

# Area-wide management approaches for year-round insecticide-resistant diamondback moth populations in Ventura County, CA

Maripaula Valdes-Berriz

Oleg Daugovish

Vegas Riffle

UC Cooperative Extension, Ventura County

**UNIVERSITY OF CALIFORNIA**  
Agriculture and Natural Resources



- Increasingly problematic in Ventura County,
- Unsustainable crop losses
- Widespread resistance to most modes of actions
- Climatic conditions allow survival and reproduction all year-round
  - 20°C (68 °F) optimal for reproduction (Saeed et al. 2009)
  - Emergence still happens as low as 4 °C (39 °F) and as high as 38 °C (100 °F) (Lui et al. 2002)
- Cole crop production all year

# General Objectives

- Exploring seasonal and regional trends in the counts of *Plutella xylostella* in Ventura County
- Inform growers of counts and results through regular updates
- Determine the efficacy of different tools for controlling *Plutella xylostella*

# Monitoring methods

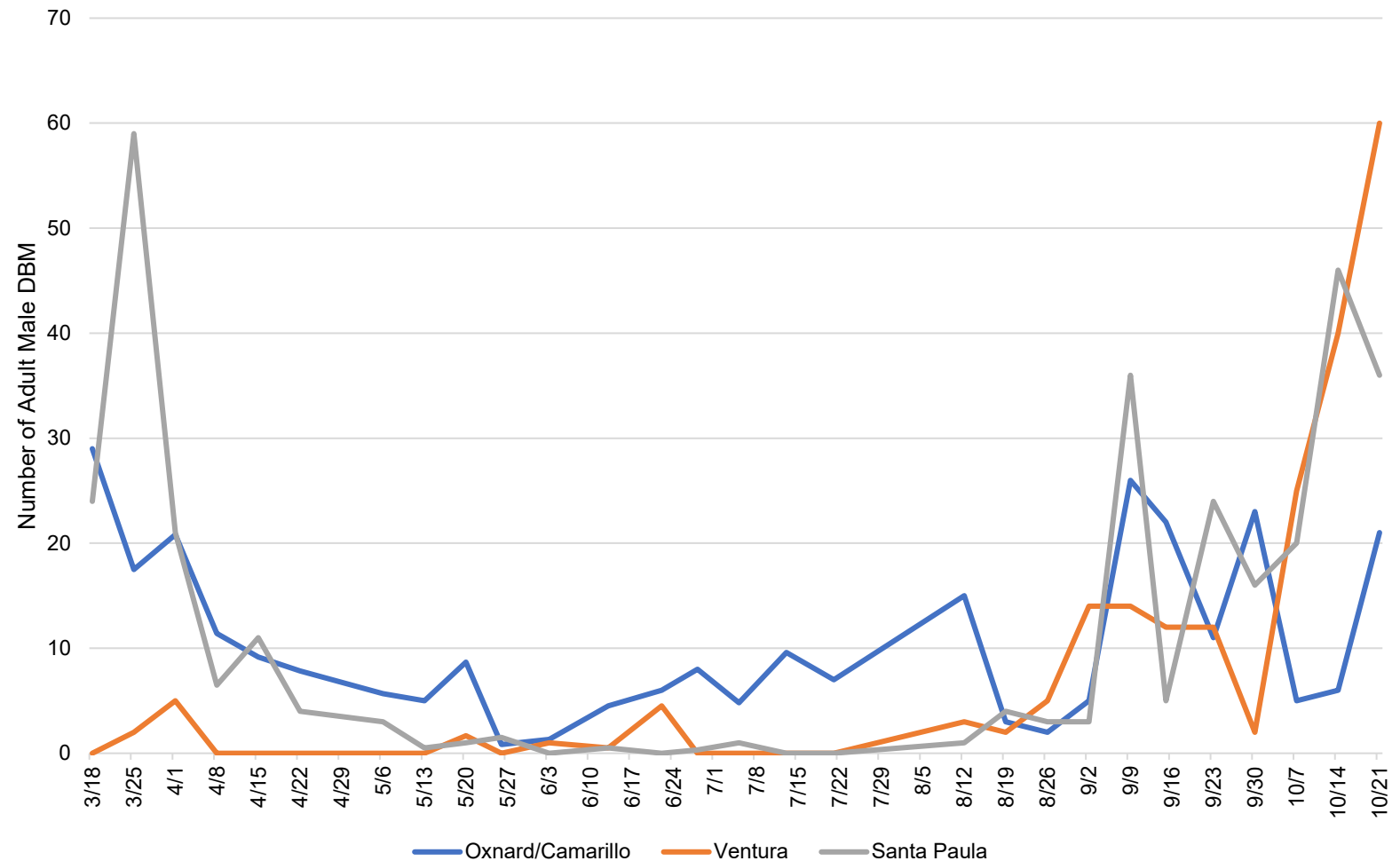


- Trece traps with pheromone lures (2) at 1 meter of height
- Checked weekly
- Changed as needed or every 4 weeks
- Some are permanent traps and some move as fields were harvested
  - *Permanent traps are in areas where cabbage fields are common throughout the year*
- Adult male counts were averaged by area/city
- Weather data obtained for each city from Historical Observations from NOAA/Nat. Weather Service
  - Temperature
    - Average temperature for the week
    - Average of daily maximum temperature for the week
  - Wind speed
    - Maximum wind speed for the week

# Monitoring Counts by City

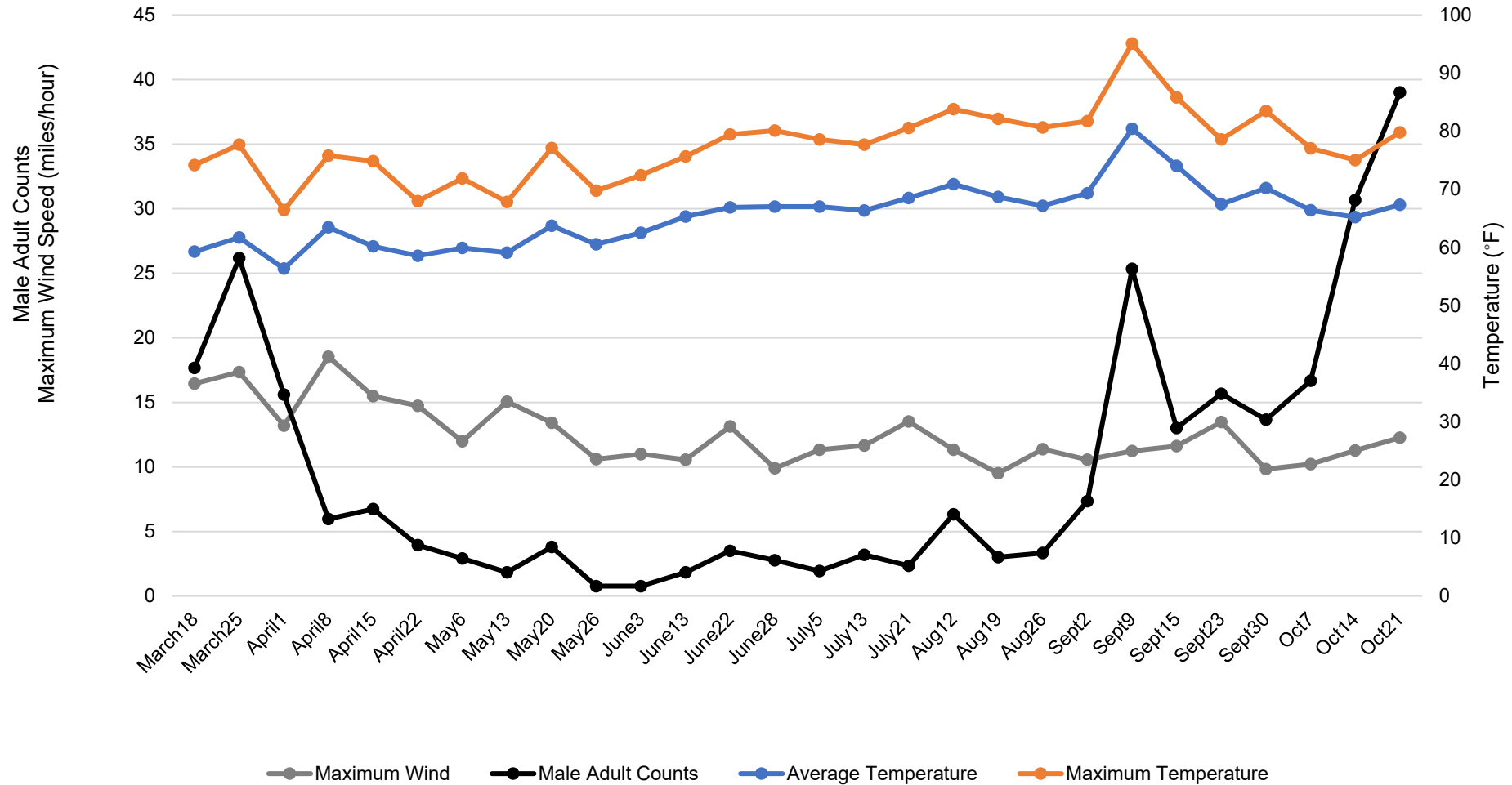
- Trap counts show the number of male adults only
- Some differences between cities, especially between May and August
- Lower counts overall April and September
- High variation within each region

Average Counts of Diamondback Moth Adult Males in 3 Areas of Ventura County



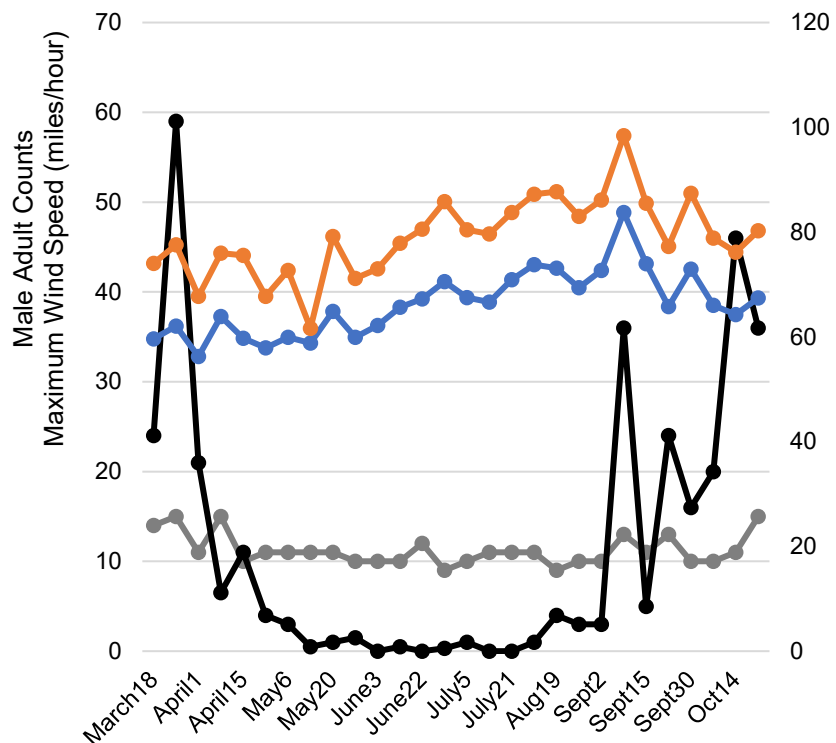
# Seasonal and regional trends

## Average Counts and Weather Trends for Ventura County



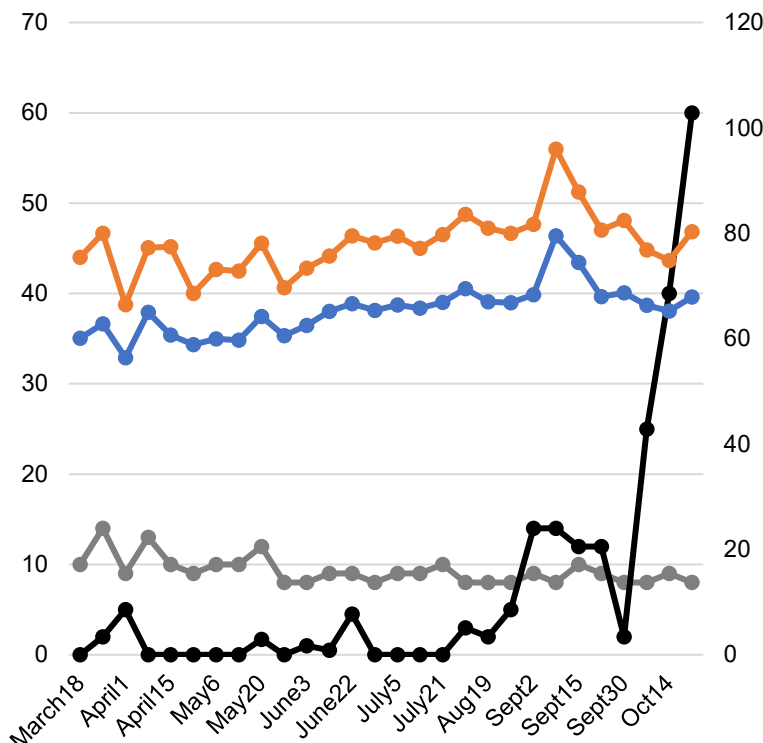
# Seasonal and regional trends

## Counts and Weather Trends in Santa Paula



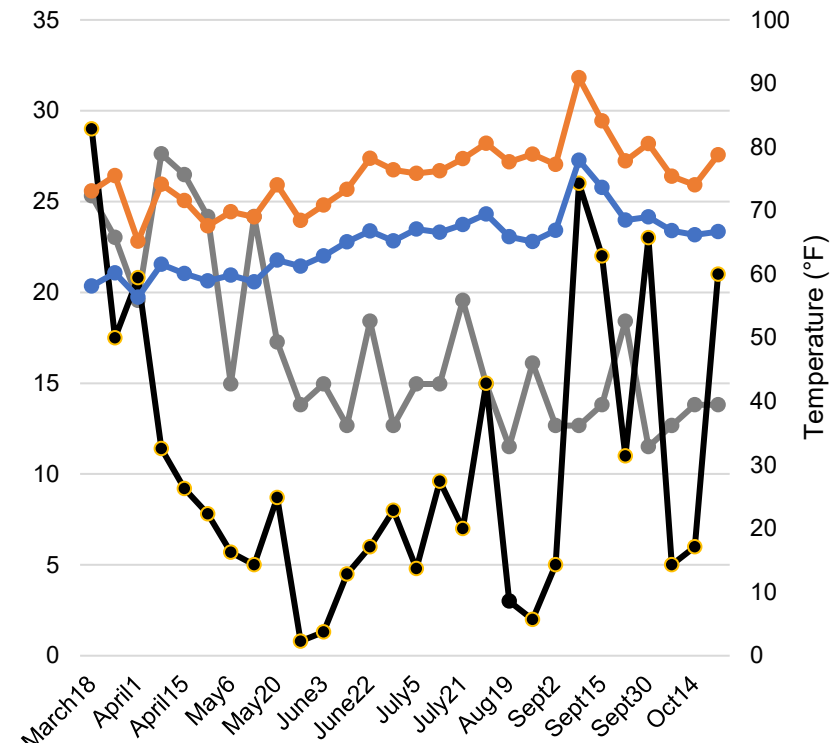
—●— Maximum Wind      —●— Male Adult Counts  
—●— Average Temperature      —●— Maximum Temperature

## Counts and Weather Trends in the City of Ventura



—●— Maximum Wind      —●— Male Adult Counts  
—●— Average Temperature      —●— Maximum Temperature

## Counts and Weather Trends in Camarillo and Oxnard



—●— Maximum Wind      —●— Male Adult Counts  
—●— Average Temperature      —●— Maximum Temperature

# Count map shared with growers



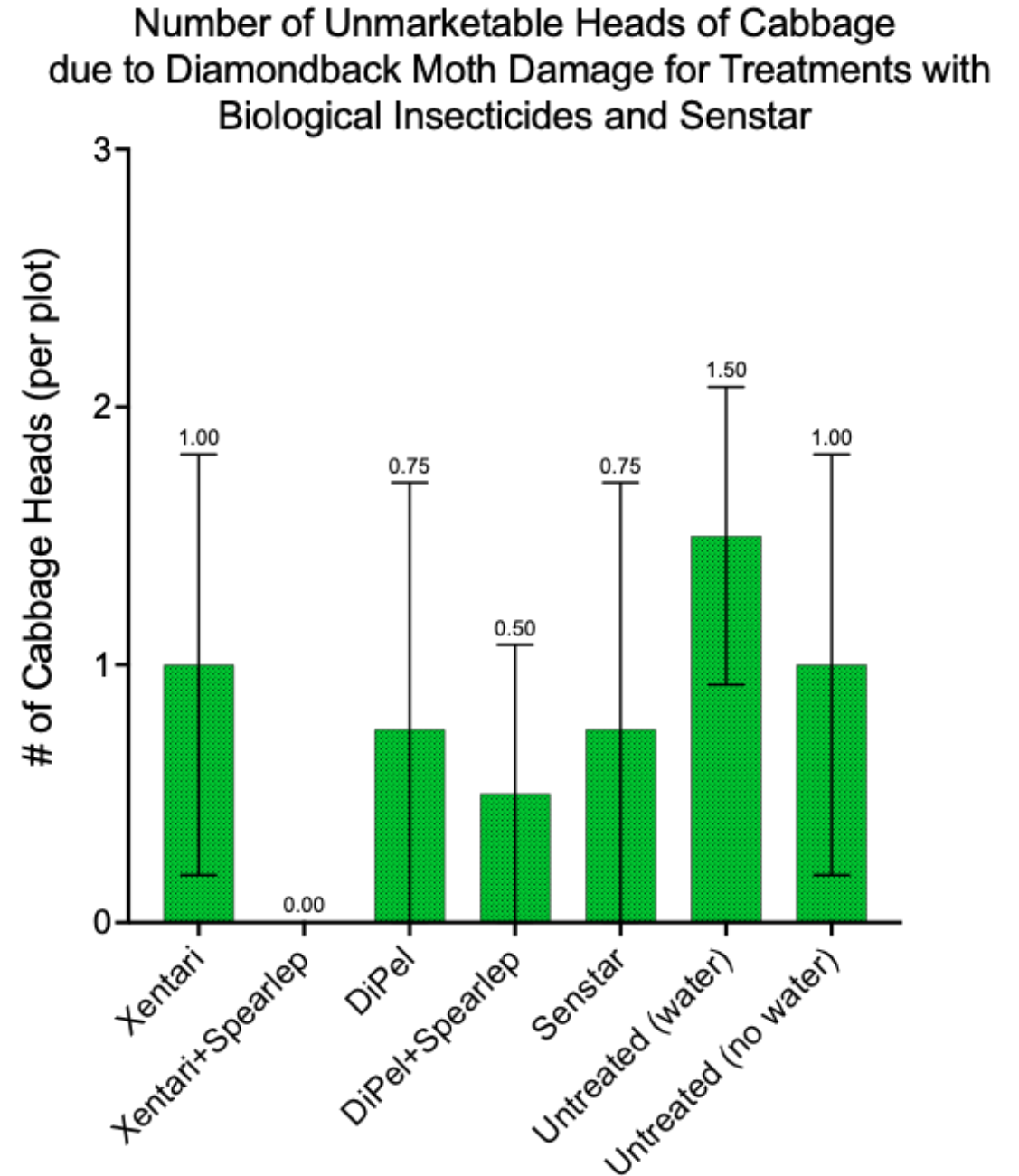


# Bioinsecticide trial: Methods

- Oxnard
- 7 treatments:
  - Xentari (Valent)+Surfactant
  - Xentari (Valent)+Surfactant+Spearlep (Vestaron)
  - DiPel (Valent)+Surfactant
  - DiPel (Valent)+Surfactant +Spearlep (Vestaron)
  - Senstar (Valent)
  - Untreated check (Exp. 1: not sprayed with water)/(Exp. 2: water+surfactant)
  - Untreated check (sprayed with water)
- Treated weekly
  - Experiment 1: 4 applications
  - Experiment 2: 2 application (crop destroyed)

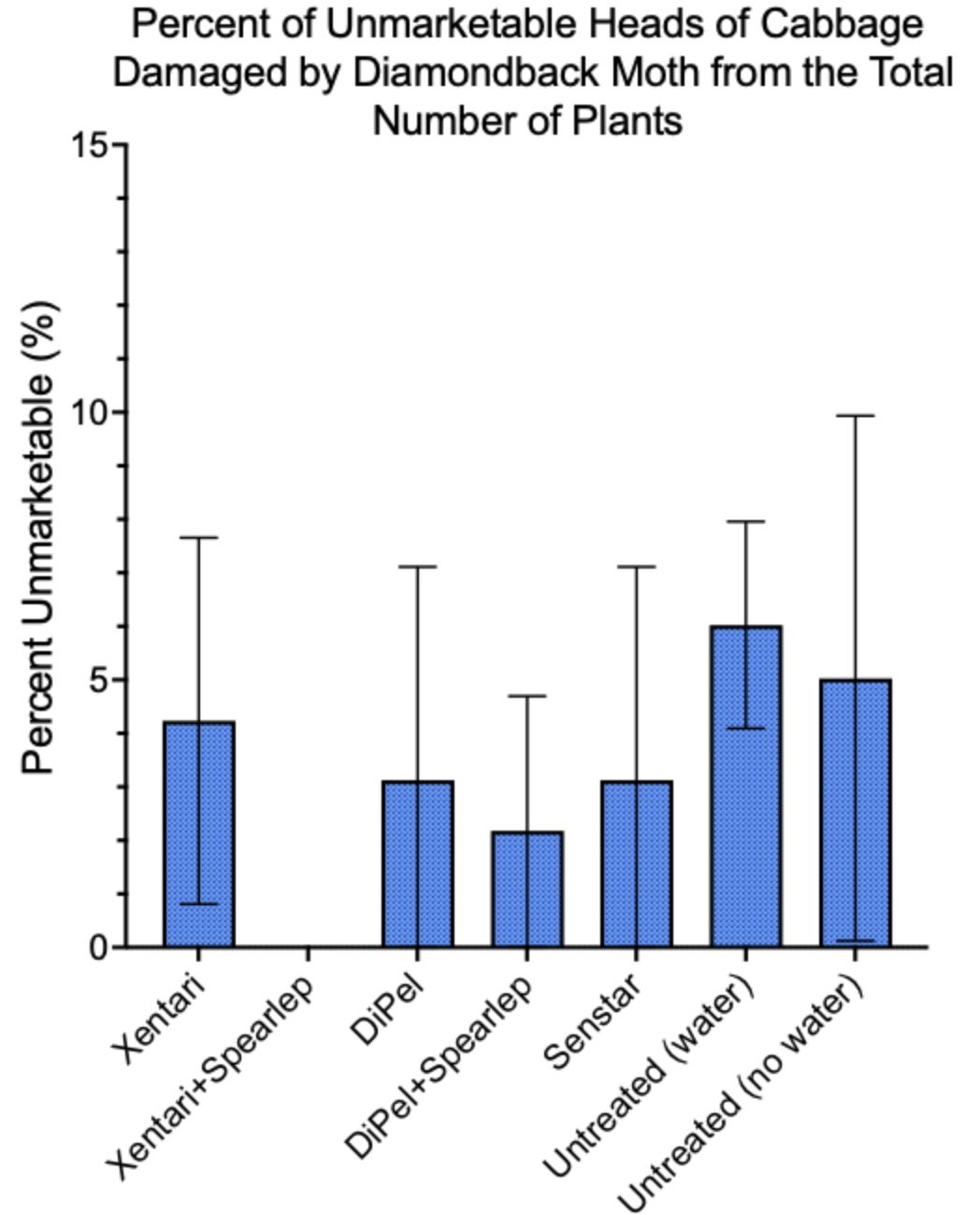
# Bioinsecticide trial #1: Damage by Counts

- Counts of head with damage after first harvest
- Lowest larvae counts on:
  - Xentari+Spearlep
  - DiPel+Spearlep
  - DiPel and Senstar also <1
- Important: these are small plots and recolonization from adjacent field is happening



# Bioinsecticide trial #1: Damage from Total

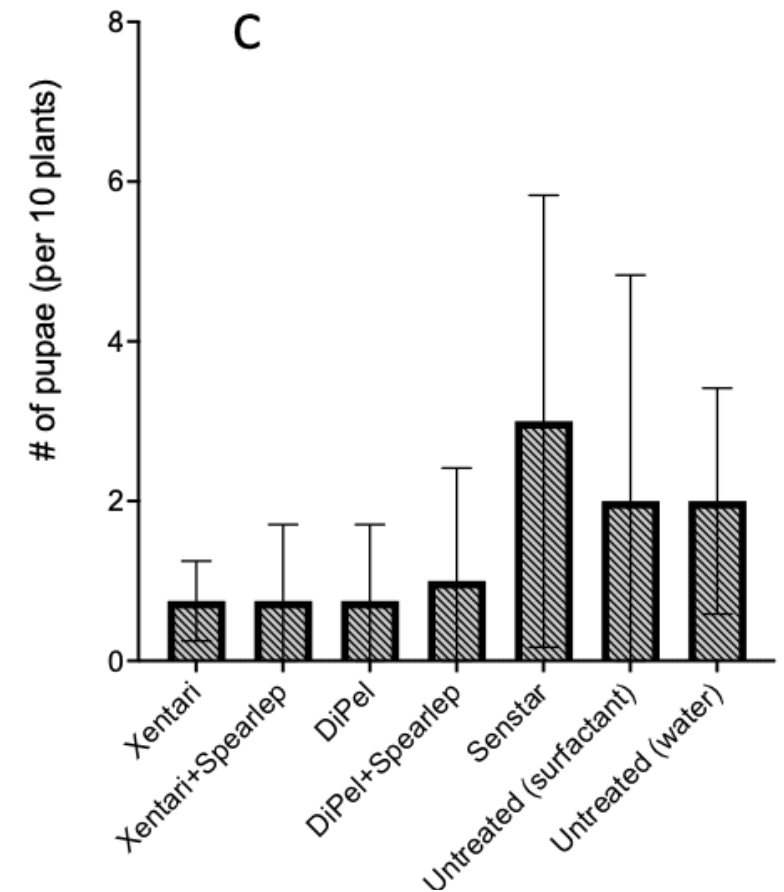
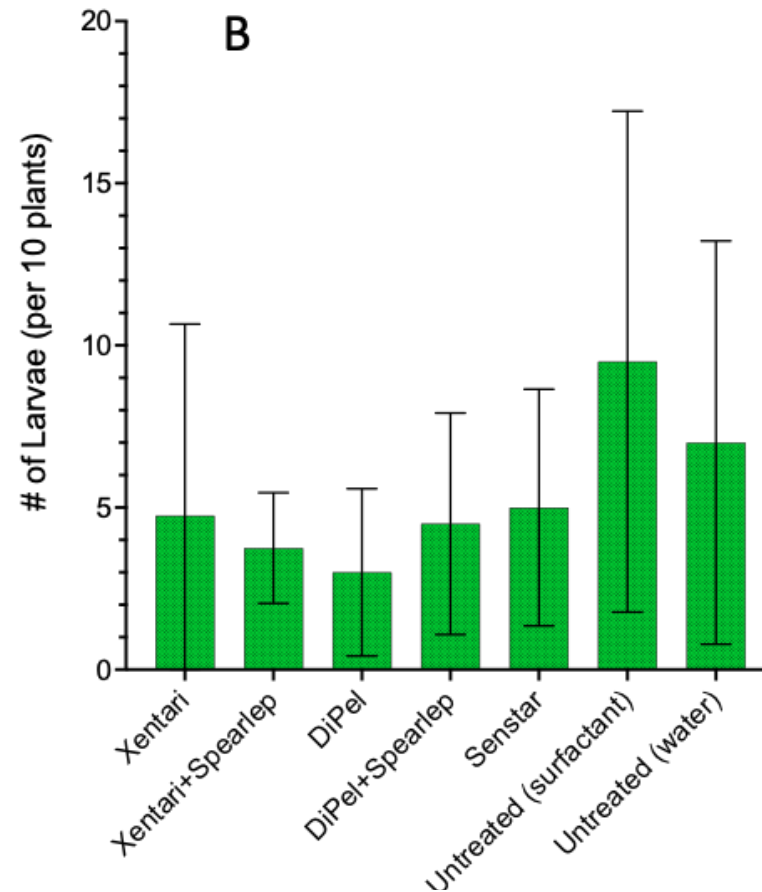
- Same pattern as before



# Bioinsecticide trial #2: Counts

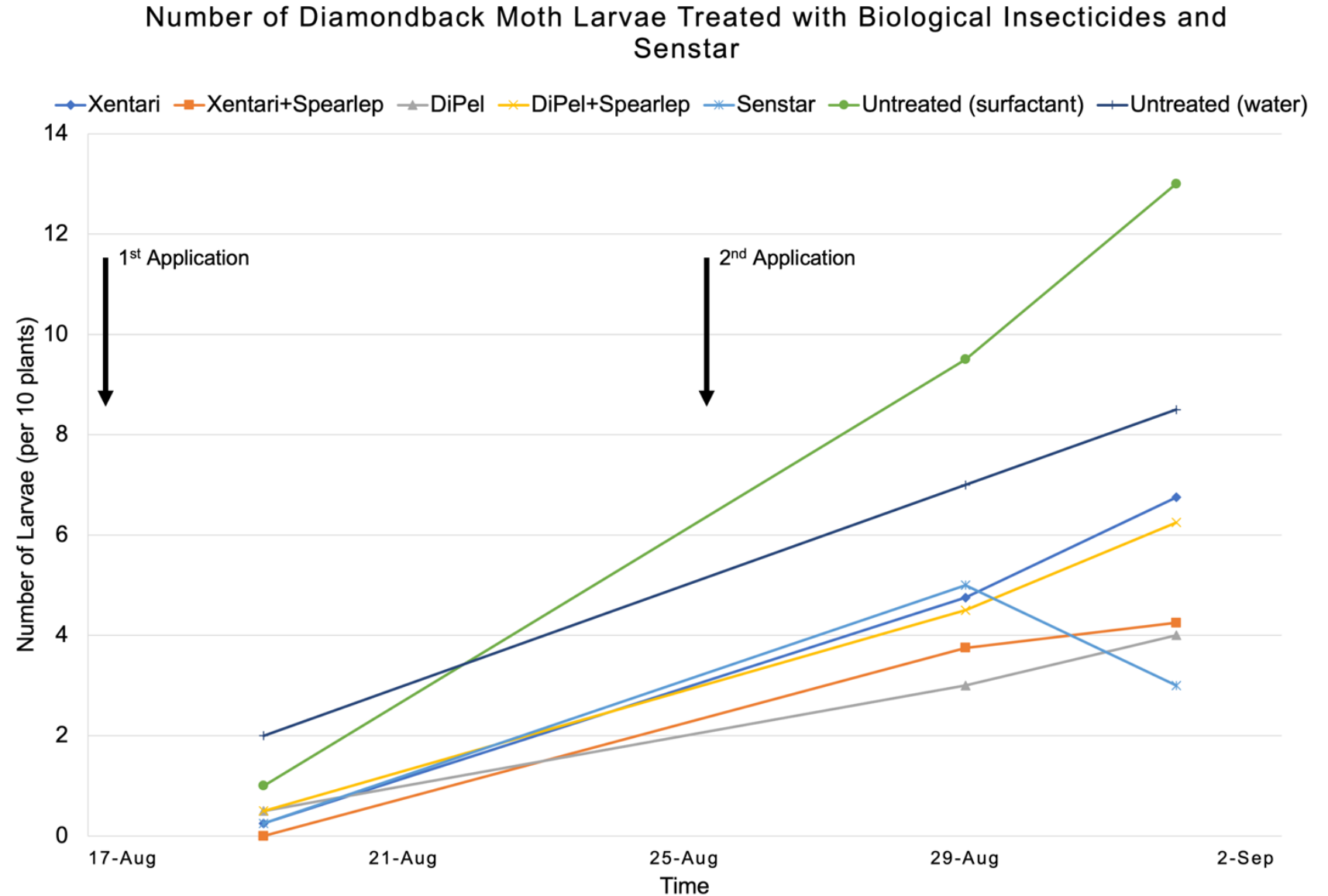
- Only differences between larvae counts were significant
- Treatment was sig. ( $p=0.02$ ) for larvae:
  - Senstar - Untreated+Surfactant
  - Xentari+Spearlep - Untreated+Surfactant
  - DiPel - Untreated+Surfactant
- # of holes and pupae counts were not sig. different between treatments

Number of Larvae and Pupae on Cabbage Treated with Bioinsecticides and Senstar



# Bioinsecticide Trial #2: Larvae Counts

- Both untreated checks had higher larvae counts
- All treatments had lower larvae counts after two treatments
- Lowest counts:
  - Xentari+Spearlep
  - DiPel
  - Senstar

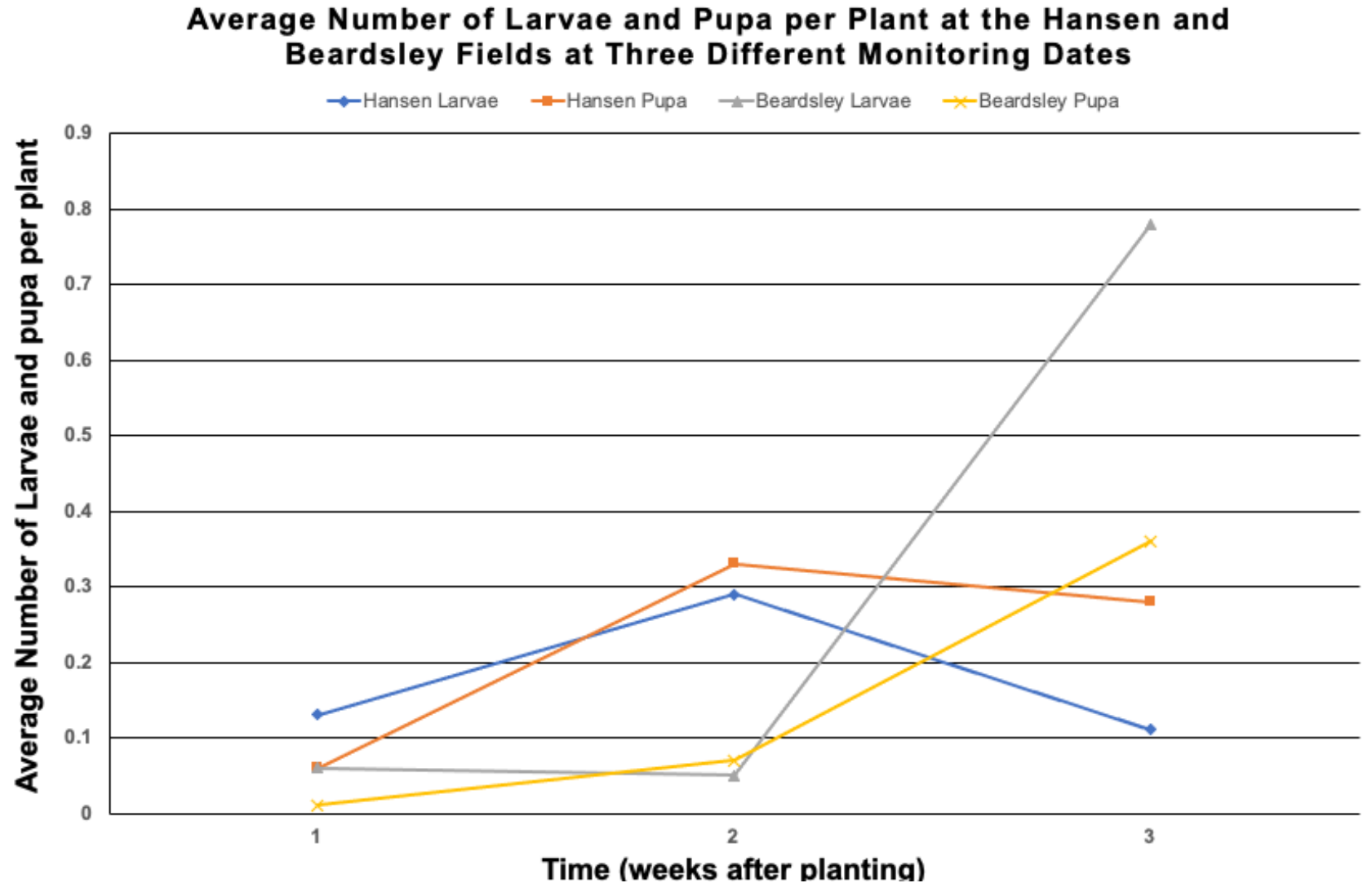


# Cultivar trials: Methods

- 2 sites: Camarillo and Santa Paula/HAREC
  - Camarillo/ Beardsley was conventional
  - Hansen: not sprayed with cover crop around it
- 27 and 17 cultivars, resp.
- **Eggs and larvae not found on nurse plants**
- Different pest pressure at each site

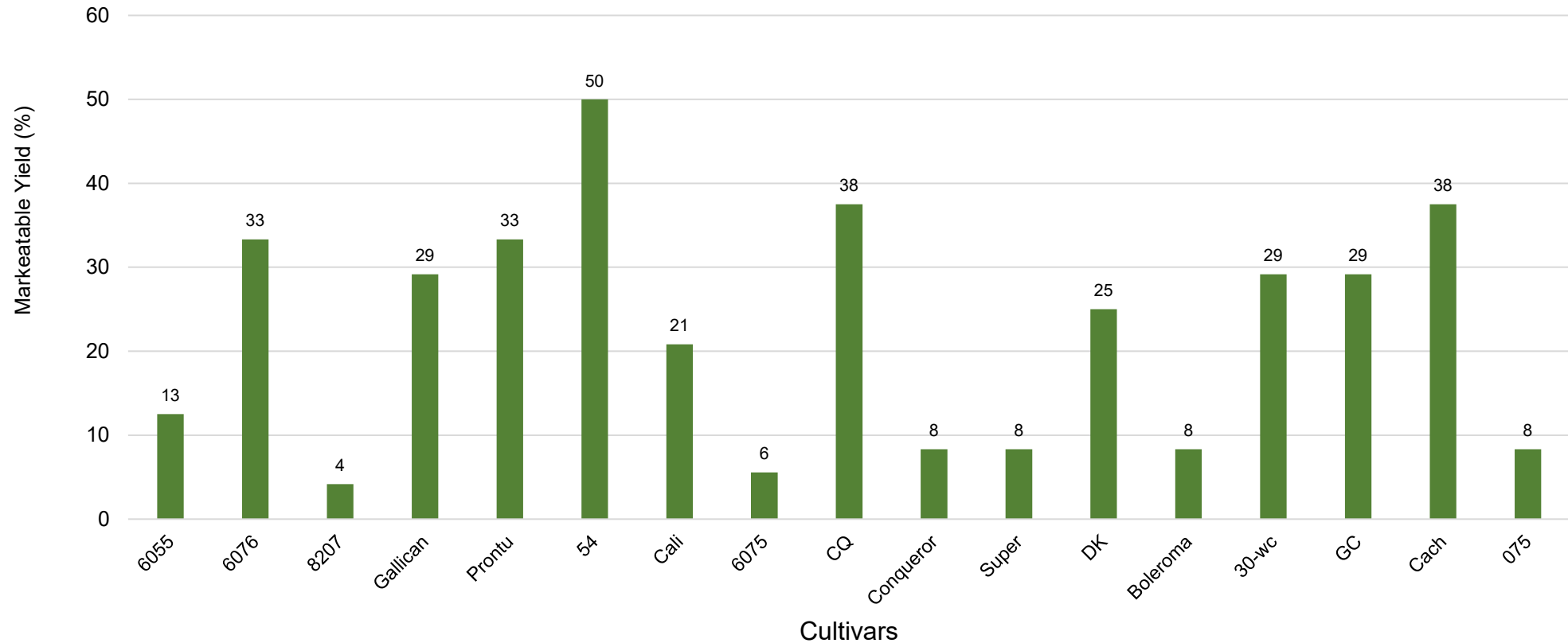
# Cultivar Trials: Larvae and Pupae Counts

- Different pest pressure at each site:
  - High at Beardsley, lower initially
  - Medium at Hansen, drops after the third week
- Larvae and pupae counts dropped at Hansen after 2<sup>nd</sup> week
- Plants from the same source/nursery
- High level of parasitism and mortality at Hansen was observed



# Cultivar trial at Hansen: Yield

Marketable Yield for Seventeen Cabbage Cultivars Grown at Hansen (HAREC)

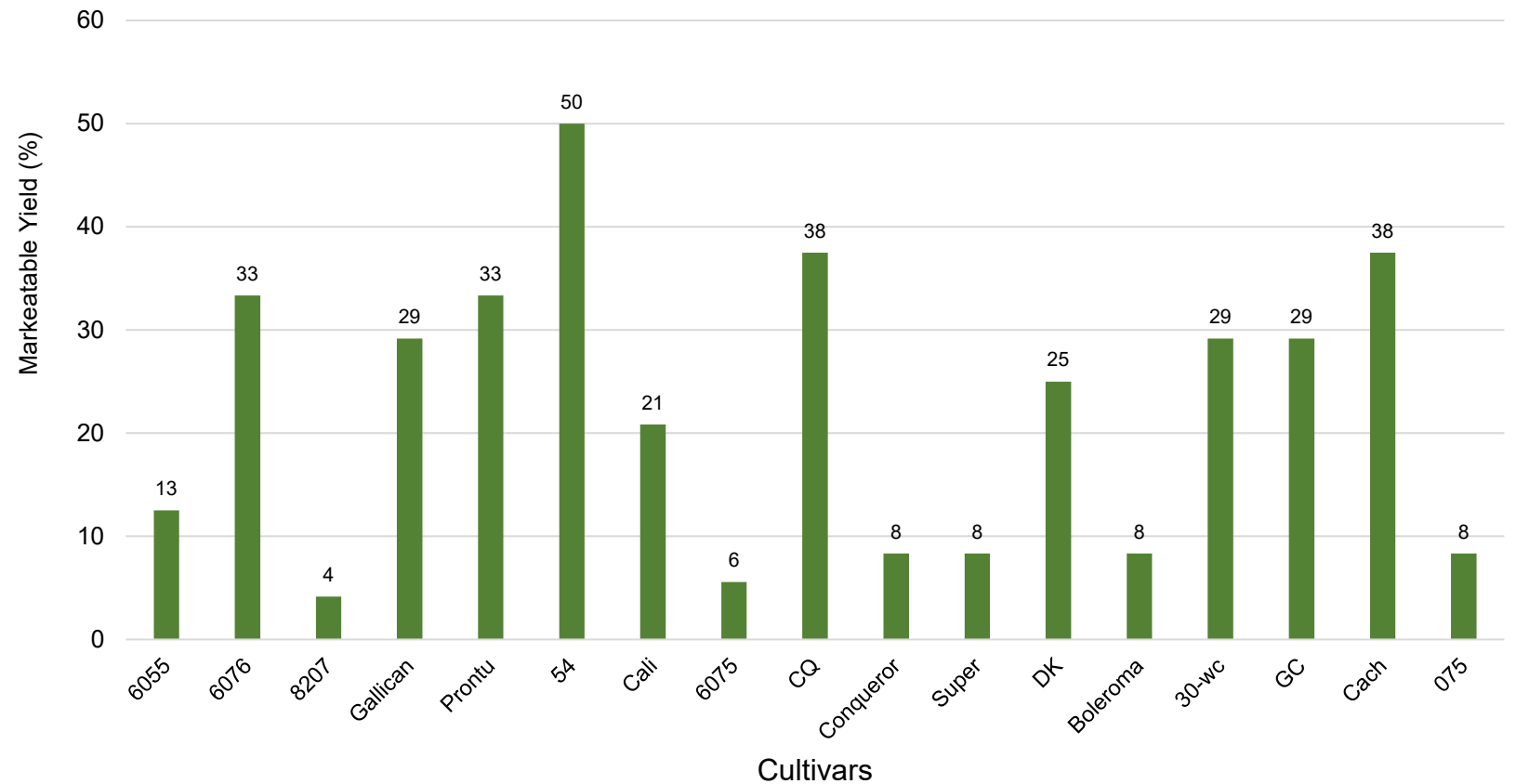




# Cultivar Trials: Results

- Not all cultivars were represented
  - 56 was not represented at Hansen
- Cultivar performance did not match between sites
  - 6075 did not do well
- Large numbers of predators (spiders) and *Diadegma* parasitism was observed at Hansen
- Low levels of parasitism at Beardsley

Marketable Yield for Seventeen Cabbage Cultivars Grown at Hansen (HAREC)



# Cultivar Trials: Results

- There were clear diff. in the level of damage between cultivars
- The marketable yield did not reflect these differences
- Should be explored further as some cultivar might have potential
- Other observations/ issues:
  - Diff. maturity levels for cultivars made assessment more difficult
  - Presence of other pests such as the cabbage moth at Hansen

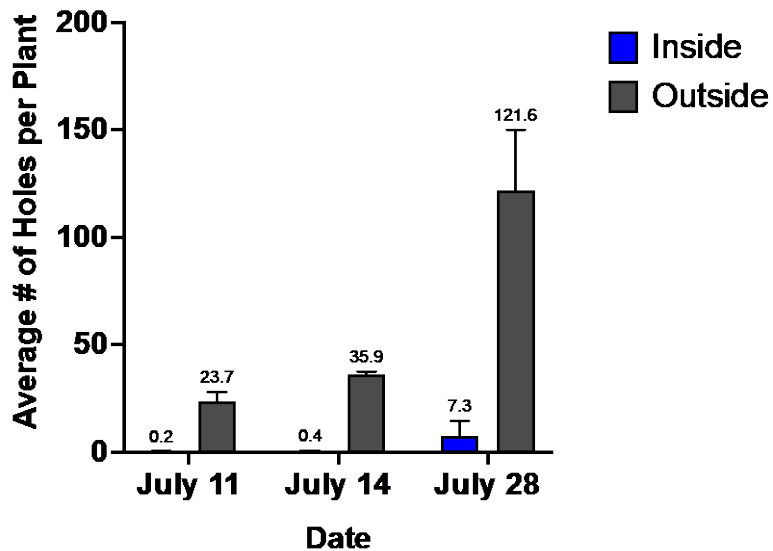




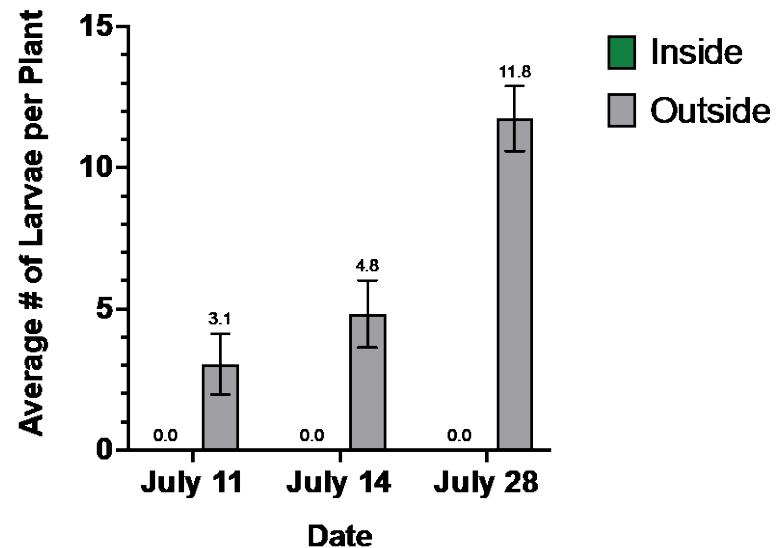
# Insect netting



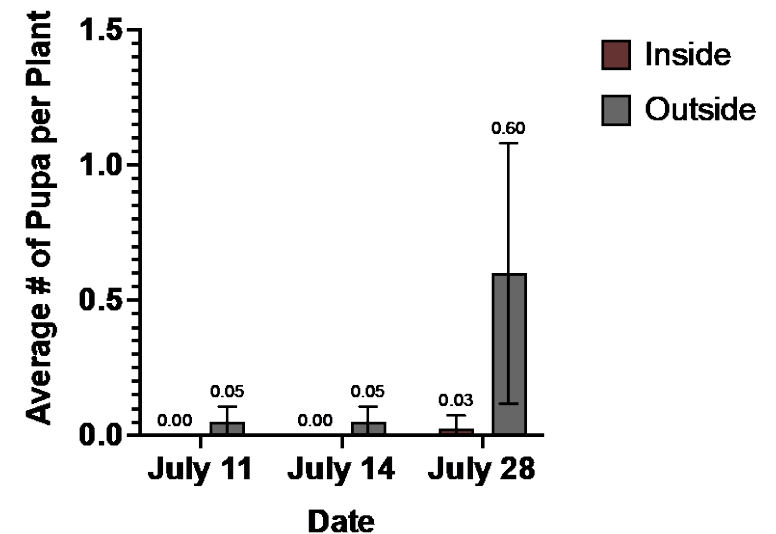
**Average Number of Holes per Plant Inside and Outside Insect Netting**



**Average Number of Larvae per Plant Inside and Outside Insect Netting**



**Average Number of Pupa per Plant Inside and Outside Insect Netting**





# Conclusions

- Factors other than temperature and wind are affecting regional abundance of diamondback moth
  - Area cultivated with cole crops
  - Surrounding vegetation (at both smaller and larger scales) and topography?
  - Presence and abundance of predators and parasitoids
- Methods such as more resistant cultivars and bioinsecticides could provide additional protection under low and medium pest pressure
- Enhancing the effect of predators and parasitoids could be additive to other management practices

# Thank you!

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Growers

PCAs



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**Science-Based Solutions for Ventura  
County's Communities, Farms and  
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