Research Update on Thrips and INSV

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

2021 Pest Management Series
11/18/2021

USDA Agricultural Research Service

Topics covered

Thrips/INSV biology and monitoring

- Life cycle and transmission of INSV
- Flight studies: height of thrips movement
- 2021 thrips monitoring
- Temperature data

INSV epidemiology and host range

- Top 10 hosts
- Weeds in non-lettuce crops: CA
- AZ studies

Cultural strategies for managing thrips/INSV

- 2021 rogueing trials

Field observations on varieties

2021 INSV reporting

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Western flower thrips, *Frankliniella occidentalis*

Adults are 1-2 mm in length
Female can lay 150-300 eggs
Egg to adult = 11-44 days

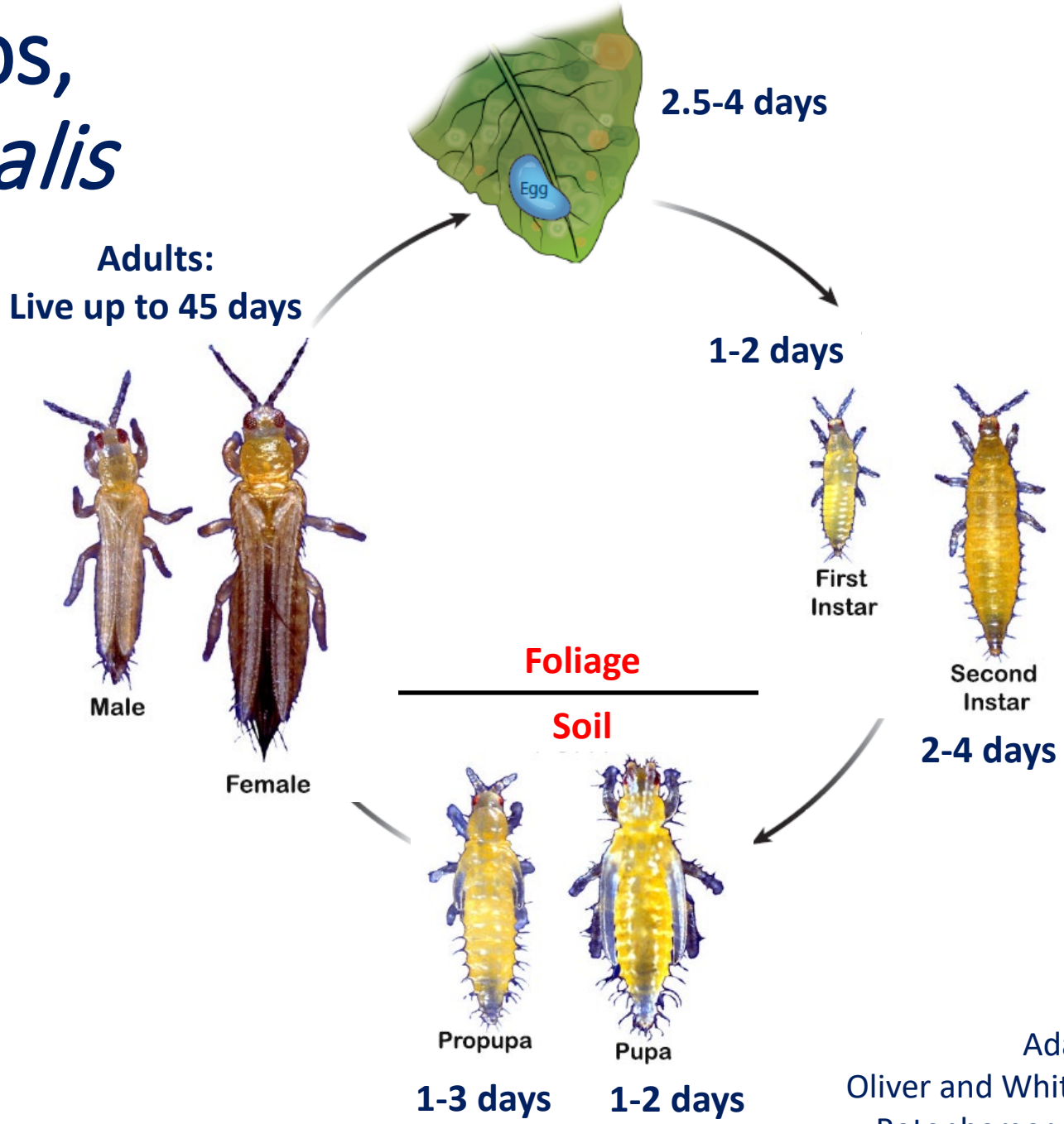
<u>Development requirements</u>

- **7.2 – 40.0°C (45 – 104°F)**
- **Development is reduced outside of temperature limits**

<u>Ideal conditions for development</u>

- **Egg to adult = 268 degree days (°C)**
- **Egg to adult = 11 days**

Thrips host range = 100s of plants



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

Western flower thrips as vectors for tospoviruses

Tospoviruses affecting lettuce on the Central Coast of CA

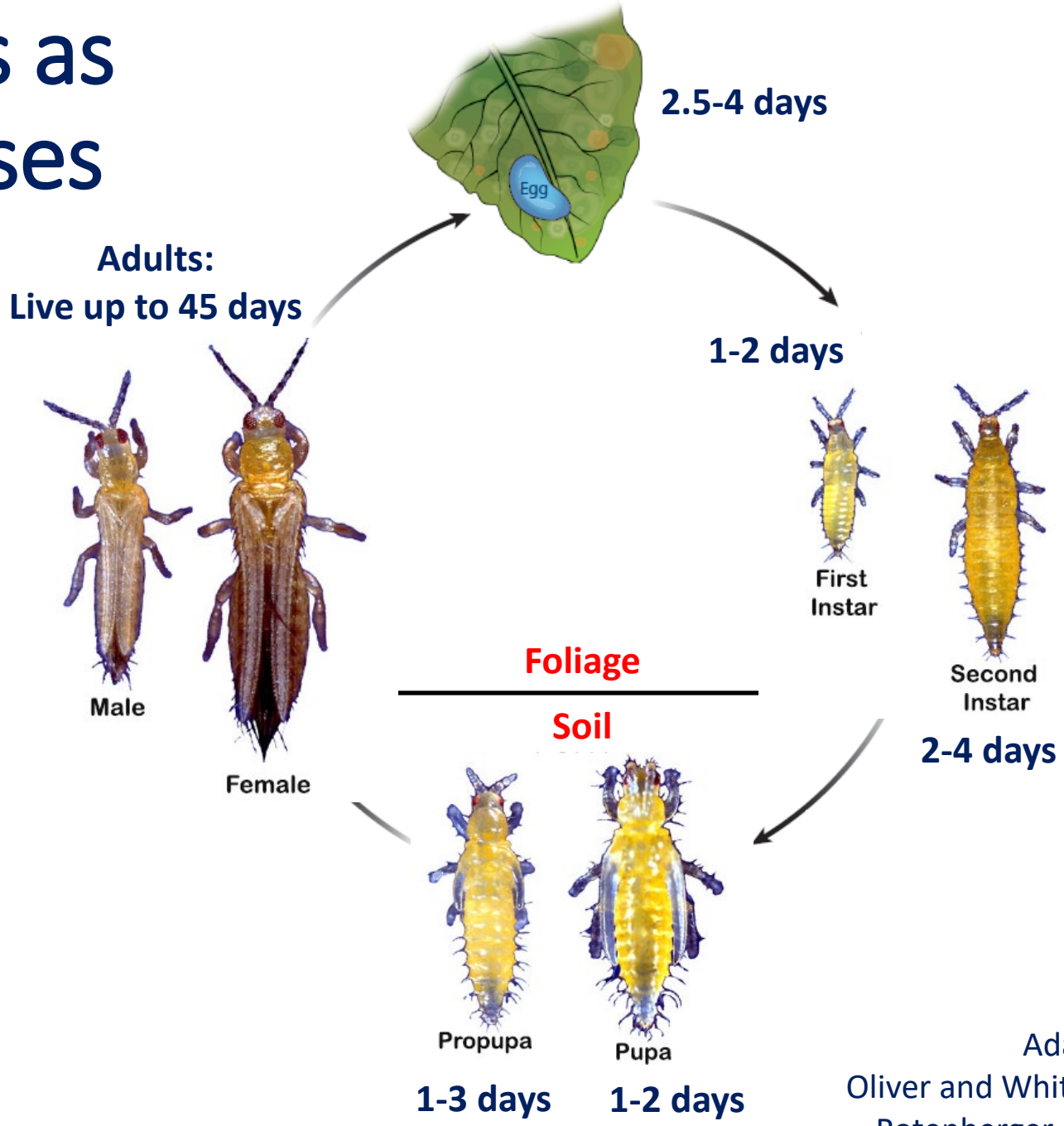
- ***Impatiens necrotic spot virus*** **(INSV)**
- ***Tomato spotted wilt virus*** **(TSWV)**

Virus must be acquired as larvae to transmit as an adult

- **Only adults can transmit the virus.**
- **Virus is not passed from adult to offspring**

INSV host range = 100s of plants

- **Many infected plants do not show symptoms**



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Oliver and Whitfield, 2016
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Two types of infection

Two types of infection

Primary infection

Outside field

Two types of infection

Secondary infection

Within field

Primary infection

Outside field

Western flower thrips (*Frankliniella occidentalis*)

- Thrips are poor flyers
- Rely heavily on wind for dispersal
- Distance is hard to estimate

Photo by Daniel Hasegawa

Height of thrips movement in the Salinas Valley

Chualar and Gonzales: 10/3 - 10/10/2020

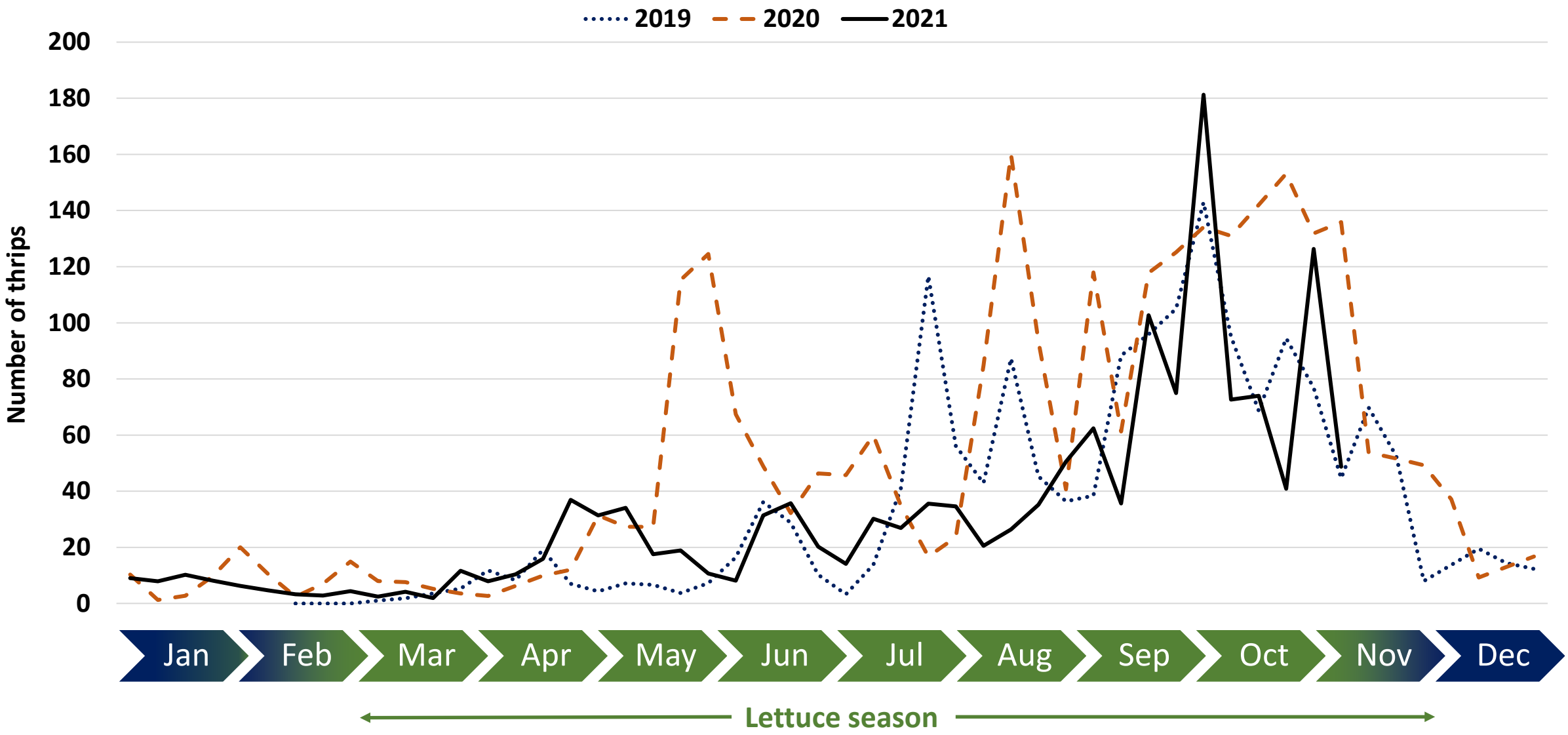
Height (ft)	Average number thrips
10.00	6%
8.75	16%
7.50	14%
6.25	17%
5.00	17%
3.75	18%
2.50	12%
1.25	16%
TOTAL	**100%**

Soledad: 9/9 - 10/6/2021

25-27 feet: ~50 thrips/card

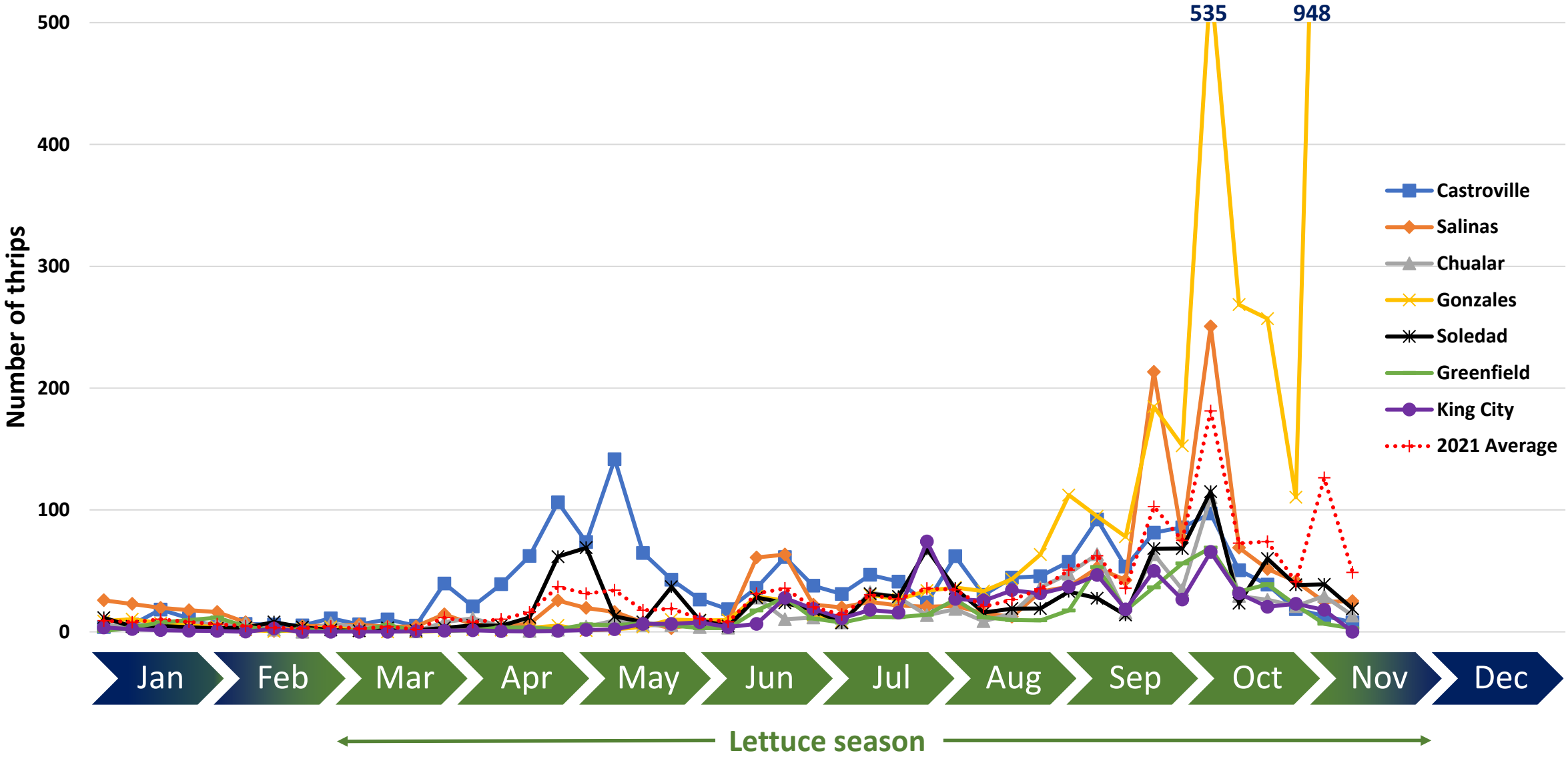
Thrips monitoring

Thrips/sticky card/week (21 total, average)

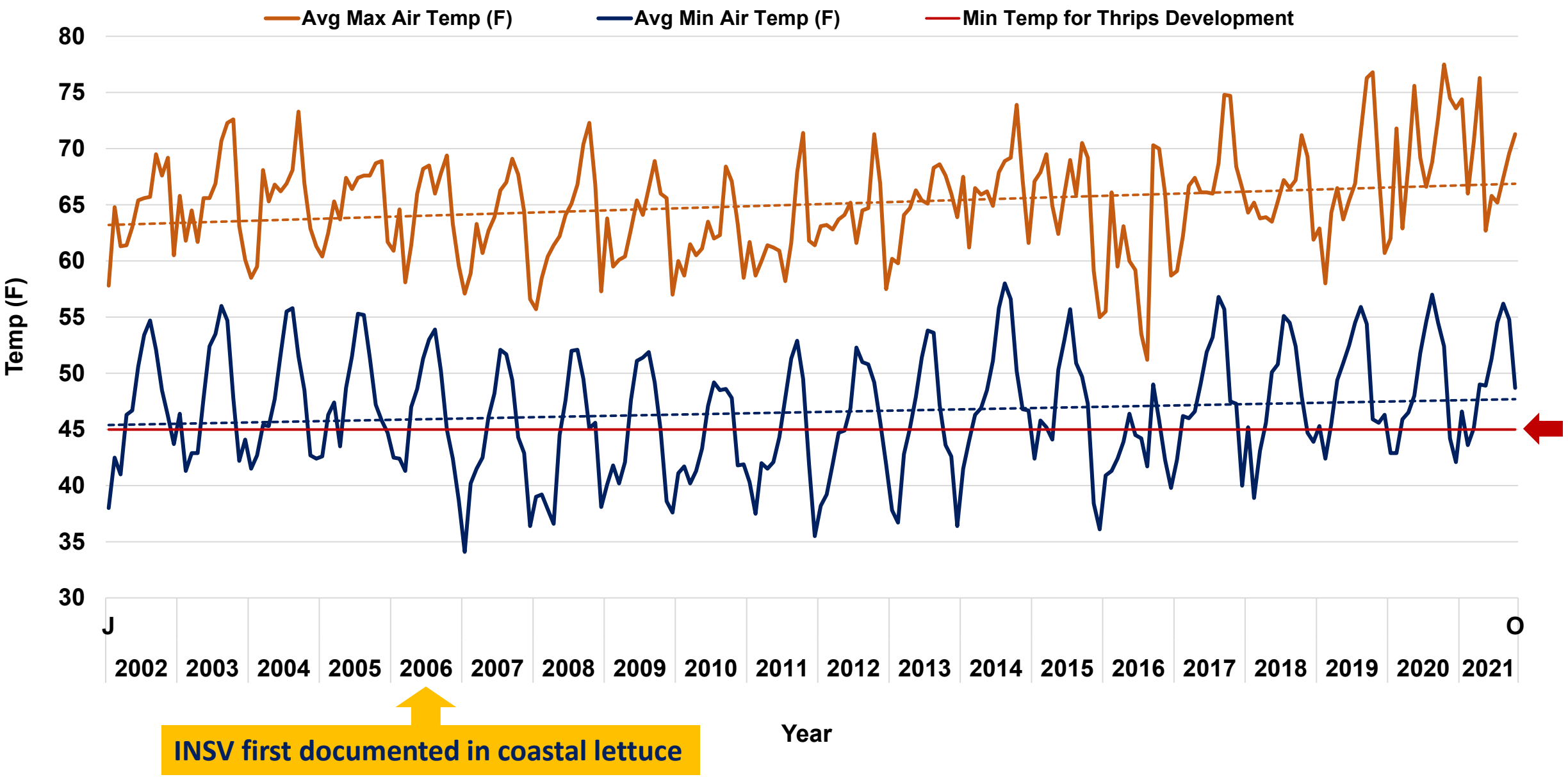


2021 Thrips monitoring

Thrips/sticky card/week (21 total, grouped by region)



Air temperature: 20 years



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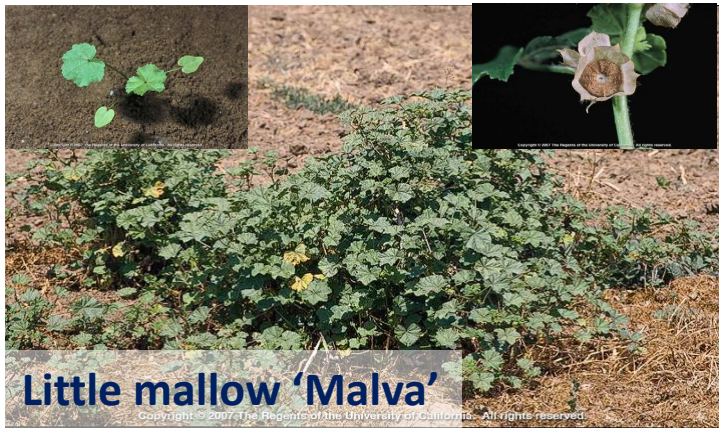
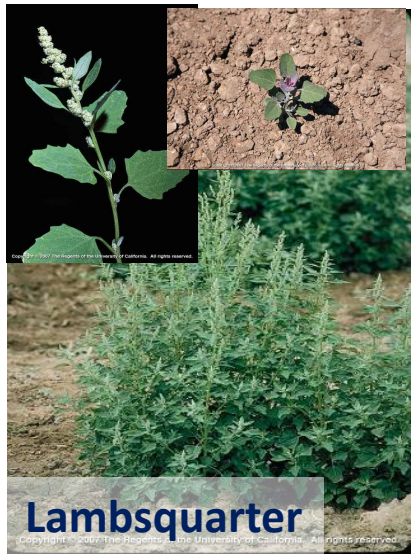
Top 10 hosts





Pictures courtesy of Richard Smith and UC ANR

Field surveys for INSV hosts

April – October 2021

TOP 10 HOSTS	INSV positive / Total	% INSV positive
Perennial Artichoke (2 fields)		
Common chickweed*	26/50	52%
Swinecress	1/30	3%
Broccoli (2 fields)		
Annual sowthistle	1/20	5%
Nettleleaf goosefoot	1/20	5%
Cauliflower (1 field)		
Annual sowthistle	1/20	5%
Nettleleaf goosefoot	0/20	0%
Common lambsquarter	0/20	0%
Vineyard (1 field)		
Little mallow	17/44	38%
Annual sowthistle	23/37	62%
Nettleleaf goosefoot	32/42	76%
Common knotweed	8/36	22%
Shortpod mustard*	1/40	2%

Other crops	INSV positive / Total	% INSV positive
Black mustard	0/60	0%
Russian knapweed	0/56	0%
Beans	0/42	0%
Peas	8/46	17%
Sunflower	1/32	3%
Radicchio*	22/22	100%

Optimal conditions for INSV transmission

	INSV positive / Total	% INSV positive
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Annual sowthistle	23/37	62%
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Shortpod mustard*	1/40	2%

*Shortpod mustard (70 flowers)

~5.4 adult thrips per flower

~4.1 nymph thrips per flower

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*Shortpod mustard (70 flowers)
~5.4 adult thrips per flower
~4.1 nymph thrips per flower

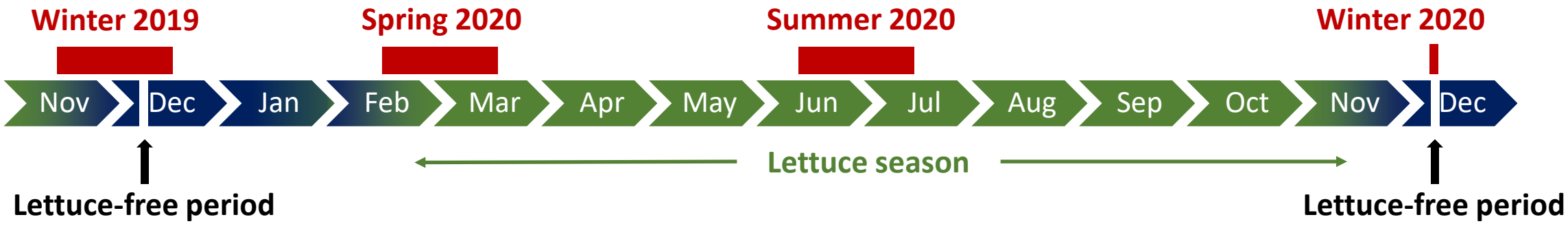
High density of INSV and thrips hosts

Virus acquisition/transmission by thrips

Top 10 hosts for INSV

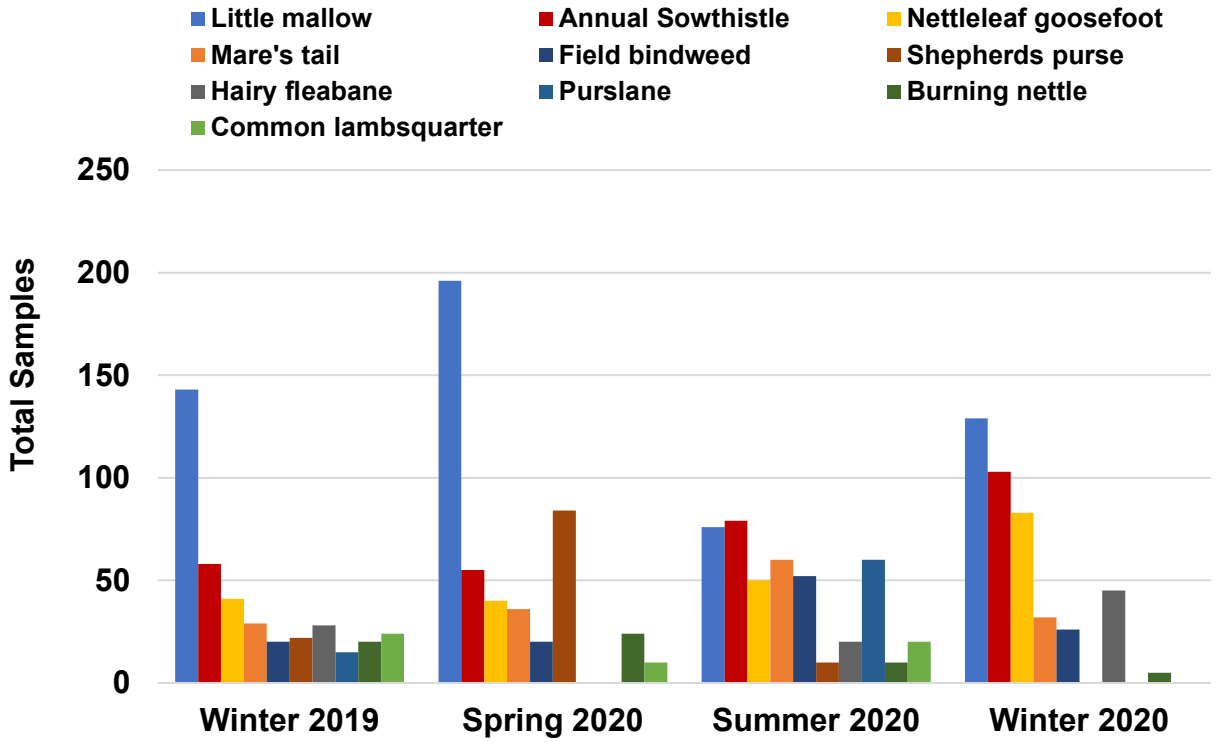
CLGRP 2020-2021

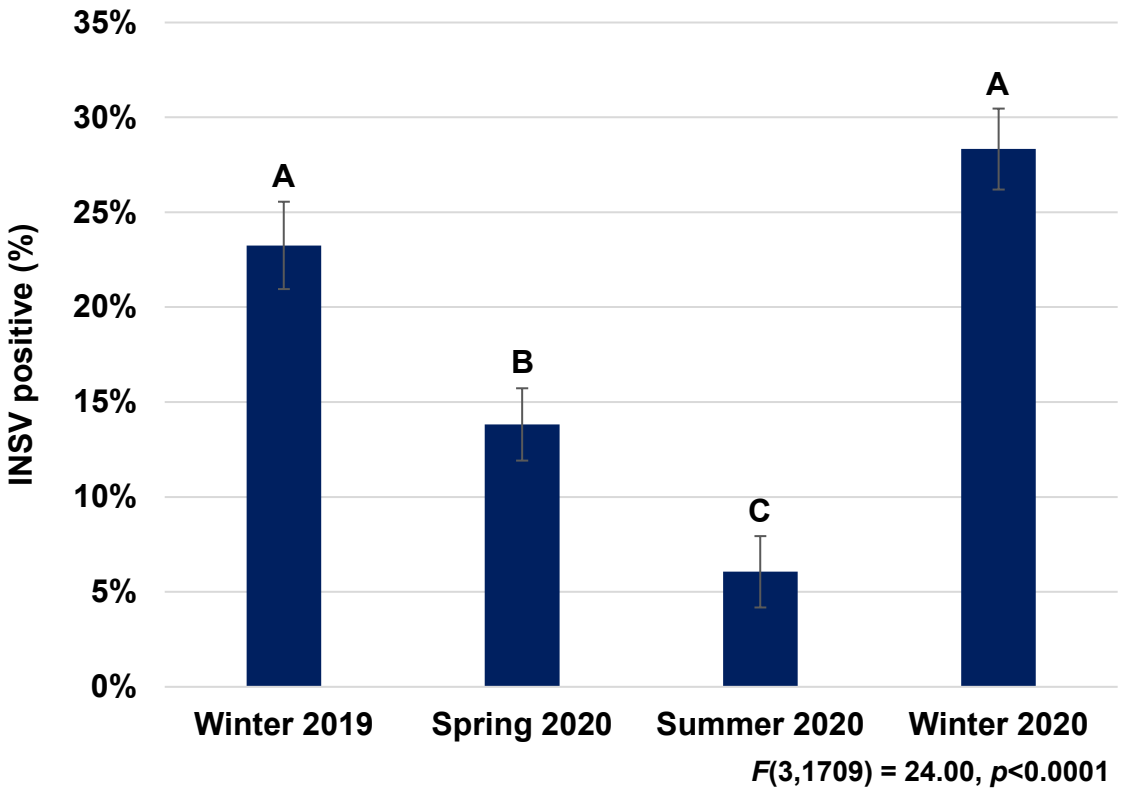
#	Common name	WINTER 2019			SPRING 2020			SUMMER 2020			WINTER 2020			TOTAL		
		Total	INSV	Percent	Total	INSV	Percent	Total	INSV	Percent	Total	INSV	Percent	TOTAL	INSV	Percent
1	Little mallow	143	25	17%	196	49	25%	76	5	7%	129	30	23%	544	109	20%
2	Annual sowthistle	58	25	43%	55	8	15%	79	3	4%	103	29	28%	295	65	22%
3	Nettleleaf goosefoot	41	4	10%	40	7	18%	50	6	12%	83	25	30%	214	42	20%
4	Mare's tail	29	2	7%	36	0	0%	60	1	2%	32	12	38%	157	15	10%
5	Field bindweed	20	7	35%	20	6	30%	52	2	4%	26	13	50%	118	28	24%
6	Shepherd's purse	22	7	32%	84	3	4%	10	1	10%				116	11	9%
7	Hairy fleabane	28	10	36%				20	0	0%	45	15	33%	93	25	27%
8	Purslane	15	11	73%				60	4	7%				75	15	20%
9	Burning nettle	20	6	30%	24	1	4%	10	2	20%	5	3	60%	59	12	20%
10	Common lambsquarter	24	14	58%	10	4	40%	20	2	10%				54	20	37%
...	Top 10 total	400	111	27%	465	78	16%	437	26	5%	423	127	30%	1725	342	20%
73	TOTAL	824	128	16%	723	79	11%	822	39	5%	952	178	19%	3321	429	13%



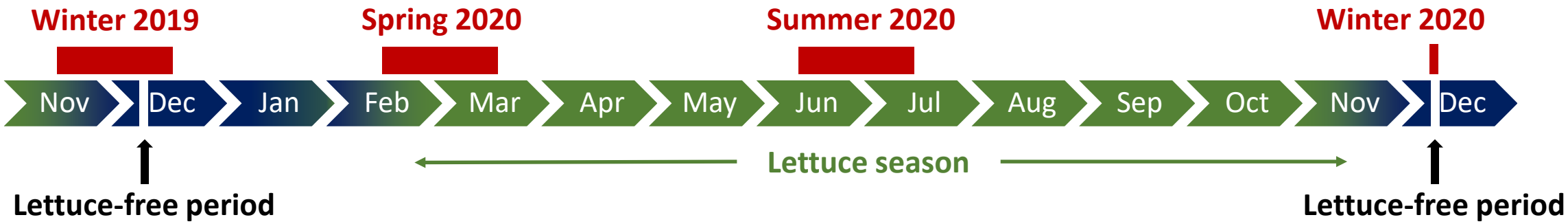
Top 10 hosts for INSV

CLGRP 2020-2021





F(3,1709) = 24.00, *p*<0.0001



Note on weed management

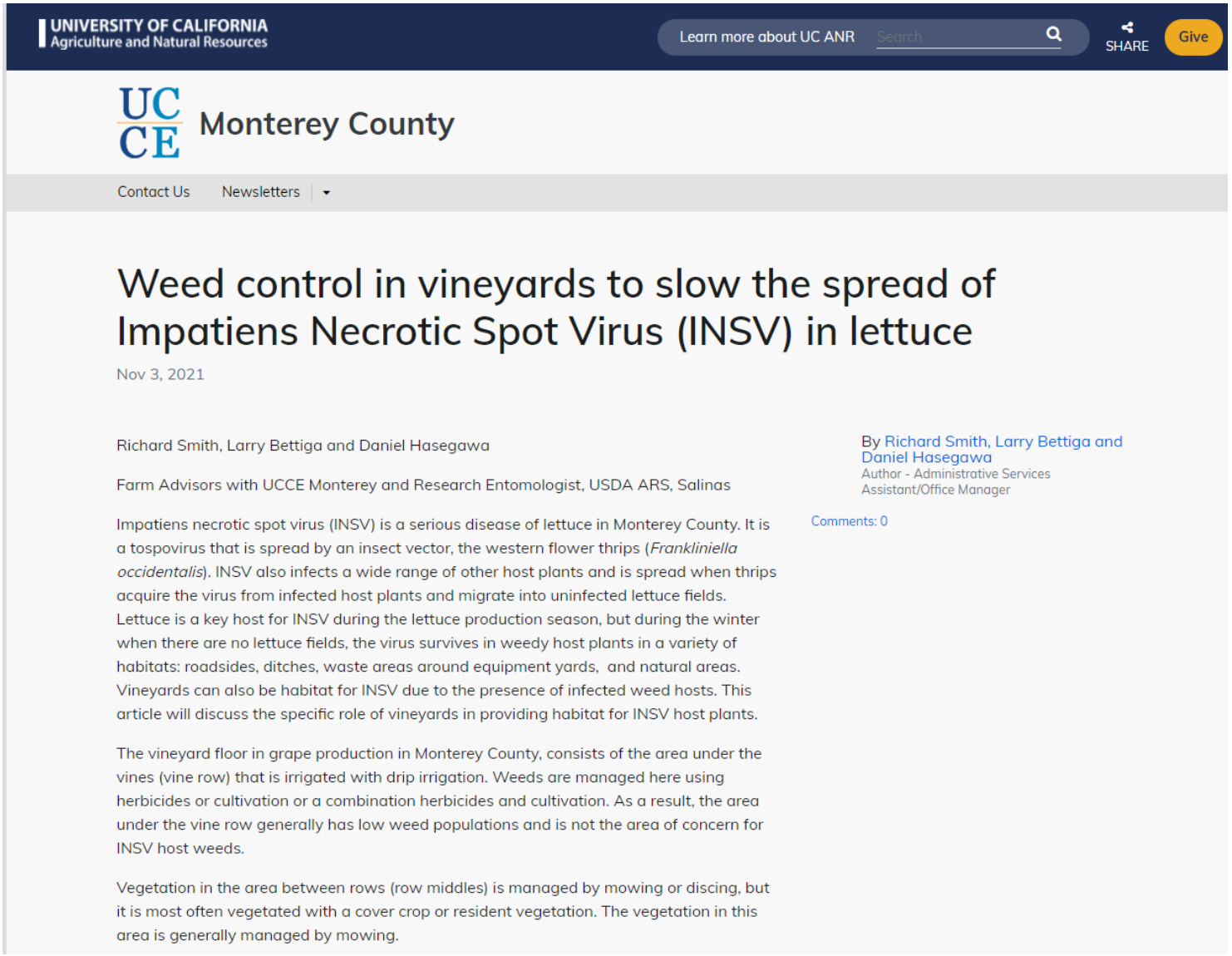
Lettuce, thrips, and INSV are still around, although acreage and populations are declining
Recent rain = emergence of weeds
Transition of the virus from lettuce to weeds

Continue weed management during off-season months (December and January) to reduce potential reservoirs of INSV *before* 2022 lettuce season and *before* thrips populations increase

Establish Valley-wide efforts to manage “hard to access” areas

Salinas Valley Agriculture Blog

Nov 3, 2021



Weed control in vineyards to slow the spread of Impatiens Necrotic Spot Virus (INSV) in lettuce

Nov 3, 2021

Richard Smith, Larry Bettiga and Daniel Hasegawa

Farm Advisors with UCCE Monterey and Research Entomologist, USDA ARS, Salinas

By Richard Smith, Larry Bettiga and Daniel Hasegawa
Author - Administrative Services Assistant/Office Manager

Comments: 0

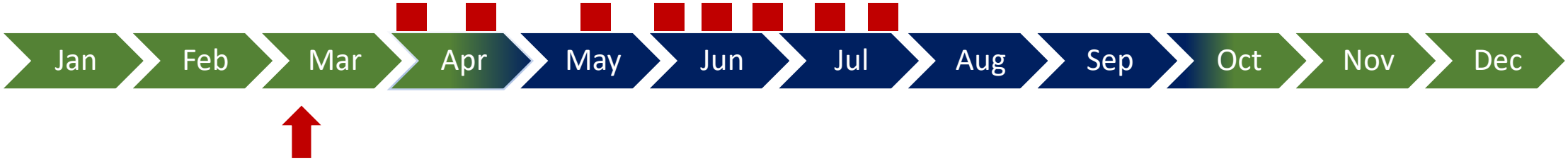
Impatiens necrotic spot virus (INSV) is a serious disease of lettuce in Monterey County. It is a tospovirus that is spread by an insect vector, the western flower thrips (*Frankliniella occidentalis*). INSV also infects a wide range of other host plants and is spread when thrips acquire the virus from infected host plants and migrate into uninfected lettuce fields. Lettuce is a key host for INSV during the lettuce production season, but during the winter when there are no lettuce fields, the virus survives in weedy host plants in a variety of habitats: roadsides, ditches, waste areas around equipment yards, and natural areas. Vineyards can also be habitat for INSV due to the presence of infected weed hosts. This article will discuss the specific role of vineyards in providing habitat for INSV host plants.

The vineyard floor in grape production in Monterey County, consists of the area under the vines (vine row) that is irrigated with drip irrigation. Weeds are managed here using herbicides or cultivation or a combination herbicides and cultivation. As a result, the area under the vine row generally has low weed populations and is not the area of concern for INSV host weeds.

Vegetation in the area between rows (row middles) is managed by mowing or discing, but it is most often vegetated with a cover crop or resident vegetation. The vegetation in this area is generally managed by mowing.

Field surveys for INSV hosts in Arizona

Weed sampling for INSV:



INSV detected in lettuce in early March 2021:
Yuma and Tacna, AZ
Imperial and Riverside Counties, CA

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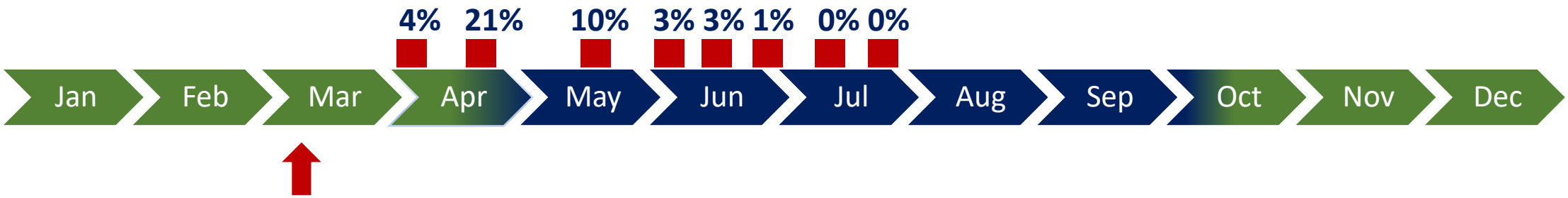

INSV detected in lettuce in early March 2021:
Yuma and Tacna, AZ
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Currently working with Apurba Barman (UCCE Imperial) and Alex Putman (UC Riverside) to test samples in Southern California dessert

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Two types of infection

Secondary infection

Within field

Primary infection

Outside field

Two types of infection

***Roguing**: diseased plants are removed to slow the spread of disease*
"Extension of weed management"

Secondary infection

Within field

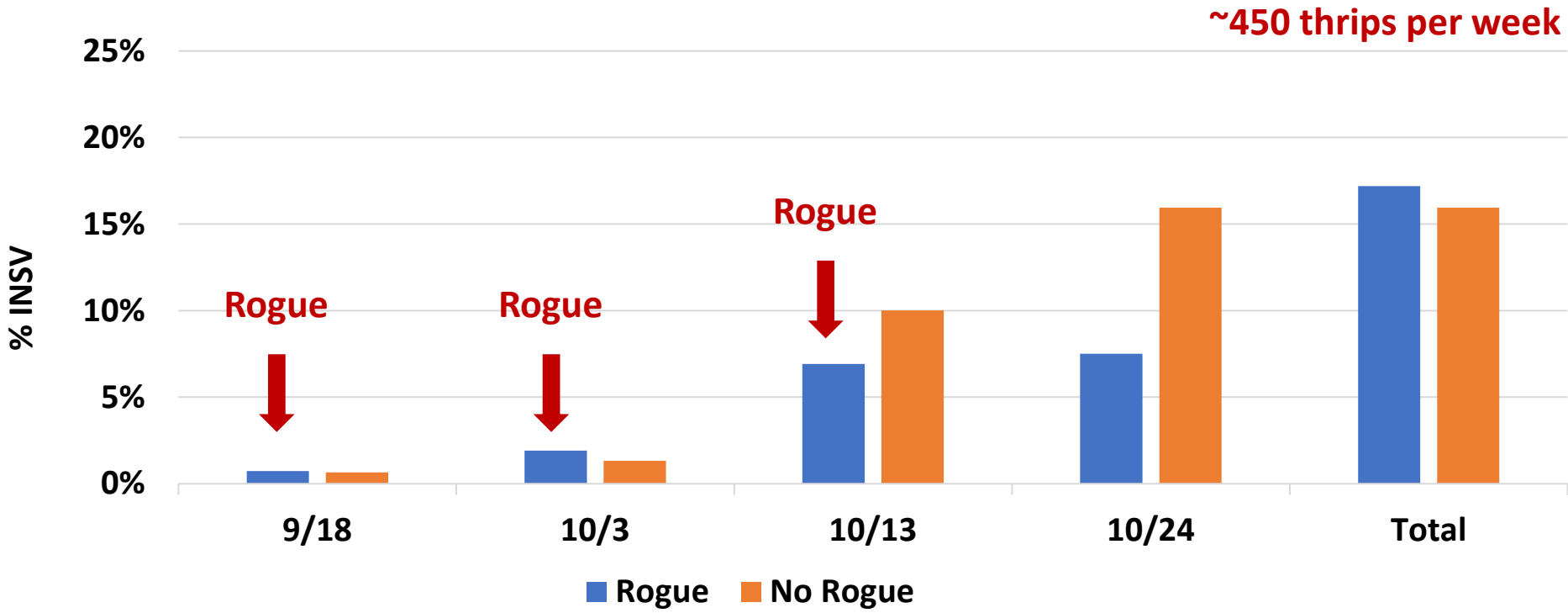
Primary infection

Outside field

Rogue trial #1: Fall 2020

Plant: 8/21/20
Harvest: 10/24/20

40 in. beds, conventional, direct-seeded
Treatment sizes = 50 x 50 ft.
Rogue = removing (bagging) INSV symptomatic plants from the field
3 Rogues

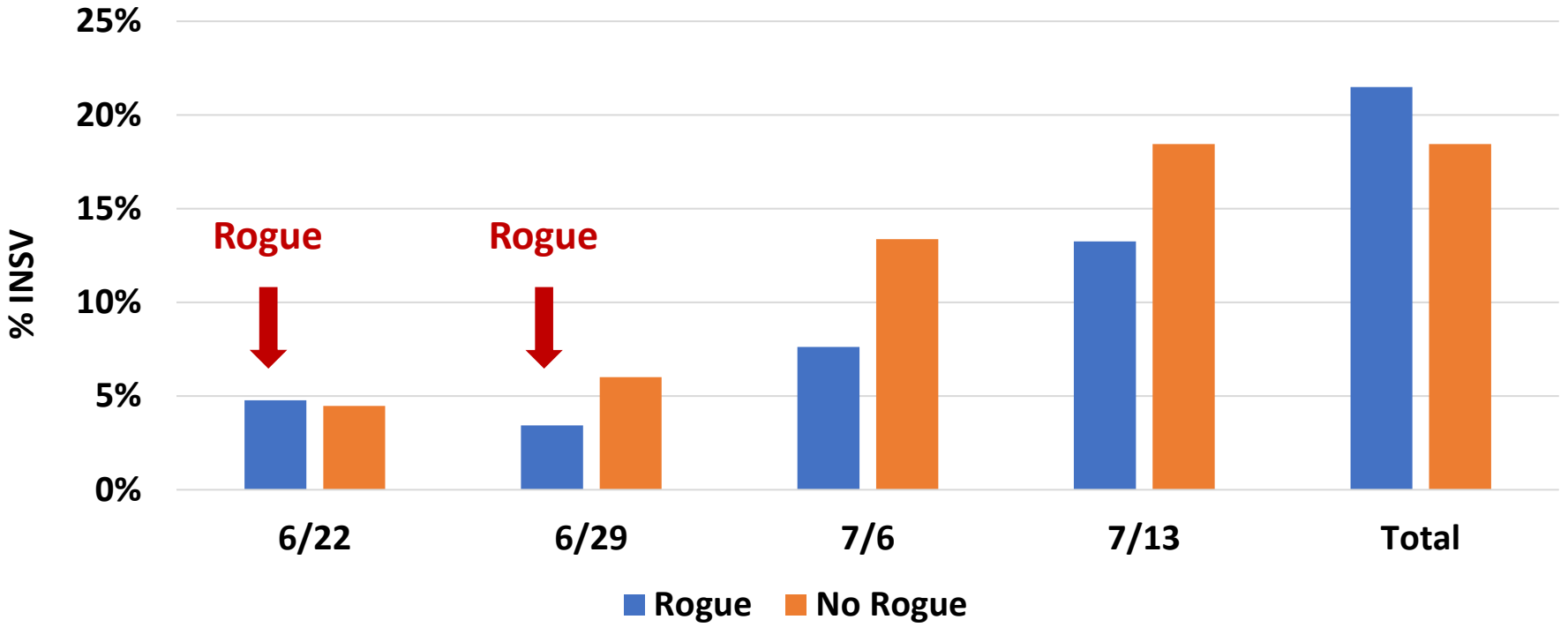


Rogue trial #2: Summer 2021

Plant: 5/12/21
Harvest: 7/19/21

80 in. beds, conventional, direct-seeded
Treatments: Rogue (2), No Rogue (2)
Treatment sizes = 50 x 50 ft.
Rogue = removing (bagging) INSV symptomatic plants from the field
2 Rogues

~117 thrips per week

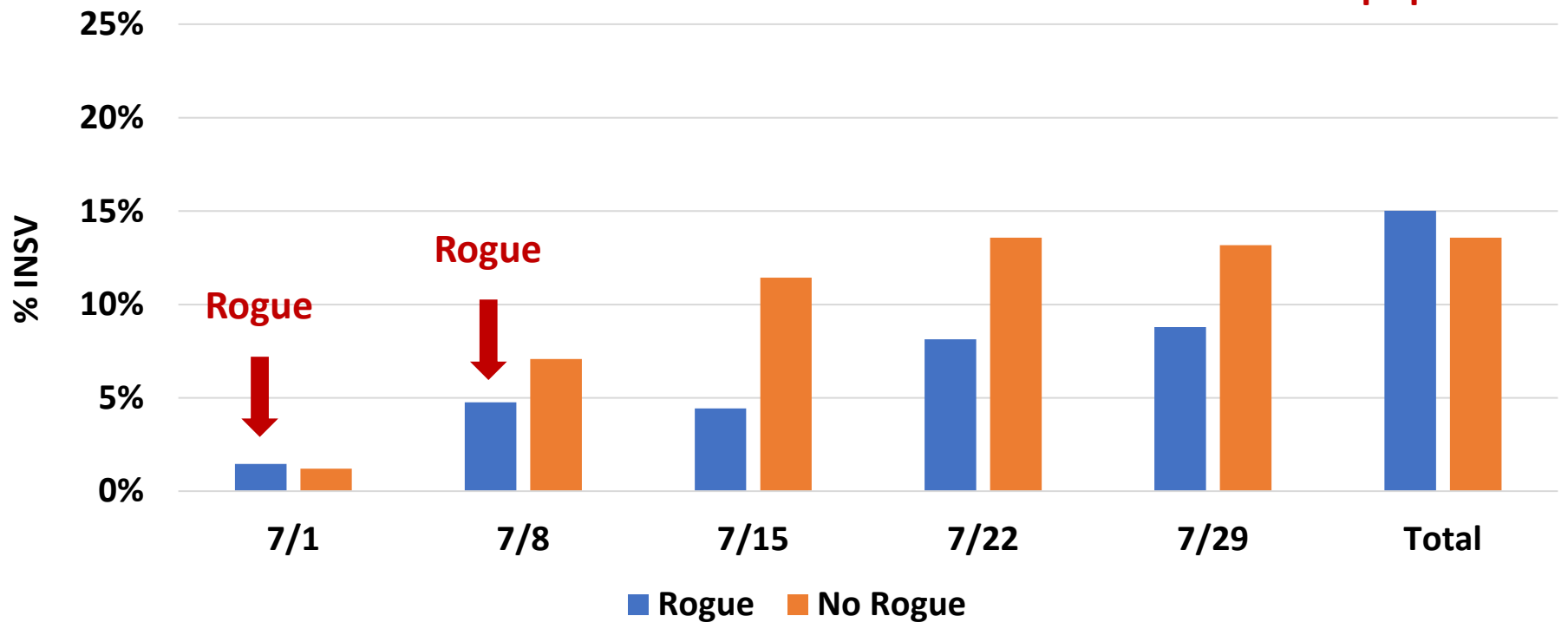


Rogue trial #3: Summer 2021

Plant: 6/10/21
Harvest: 8/2/21

80 in. beds, conventional, transplanted
Treatments: Rogue (2), No Rogue (2)
Treatment sizes = 50 x 50 ft.
Rogue = removing (bagging) INSV symptomatic plants from the field
2 Rogues

~127 thrips per week



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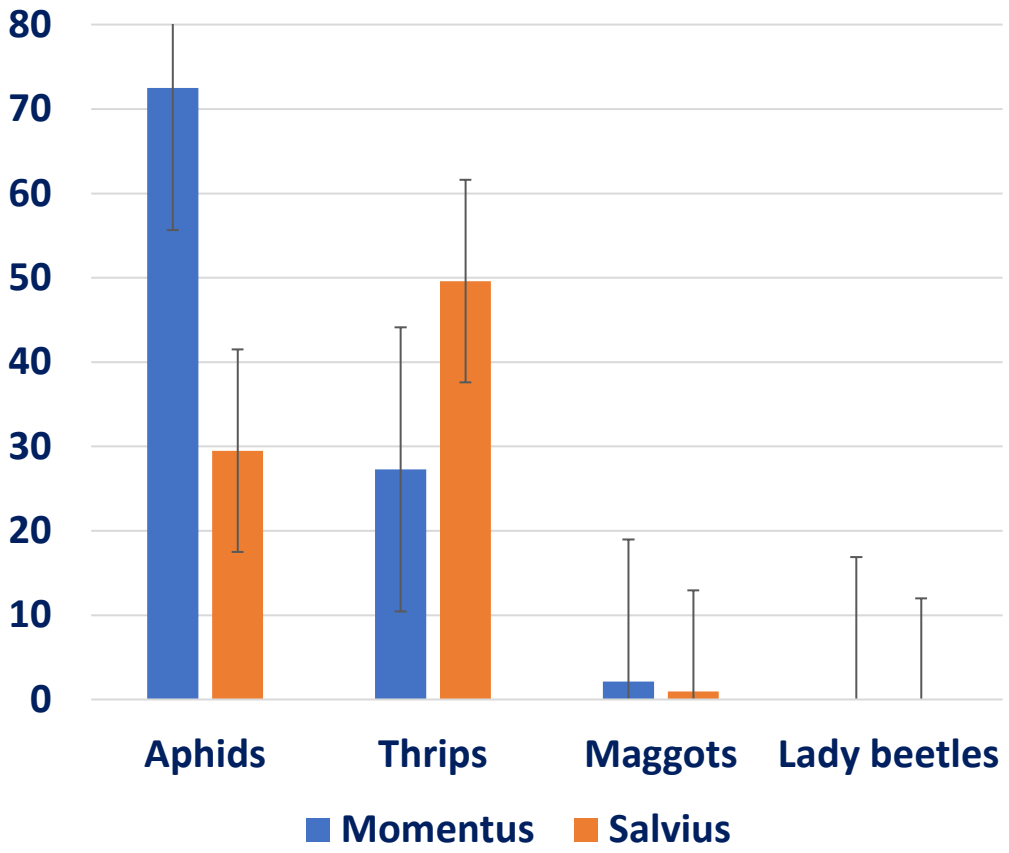


Variety	INSV Symptoms
Vicious	+++++
Boronda	+++
Momentous	++
Salvius	++++
Copious	+

INSV Reporting: 2021 Season

of fields reporting INSV at >1% incidence
(~25% of industry reporting: growers/shippers, ag service companies)

GROWER-SHIPPER ASSOCIATION of Central California Since 1930

MAP	LOCATION	SEASON TO DATE
1	North Salinas, Blanco, Castroville	90
2	Spreckels	94
3	Firestone	3
4	Chualar NW	44
5	Salinas South	99
6	Chualar NE	68
7	Chualar SW and Gonzales NW	44
8	Chualar SE and Gonzales NE	89
9	Gonzales SW and Soledad NW	52
10	Gonzales SE and Soledad NE	0
11	Soledad	161
12	Greenfield and South County	22
TOTAL		766

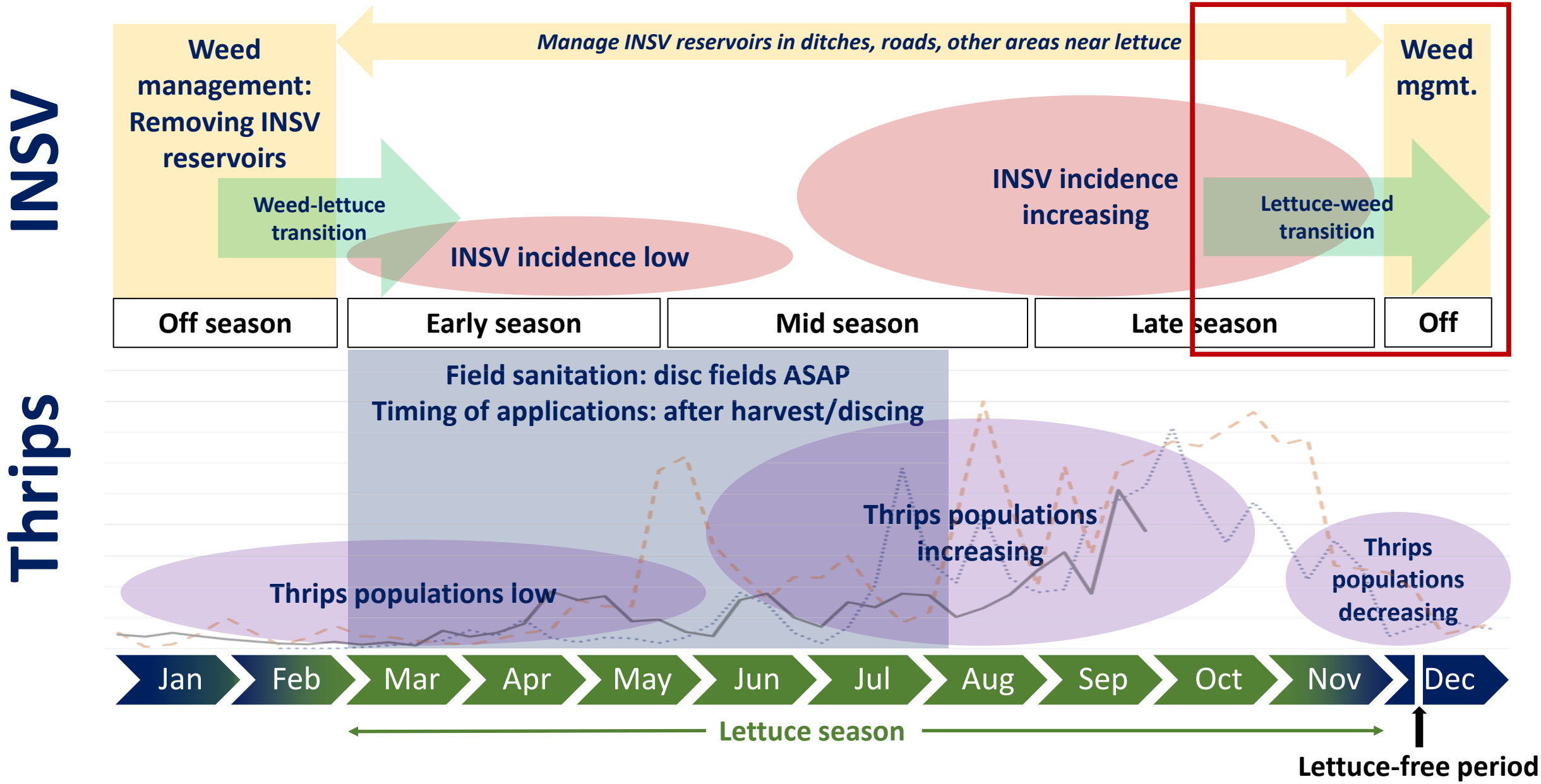
Chris Valadez, GSA President
Mary Zischke, INSV/Pythium Task Force leader
Task Force members

INSV/Pythium GAPs

GROWER-SHIPPER ASSOCIATION of Central California Since 1930

- Disk harvested fields as soon as possible
  - INSV infected plants continue to harbor thrips that could move the virus to later plantings
  - Pythium infected plants support the formation of soilborne spores that could infect subsequent plantings for several years
- Aggressively manage thrips
- Aggressively manage weed hosts
  - In lettuce plantings, in other crops on the ranch, in bordering areas, when possible
- Report disease incidence
  - Scout for both INSV and Pythium
  - Know the key symptoms of both diseases

Thrips/INSV IPM model (*in progress*)



THANK YOU

Technician: Laura Hladky

Students: Joseph Mellow, Shawn Melendy, Rahil Ryder, Duncan Miller, Mariana Garcia, Rebecca Munster, Grace Hardy, Tony Tapia

CSUMB: Elizabeth Mosqueda, JP Dundore-Arias

UCCE: Richard Smith, Apurba Barman, Jasmine Rodriguez (GSA)

U of AZ: John Palumbo, Stephanie Slinski, Bindu Poudel-Ward

UC Riverside: Alex Putman

Growers and PCAs

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 1950