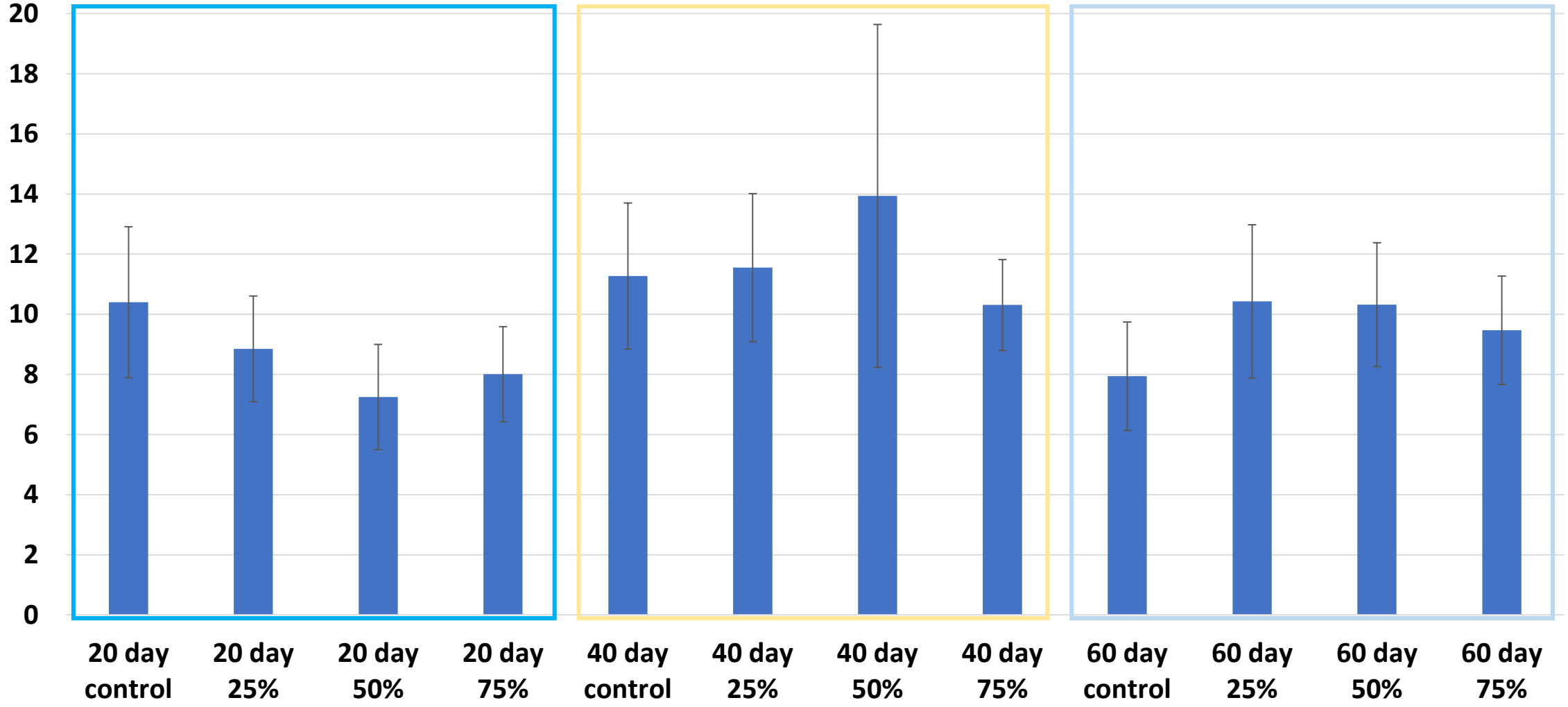
Average seed weight per plant (g) 2019




60 day 4

The next step

Does insect feeding damage increase THC content in plants?

Does it alter CBD content?

Chemical analysis

- THC production is a stress response in plants
- Any unfavorable condition can lead to stressed plants
- Does insect herbivory cause enough stress to elevate THC production levels in hemp?
- CBD and THC production are correlated, but could insect feeding lower CBD production levels in plants?
- Plant material from defoliation studies will be tested – grain and CBD
- If insect herbivory can alter chemical levels, is it isolated (one bud or local buds) or does it occur throughout the whole plant?

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- The Kuhar lab
- Katlyn Catron, Adam Taylor, Kelli Scott, Andy Dechaine, Brian Currin, Daniel Wilczek
- Travis Wagoner

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Questions?

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