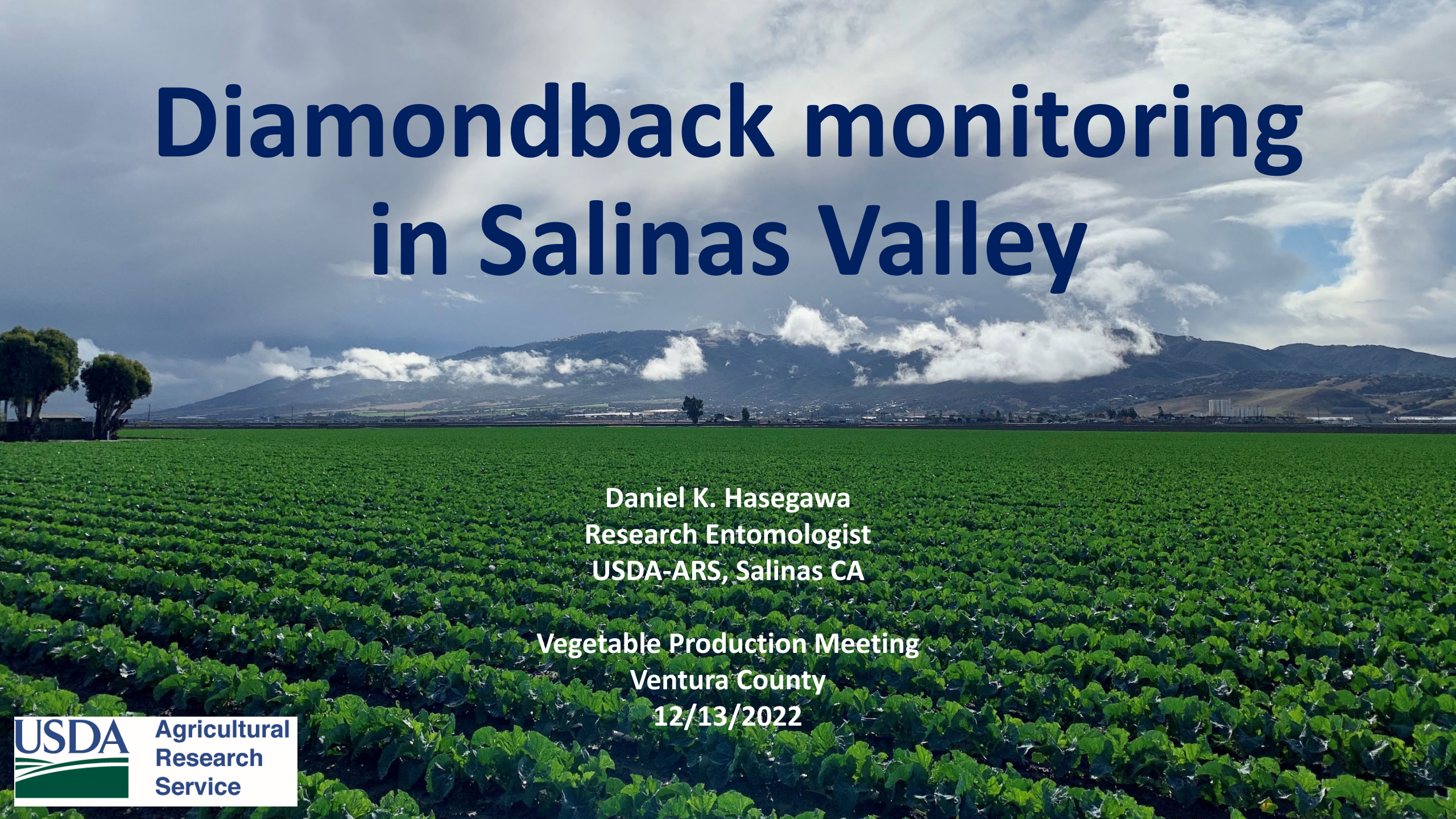
Diamondback monitoring in Salinas Valley



Daniel K. Hasegawa
Research Entomologist
USDA-ARS, Salinas CA

Vegetable Production Meeting
Ventura County
12/13/2022

USDA Agricultural Research Service

Salinas Valley insect monitoring network

Diamondback moth, thrips, aphids

Castroville

Salinas

Chualar

Gonzales

Soledad

Greenfield

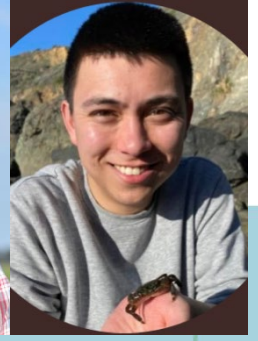
King City

96 km (~60 mi)

21 traps

- 4: Castroville
- 3: Salinas
- 3: Chualar
- 3: Gonzales
- 4: Soledad
- 2: Greenfield
- 2: King City

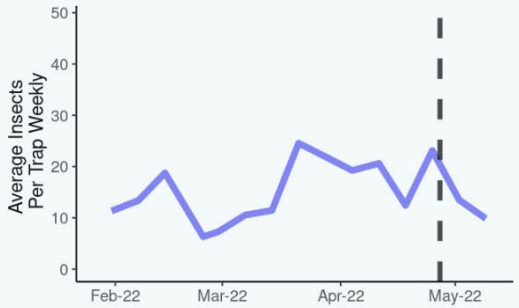
Salinas Valley Pest Map: Diamondback moth



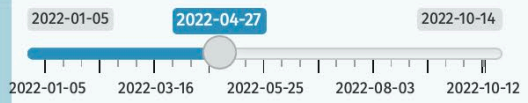
Dr. Ian Grettenberger
Dr. Ben Lee (postdoc)
UC Davis

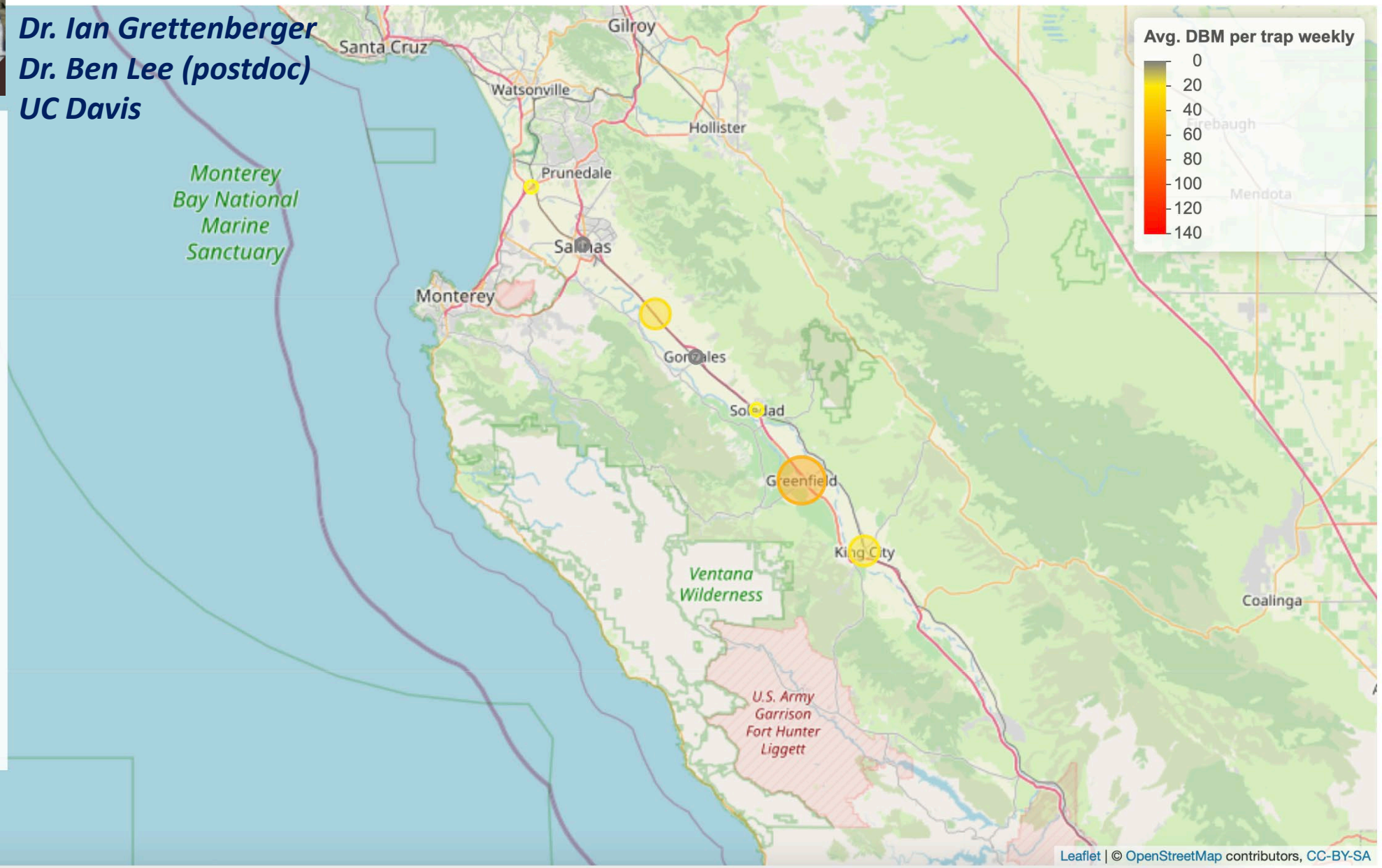
Salinas Valley Diamondback Moth

Values are average insect counts on sticky traps



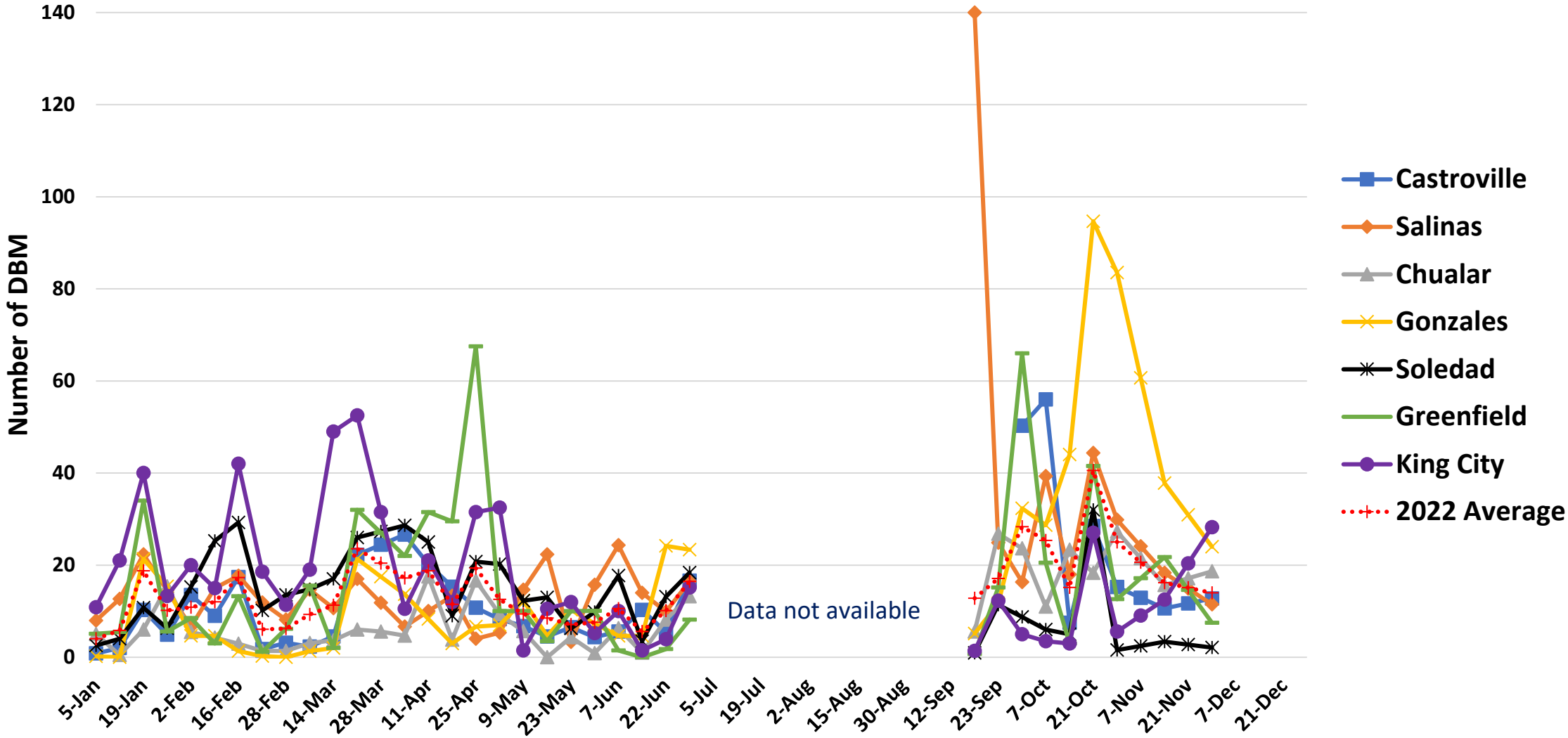
Average weekly trap catch was 19.6 across all cities. This is greater than the previous weeks average of 16.8





2022 Diamondback moth

DBM/card/week



Update on thrips and INSV in lettuce

Daniel K. Hasegawa
Research Entomologist
USDA-ARS, Salinas CA

Vegetable Production Meeting
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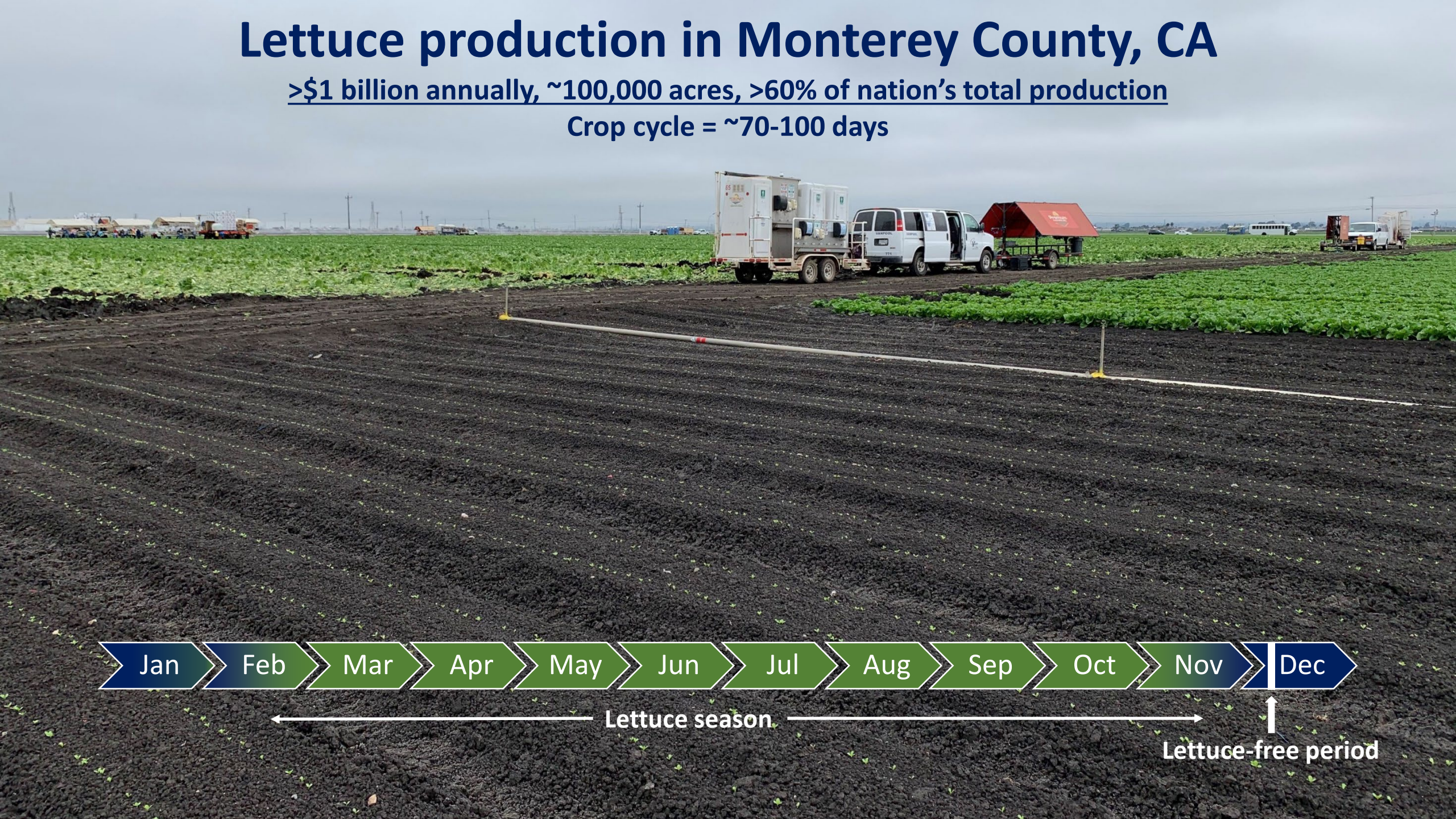
USDA Agricultural Research Service

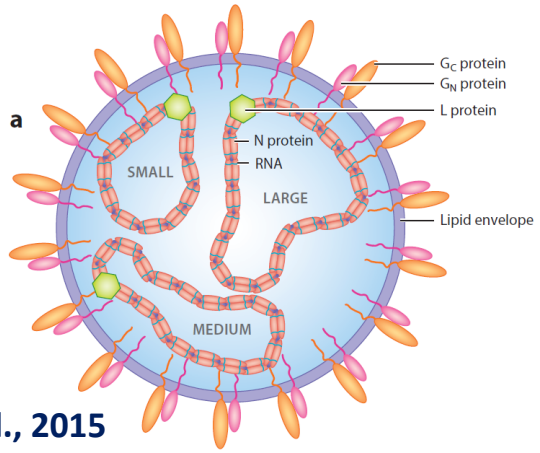
Lettuce production in Monterey County, CA

>$1 billion annually, ~100,000 acres, >60% of nation's total production

Crop cycle = ~70-100 days



Impatiens necrotic spot virus (INSV) and it's occurrence in CA lettuce



Rotenberg et al., 2015

- *Impatiens necrotic spot virus* (INSV)
  - Family *Tospoviridae*, genus *Orthotospovirus*
  - Ambisense, segmented tripartite genome

- Historically considered a pathogen of ornamental crops, but increasing importance in vegetables in Europe and North America

- 2006: INSV first reported in lettuce in the Salinas Valley

- 2006 - 2012: Minor to severe isolated outbreaks of INSV in lettuce

- 2019 - 2022: Severe outbreaks in the Salinas Valley. Up to 100% crop losses, losses = millions US$

Timeline of events: 2019 – 2022

2019: Widespread concerns about INSV in the Salinas Valley

2020: Grower-Shipper Association Task Force was created

- 70+ members: researchers, growers, shippers, PCAs, county officials, other stakeholders
- Goal: Develop strategies for managing thrips and INSV, and a second emerging disease of lettuce, Pythium Wilt
- >$100M in losses due to the two diseases
- Average pest management costs increased by 10-15%

2021: First report of INSV in Desert Regions of CA and AZ

First Report of Impatiens Necrotic Spot Virus Infecting Lettuce in Arizona and Southern Desert Regions of California

Daniel K. Hasegawa, Laura Jenkins Hladky, William M. Wintermantel, Alexander I. Putman, Apurba K. Barman, Stephanie Slinski, John Palumbo, and Bindu Poudel

Published Online: 27 Jan 2022 | https://doi.org/10.1094/PDIS-09-21-2118-PDN

2021: Salinas Valley INSV reporting

- >750 fields reported INSV at >1% incidence (~25% of industry reporting)

2022: Salinas Valley INSV reporting

- >1000 fields reported INSV at >1% incidence

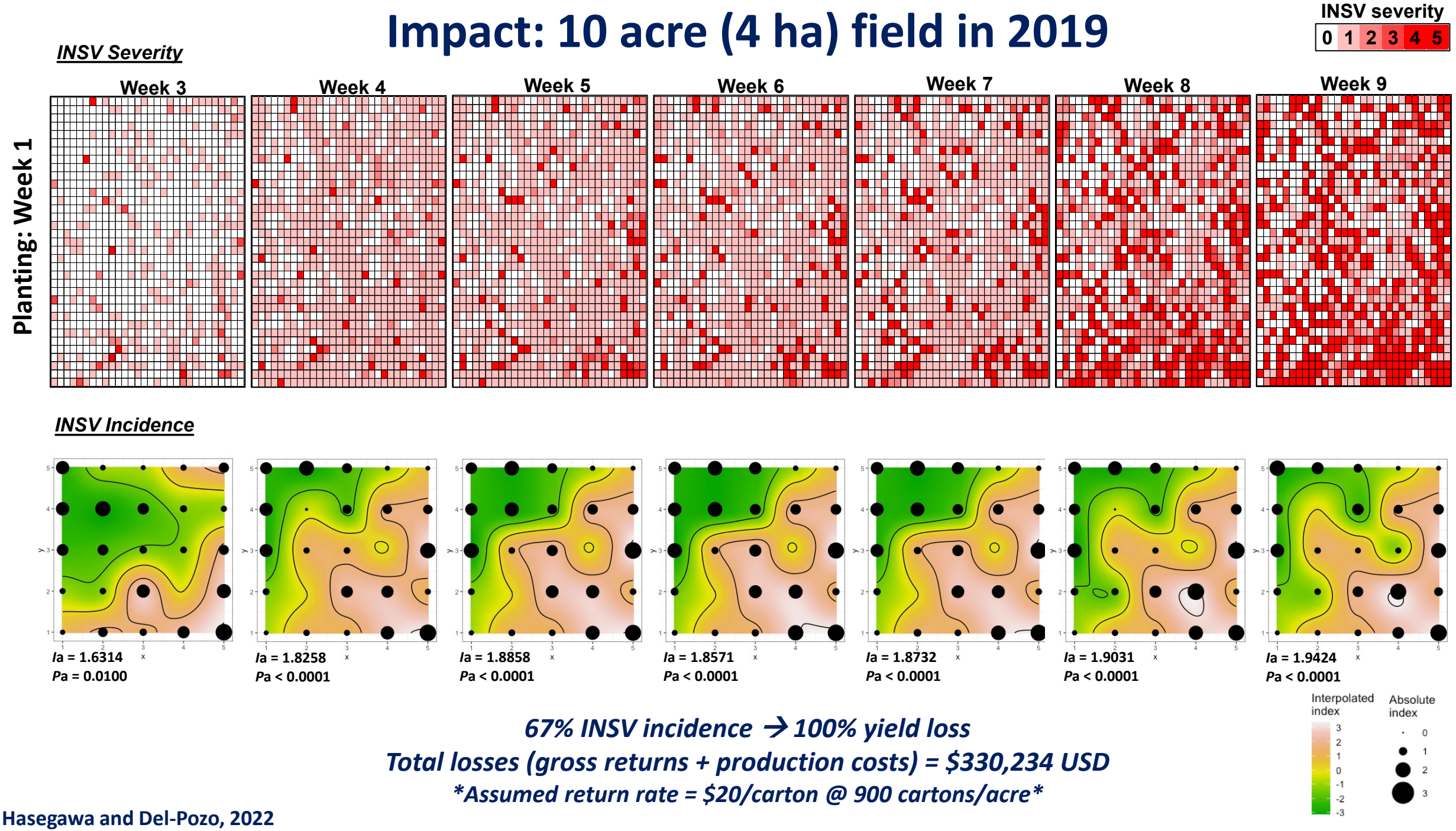
GROWER-SHIPPER ASSOCIATION
of Central California
Since 1930

Organic romaine, 2020

Conventional romaine, 2021

Conventional romaine, 2019

Impact: 10 acre (4 ha) field in 2019



67% INSV incidence → 100% yield loss

Total losses (gross returns + production costs) = $330,234 USD

****Assumed return rate = $20/carton @ 900 cartons/acre****

Hasegawa and Del-Pozo, 2022

Lettuce production in Monterey County, CA

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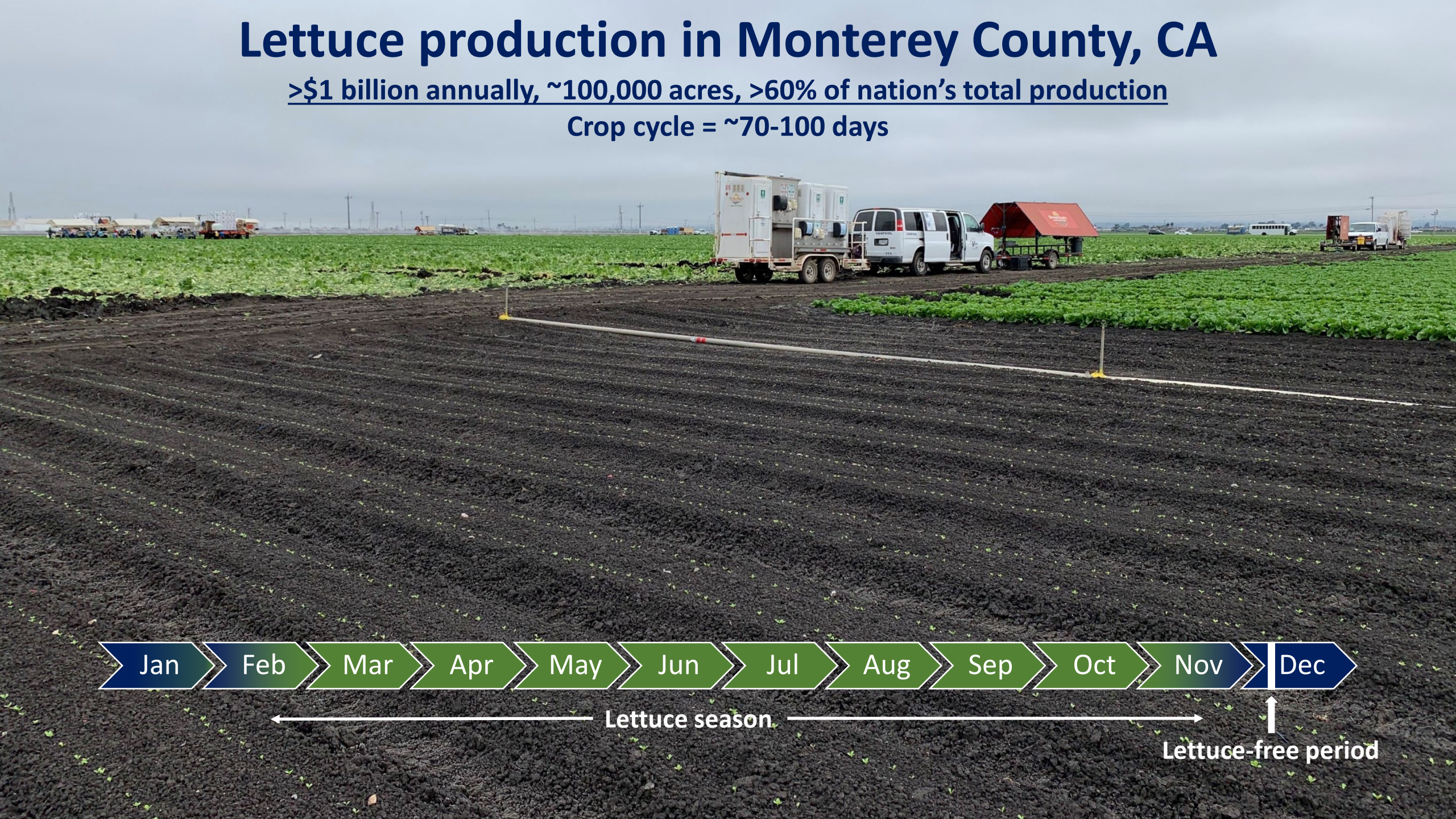
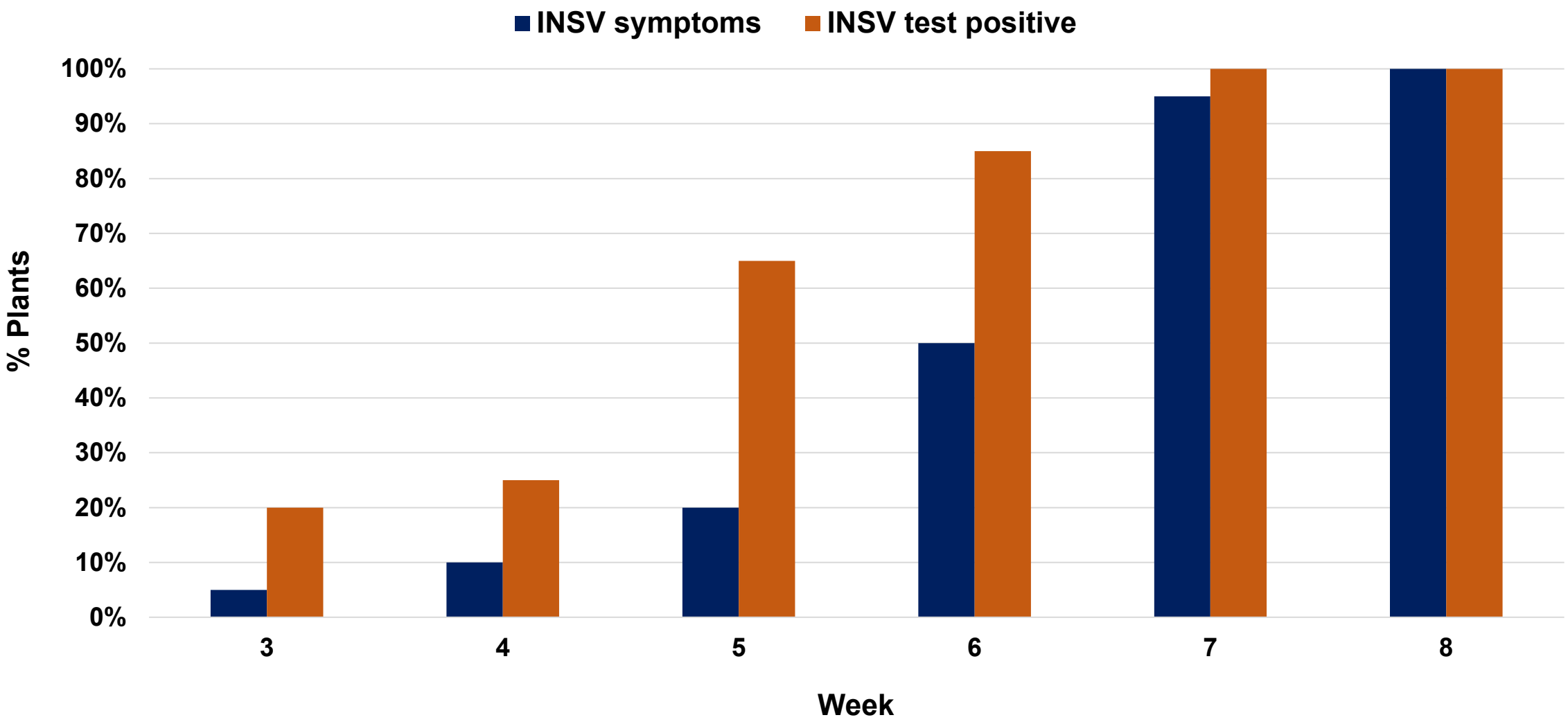
Crop cycle = ~70-100 days



Delay in INSV symptoms after infection

20 plants/week



Western flower thrips: vector for INSV

Western flower thrips, *Frankliniella occidentalis*

Vector management challenges:

- Small (1-2 mm), cryptic, high fecundity
- Limited chemical options in CA lettuce
  - ~20% organic production in 2021
- Host range = 100s of plants

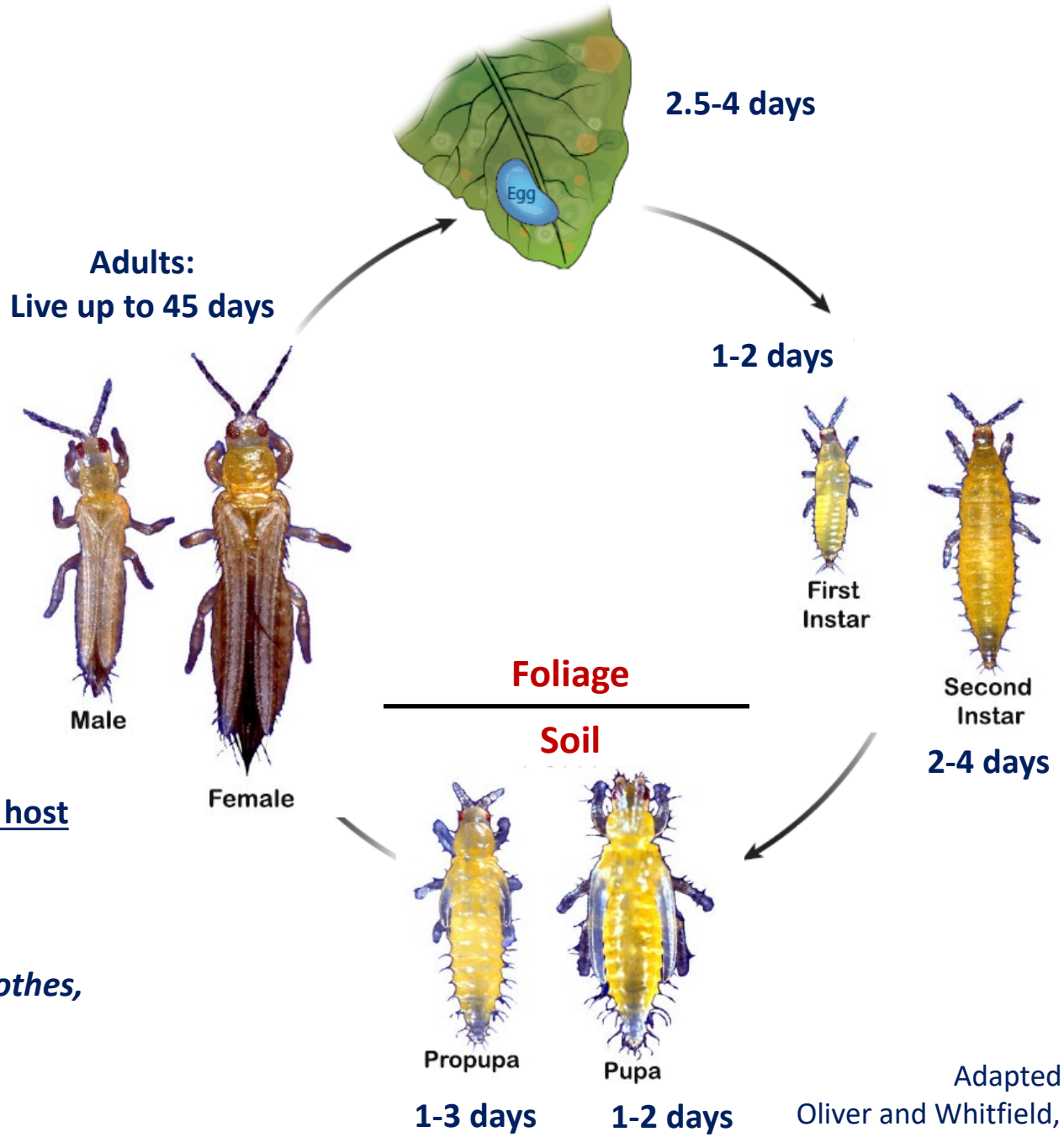
Virus Management challenges:

- Lack of genetic-based resistance to INSV in lettuce
- Host range = 100s of plants

Transmission occurs within minutes of thrips feeding

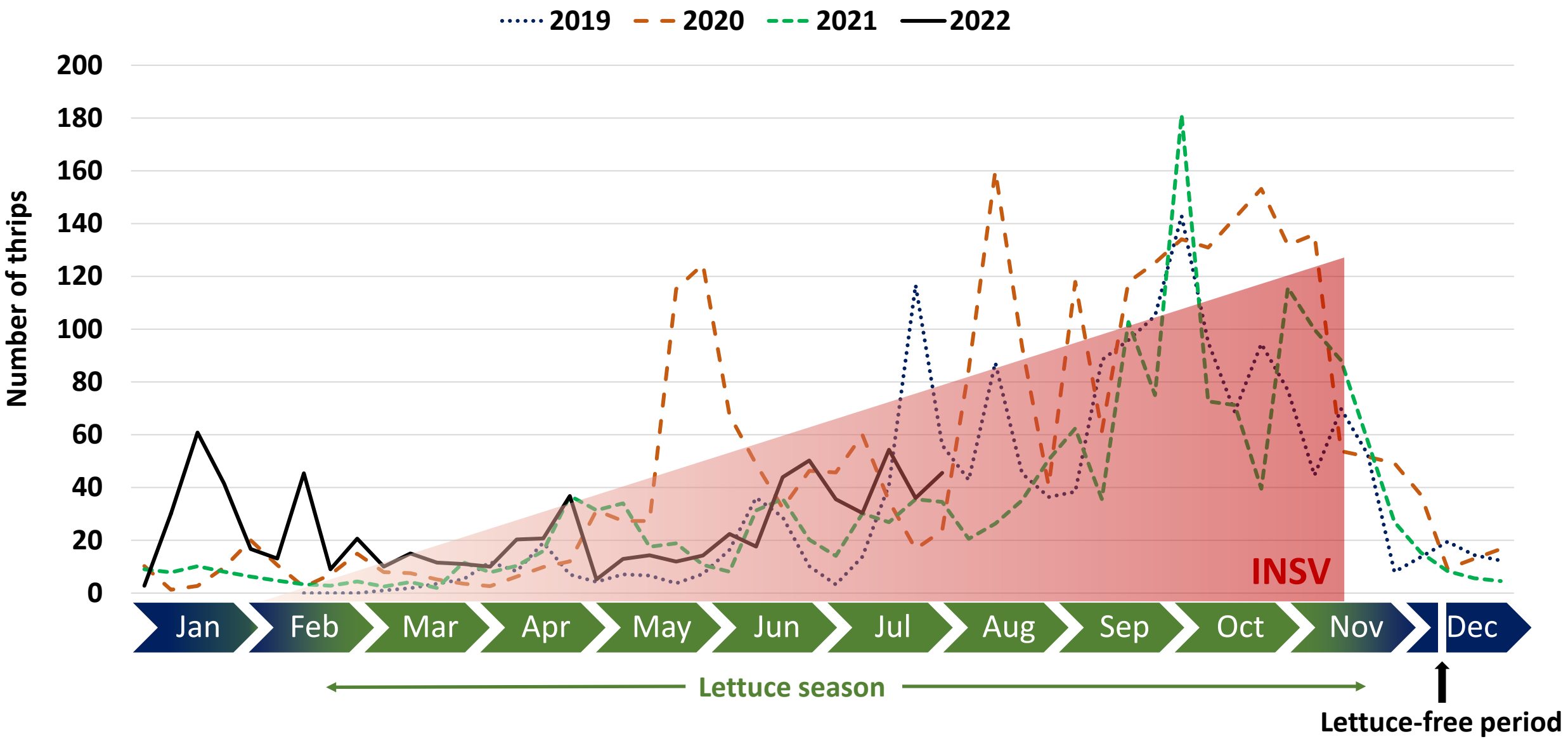
- Virus must be acquired as larvae to transmit as an adult.
- Plants that are infected with INSV must be a reproductive host for western flower thrips for virus acquisition to occur.
- Virus is not passed from adult to offspring.

- ***Virus cannot be transmitted by farm equipment, boots, clothes, or handling***



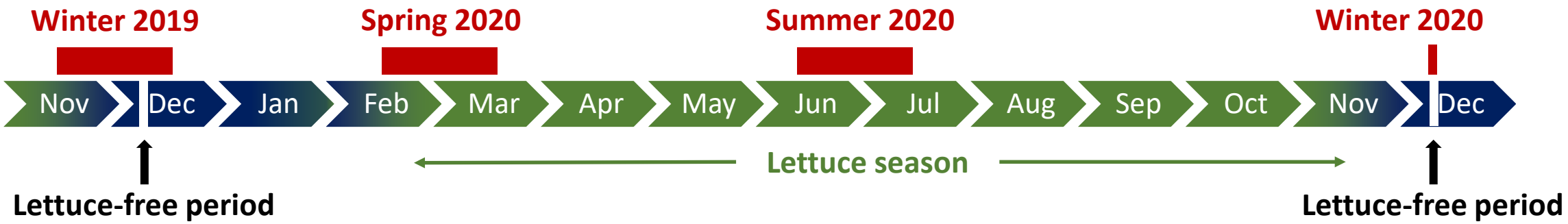
Adapted from
Oliver and Whitfield, 2016
Rotenberger et al., 2020

Vector challenges: Thrips monitoring in the Salinas Valley



Virus challenges: INSV hosts in the Salinas Valley

Sampling summary:
>3,000 plant samples tested for INSV
73 species: majority weeds, native plants, vegetable crops



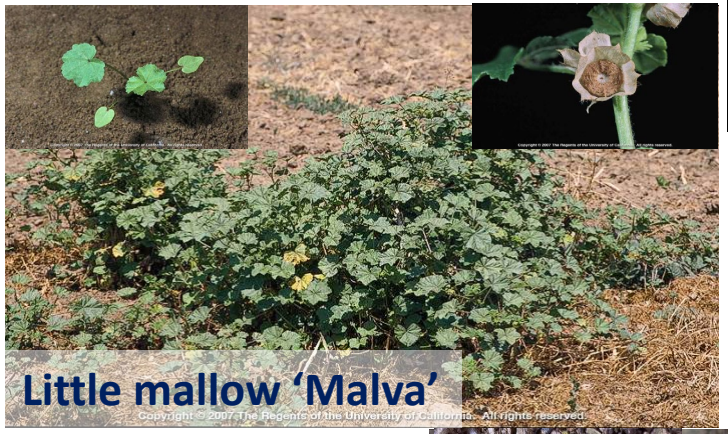
Primary detection of INSV:
Serological: TAS-ELISA

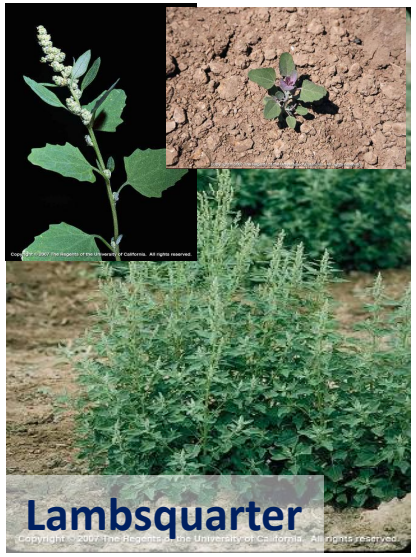
Validation:
Serological: Lateral flow rapid strip tests
Genetic: RT-PCR

$$\text{Host INSV Index} = \text{Avg ELISA}_{positive} \times (N_{positive}/N_{total})$$

Hasegawa et al., in prep

Top 10 hosts


Little mallow ‘Malva’


Lambsquarter


Annual Sowthistle


Hairy Fleabane


Nettleleaf Goosefoot


Shepherd’s purse


Burning Nettle


Field Bindweed


Marestail


Purslane

Top 10 non-lettuce hosts for INSV in the Salinas Valley, CA

	Common name	Scientific name	Family	Category	Seasonal abundance: Winter	Spring	Summer	Fall
1	Little Mallow	*Malva parviflora*	Malvaceae (Mallow Family)	Broadleaf	++	++	++	++
2	Annual Sowthistle	*Sonchus oleraceus*	Asteraceae (Sunflower Family)	Broadleaf	++	++	++	++
3	Nettleleaf goosefoot	*Chenopodium murale*	Chenopodiaceae (Goosefoot Family)	Broadleaf	+	++	++	++
4	Mare's Tail	*Conyza canadensis*	Asteraceae (Sunflower Family)	Broadleaf	+	++	++	++
5	Field Bindweed	*Convolvulus arvensis*	Convolvulaceae (Morning glory Family)	Broadleaf	0	++	++	++
6	Shepherds Purse	*Capsella bursa-pastoris*	Brassicaceae (Mustard Family)	Broadleaf	++	++	++	++
7	Common Purslane	*Portulaca oleracea*	Portulacaceae (Purslane Family)	Broadleaf	0	+	++	++
8	Hairy Fleabane	*Conyza bonariensis*	Asteraceae (Sunflower Family)	Broadleaf	+	++	++	++
9	Burning Nettle	*Urtica urens*	Urticaceae (Nettle Family)	Broadleaf	++	++	++	++
10	Common Lambsquarter	*Chenopodium album*	Chenopodiaceae (Goosefoot Family)	Broadleaf	0	++	++	++





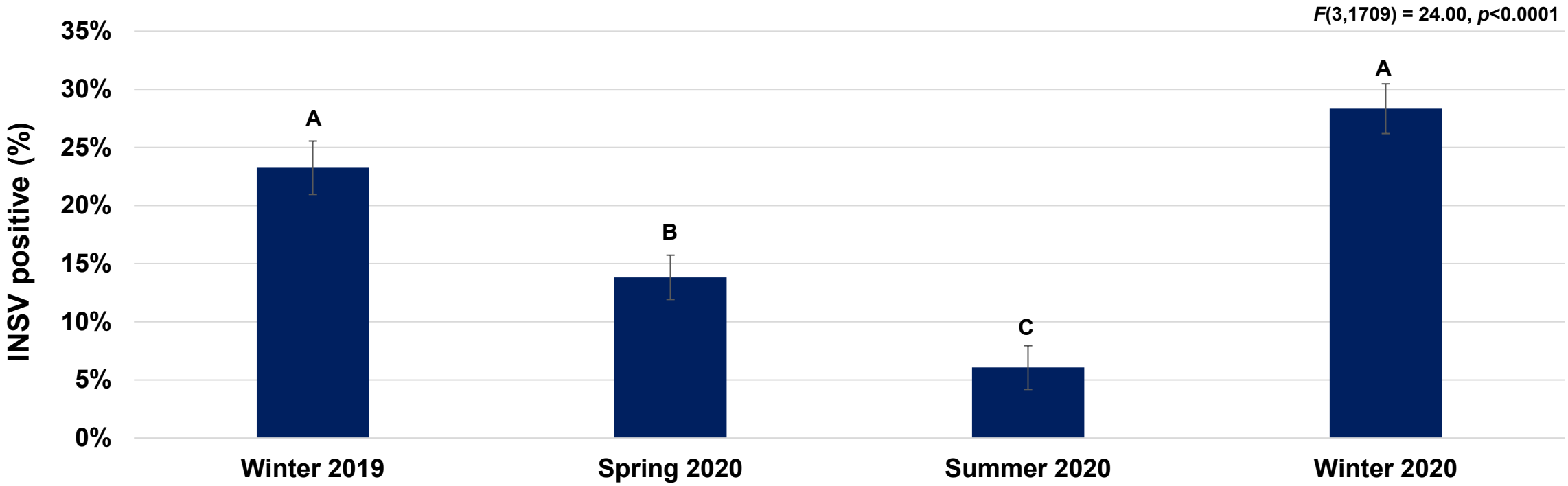


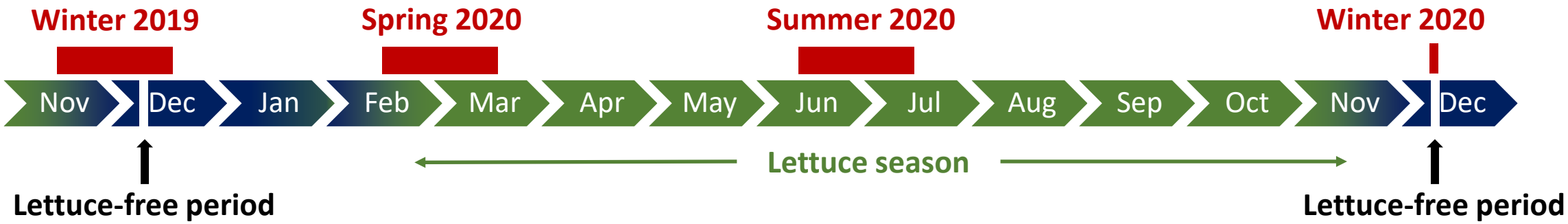



Richard Smith, UCCE
http://ipm.ucanr.edu/PMG/weeds_all.html

Hasegawa et al., in prep

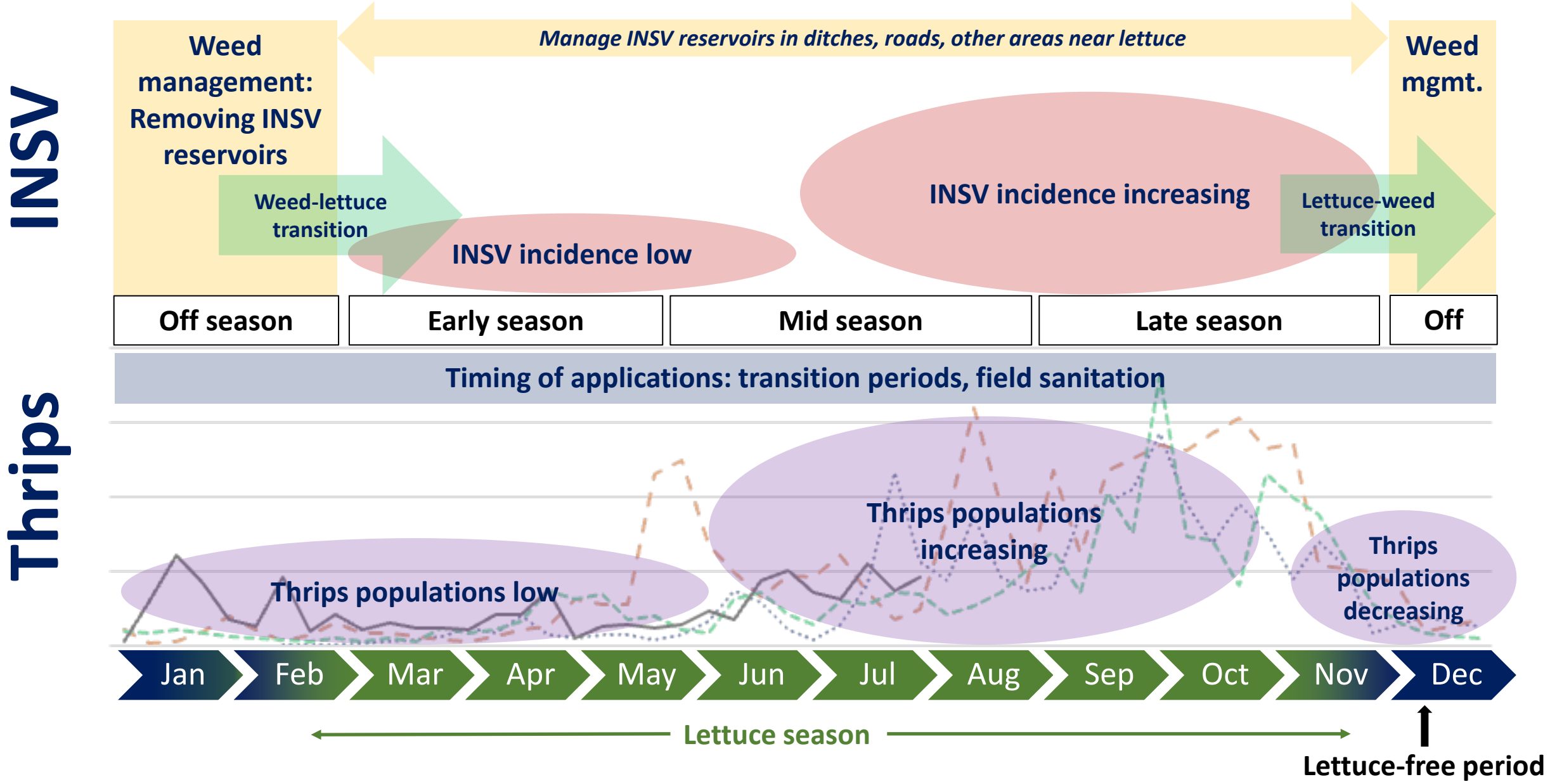
Top 10 non-lettuce hosts for INSV in the Salinas Valley, CA





Hasegawa et al., in prep

Thrips/INSV IPM model for Salinas Valley lettuce



Ongoing thrips and INSV research

- **Thrips and INSV: monitoring and host range**
  Collaborators: Richard Smith, Yu-Chen Wang, Kirsten Pearsons (UCCE Monterey), Ian Grettenberger (UC Davis)
- **Thrips: precision sprays and biocontrol**
  Collaborators: Ian Grettenberger (UC Davis)
- **INSV: Optimizing immune elicitors for virus protection in lettuce**
  Collaborators: Kerry Mauck (UC Riverside)
- **INSV: Genome sequencing**
  Collaborators: Hanu Pappu (Washington State University)
- **INSV-Pythium Wilt interactions**
  Collaborators: JP Dundore-Arias (California State University Monterey Bay)
- **Thrips and INSV: RNA interference, peptide discovery**
  Collaborators: USDA-ARS various locations
- **Emergence of INSV in desert lettuce production**
  Collaborators: John Palumbo, Stephanie Slinski, Bindu Ward-Poudel (University of AZ)

USDA Agricultural Research Service

California Leafy Greens Research Program

cdfa California Department of Food & Agriculture

California Environmental Protection Agency dpr Department of Pesticide Regulation

Grower-Shipper Association of Central California Since 1930

Thank you

USDA-ARS Salinas, CA, Entomology Lab
Lab technician: Laura Hladky
Students: Grace Hardy, Kiara Gable, Kai Larrieu, Jasmin Azad-Khan, Juan Vargas

University of California:
Richard Smith (Vegetables and Weeds, Monterey County)

Grower-Shipper Association of Central California
Chris Valadez, GSA President
Mary Zischke, INSV/Pythium Task Force leader

Growers and PCAs

California State University Monterey Bay
JP Dundore-Arias, Plant Pathology

USDA-ARS Salinas, CA, Virology Lab
Bill Wintermantel, Plant Virologist
Technician: Aaron Rocha

Email: daniel.hasegawa@usda.gov
Mobile: 831-206-8177

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