

# ***Tomato spotted wilt virus, Thrips Control and Variety Susceptibility***



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# Recent Research

- Potential sources of TSWV in Fresno Co.
- Use of insecticides for thrips/TSWV management
  - Insecticide comparisons
  - Influence of insecticide programs on TSWV incidence
- Relative susceptibility of processing tomato varieties

# Recent Research

- Potential sources of TSWV in Fresno Co.

# Reported Crop Hosts of TSWV

- Beans
- Celery
- Cilantro
- Eggplant
- Lettuce
- Pepper
- Potato
- Radicchio
- Spinach

# A Few Reported Weed Hosts of TSWV

- Field bindweed
- Common sunflower
- Black nightshade
- Hairy fleabane
- Jimson weed
- Lambsquarters
- London Rocket
- Malva
- Prickly lettuce
- Purslane
- Pigweed
- Russian thistle
- Sowthistle
- Tree tobacco

# Sources of TSWV in Fresno Co.

- **Other crops**

- **Tomato transplants? Three transplant houses monitored over 3 years and TSWV was not detected**
- **Almond orchards? 4 Almond orchards monitored for thrips and TSWV over 2 years, no TSWV**
- **Radicchio? TSWV and high thrips detected one year at one location**
- **Lettuce? TSWV is detected in Fall lettuce, rare but present in Spring. Intensive insecticide applications.**



## Tomato spotted wilt virus detected in lettuce, 2008

Five Points Area

31 Mar: 1 plant/20 min, 0 detected in two fields

16 Apr: 5 plants/100 row ft

Huron Area:

31 Mar: Two fields: 11 and 13 plants/20 min





# Monitored Lettuce Fields in Fall 2008

Firebaugh, CA

Mendota, CA

Fresno

Cantua Creek, CA

\* 1.3%

\* 0.5%

\* 0%

Huron, CA

\* 0.5%

Kings

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Image NASA

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# Monitored Lettuce Fields in Spring 2009

No TSWV  
detected  
Jan - Mar

Firebaugh, CA

Mendota, CA

Fresno

Cantua Creek, CA

Huron, CA

Kings

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# Monitored Lettuce Fields in Fall 2009

By late-Oct  
or early-Nov

Firebaugh, CA

Mendota, CA

Fresno

Cantua Creek, CA

\* 0.1, 0.8%

\* 1.3, 1.1%

Huron, CA \* 0.9, 2.5%

\* 1.0, 2.8%

Kings

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# Sources of TSWV in Fresno Co.

- Weeds

- Surveys conducted from 2005 to 2008 – very few weeds with TSWV were detected



Weeds  
TSWV +  
in mid-Jan  
2009

Firebaugh, CA  
\*1 TSWV +  
sowthistle

Firebaugh area  
samples:  
3 sowthistle  
2 malva  
1 goosefoot

Five Points area  
samples:  
7 sowthistle  
2 prickly lettuce

\*1 TSWV +  
sowthistle

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Streaming 100%

36°22'44.27" N 120°14'05.21" W elev 281 ft

Eye a



Weeds  
sampled  
in Feb 2009

Firebaugh, CA

Mendota, CA

Fresno

Cantua Creek, CA



Huron, CA

Huron area sample  
5 sowthistle  
5 safflower volunt  
ALL TSWV negat

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Image NASA

36°22'44.27" N 120°14'05.21" W elev 281 ft

Streaming ||||| 100%

Eye a



Weeds  
sampled in  
early  
Mar 2009:  
TSWV neg

Almond orchard in Firebaugh area

7 prickly lettuce

3 shepherd's purse

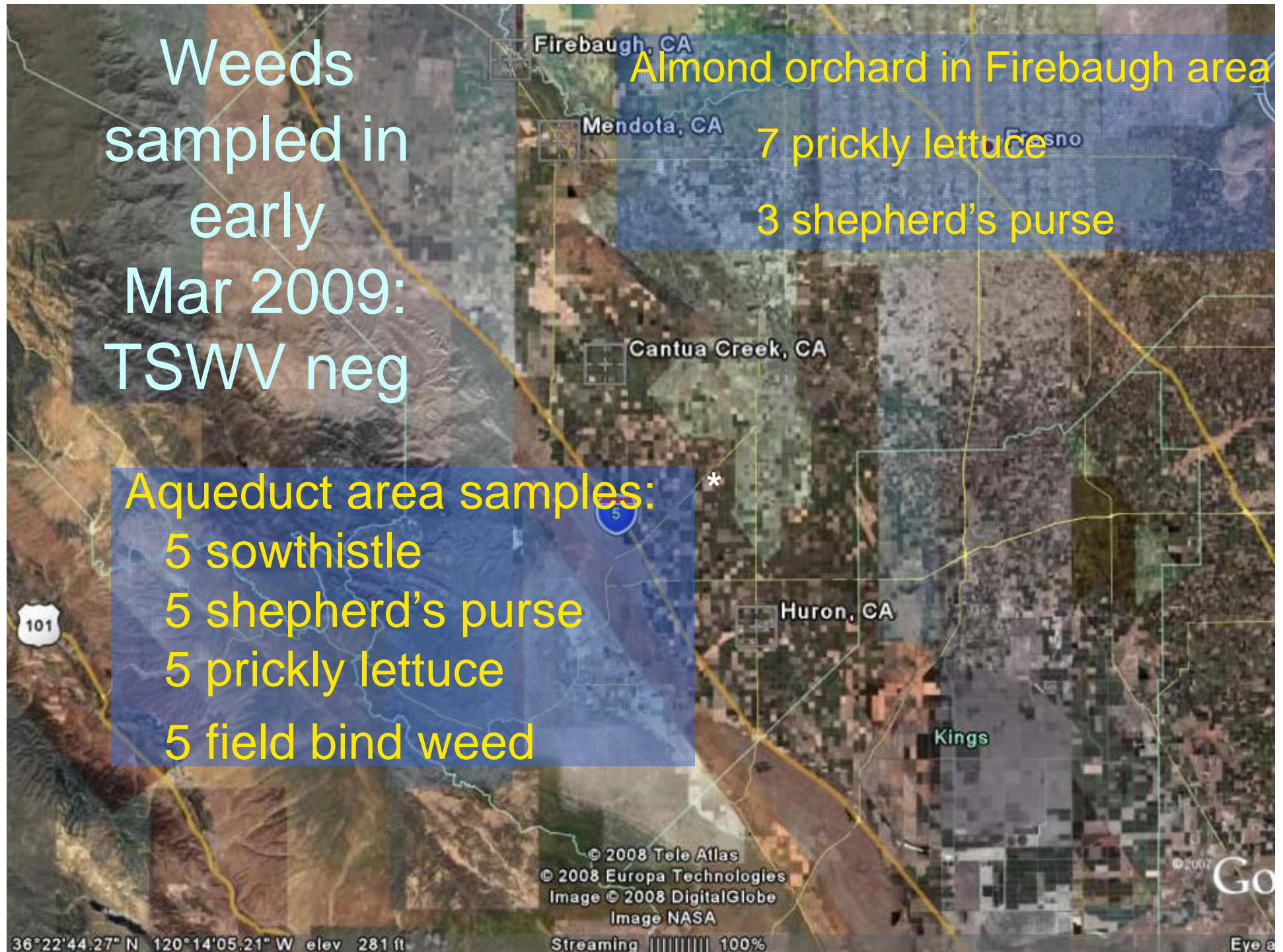
Aqueduct area samples:

5 sowthistle

5 shepherd's purse

5 prickly lettuce

5 field bind weed



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Image NASA

Streaming 100%

36°22'44.27" N 120°14'05.21" W elev 281 ft

Eye a



# Uncultivated Fields Evaluated in Spring 2009

3 Firebaugh area  
locations  
2 Five Points  
area locations

Firebaugh, CA

Mendota, CA

Fresno

Cantua Creek, CA

Huron, CA

Kings

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**Five Points Area Uncultivated Field on 25 Mar**  
**(6% sowthistle TSWV+)**

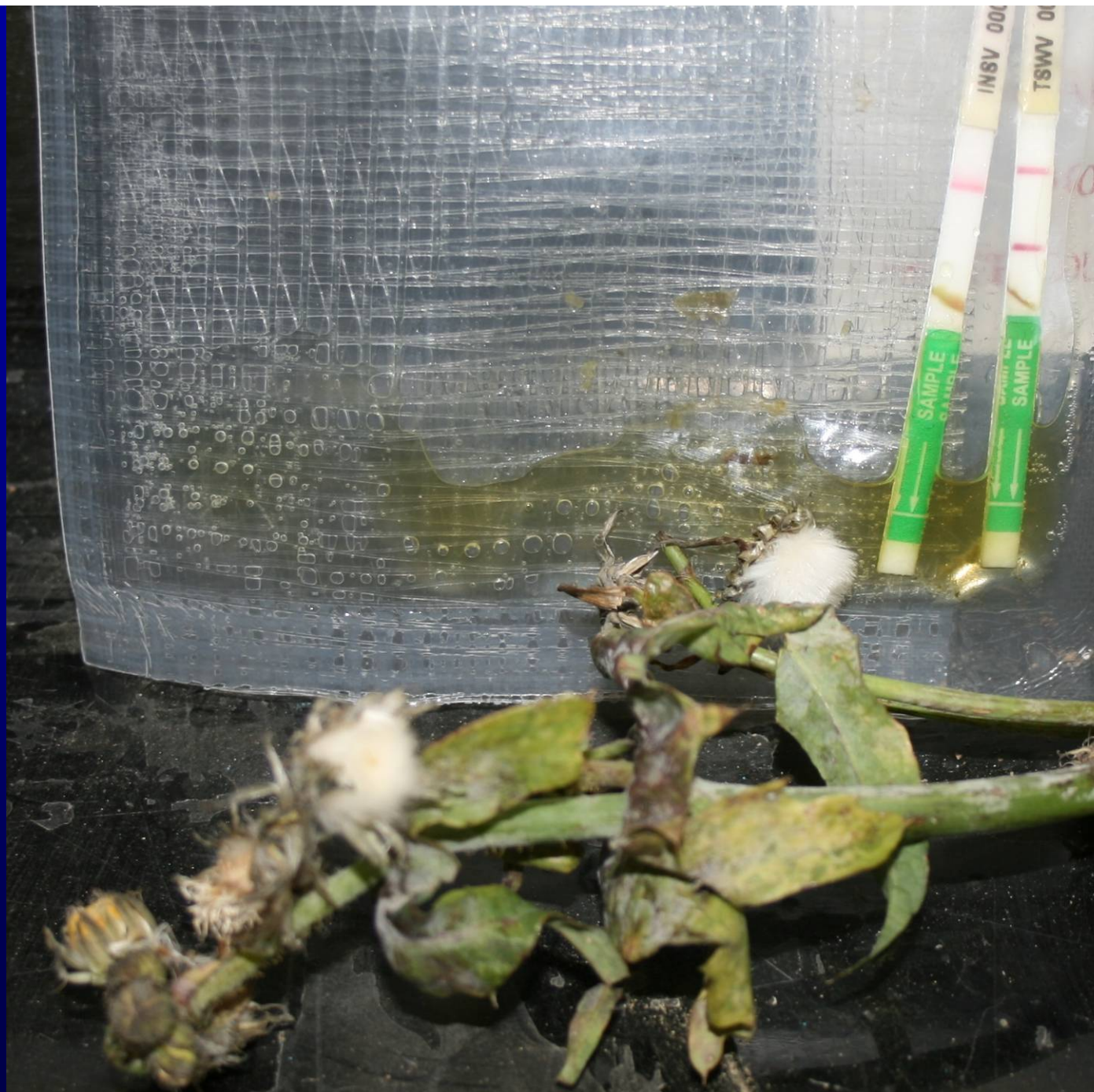




**Five Points Area Uncultivated Field on 22 Apr**  
(2% sowthistle and 7% prickly lettuce TSWV+)

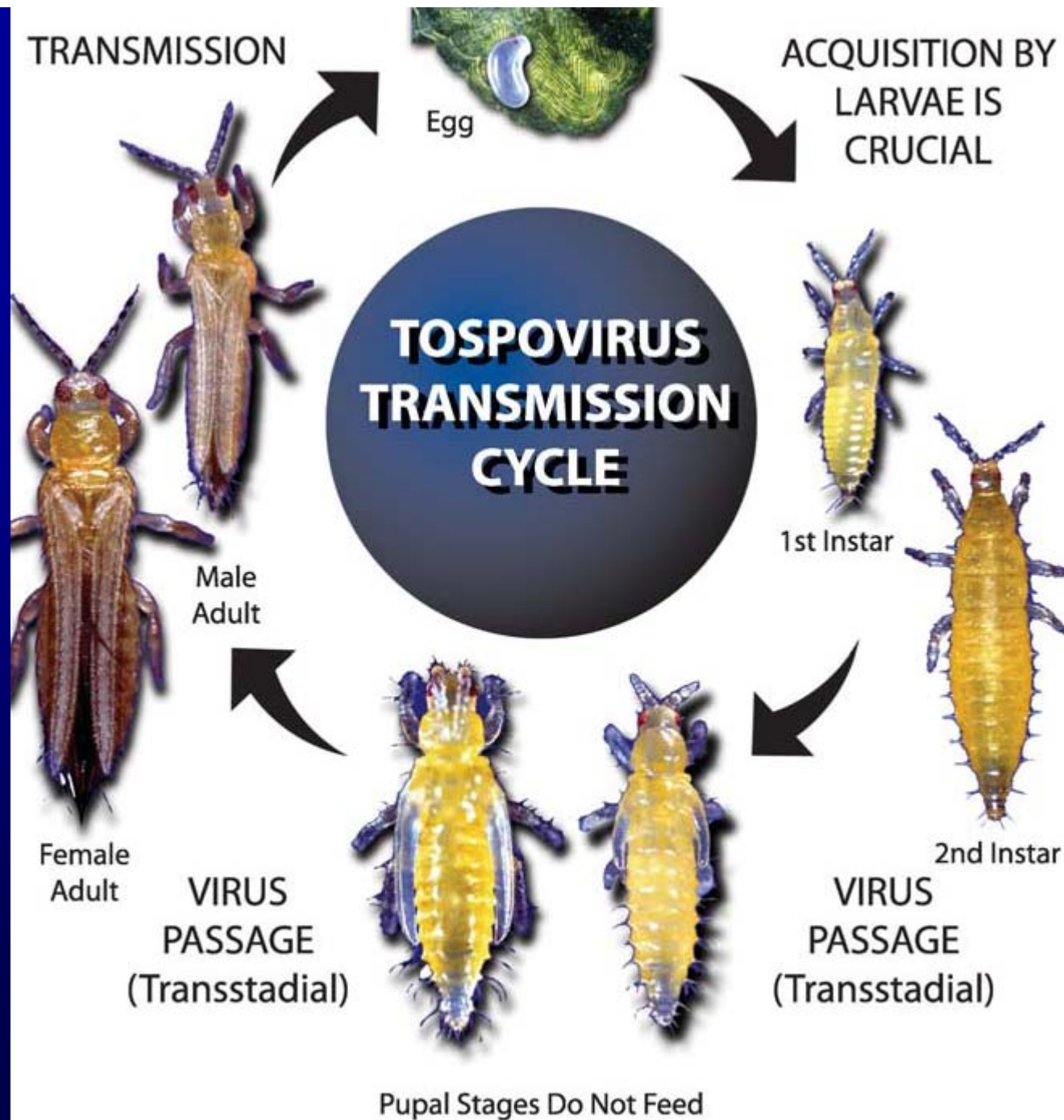






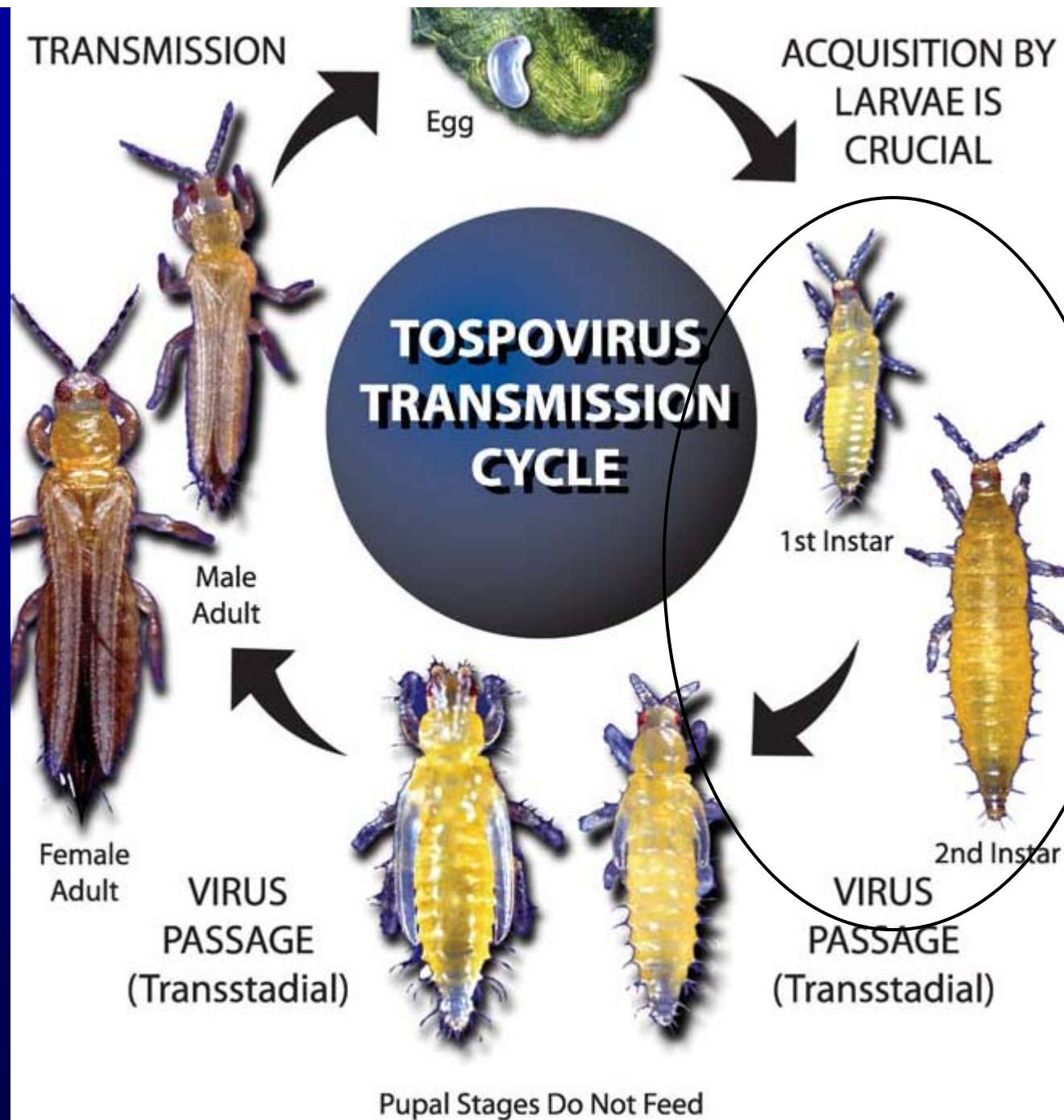
# Recent Research

- Potential sources of TSWV in Fresno Co.
- Use of insecticides for thrips/TSWV management
  - Insecticide comparisons
  - Influence of insecticide programs on TSWV incidence



A. E. Whitfield, D. E. Ullman, and T. L. German. 2005. **TOSPOVIRUS-THRIPS INTERACTIONS**. *Annu. Rev. Phytopathol.* 2005. 43:459–89





TSWV must be acquired by the larvae to be transmissible.

TRANSMISSION

ACQUISITION BY  
LARVAE IS  
CRUCIAL

Egg

## TOSPOVIRUS TRANSMISSION CYCLE

Male  
Adult

1st Instar

2nd Instar

Female  
Adult

VIRUS  
PASSAGE  
(Transstadial)

VIRUS  
PASSAGE  
(Transstadial)

Pupal Stages Do Not Feed

Adults emerge and resume feeding on flowers, buds, and terminal foliage.

Adults can live 30 to 45 days and transmit the viruses to plants throughout their life.



# Limitations of Thrips Control with Insecticides

- Thrips adults and immature stages generally prefer areas of the plant where they are sheltered (flower or bud tissues)
- Thrips populations can increase very rapidly, 200-300 eggs/female
- Insecticide resistance is a concern

# Insecticide Comparisons 2007-2009

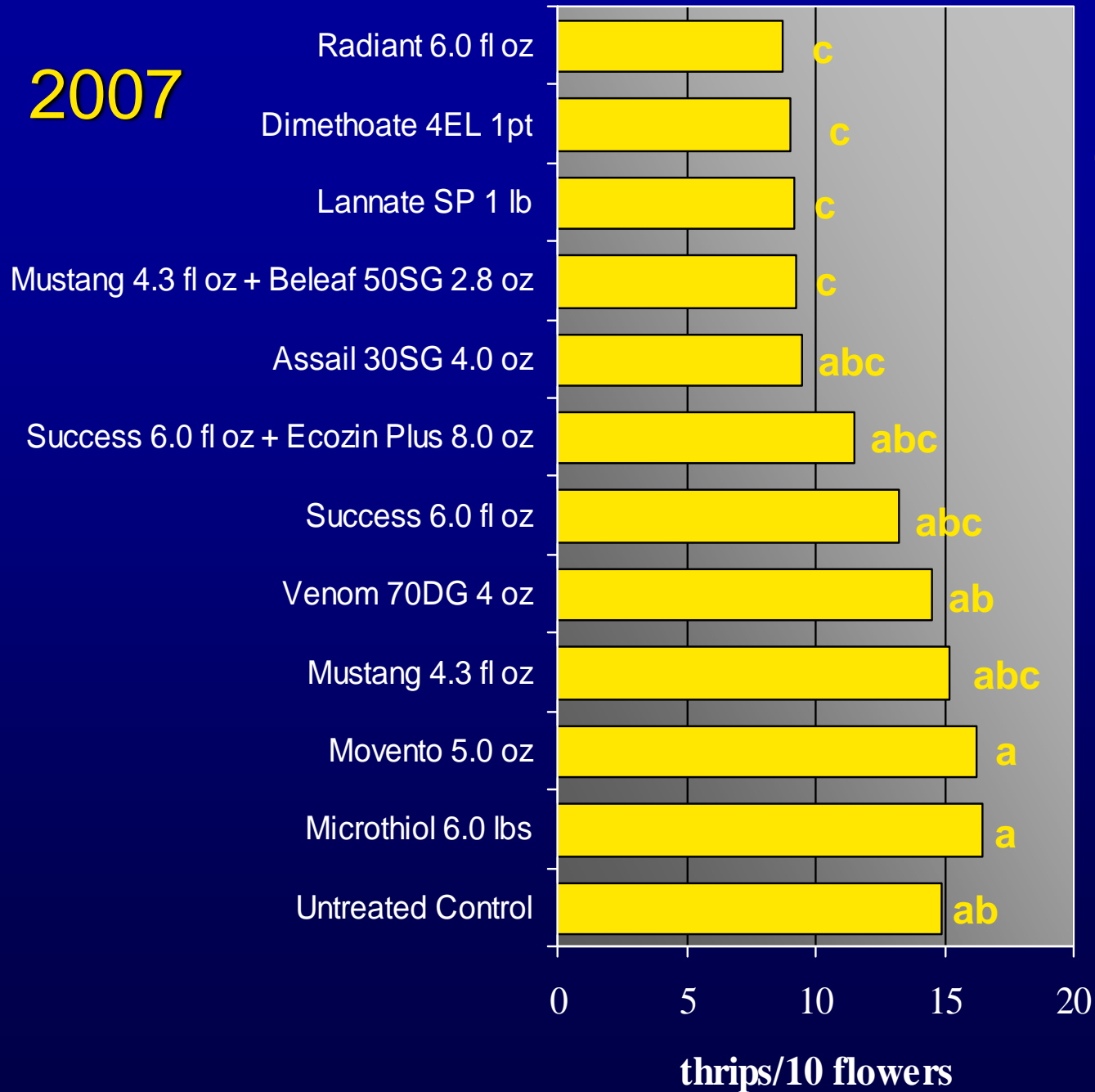
- Varieties and plant dates
  - H 9997 direct seeded on 9 Mar 07
  - H 9665 direct seeded on 9 Apr 2008
  - H 8004 transplant on 14 May 2009
- Materials were applied in the equivalent of 25 gallons of water with Induce 0.25%
- Experimental design: four-replication randomized complete block



Some materials tested may not be registered on tomatoes. All applicable labels should be read before writing a pesticide recommendation.



2007



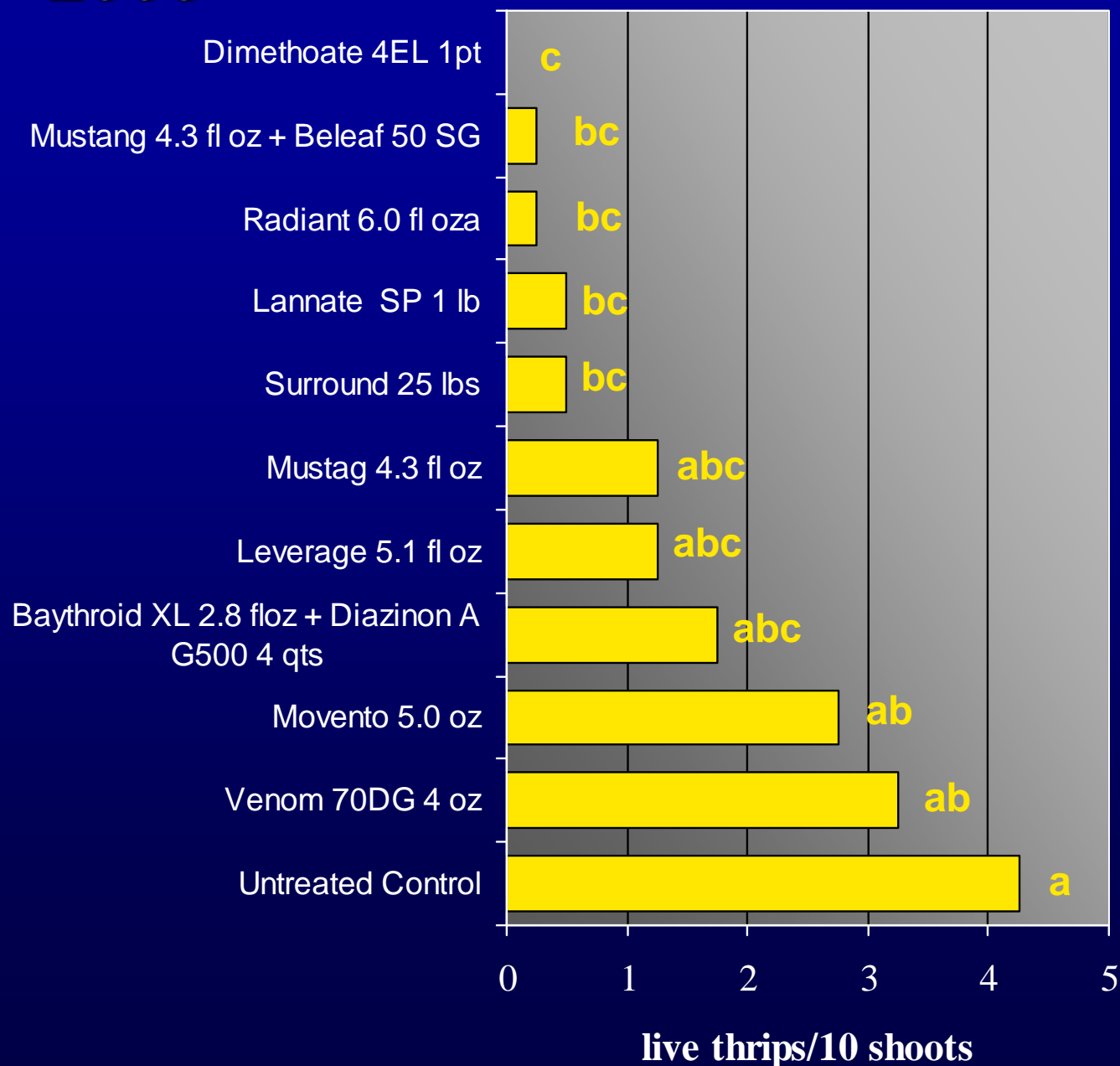
## Thrips Counts (4 days after treatment)



All materials were  
applied on 1 Jun with  
Induce 0.25% v/v



2008



## Live Thrips (4 days after treatment)

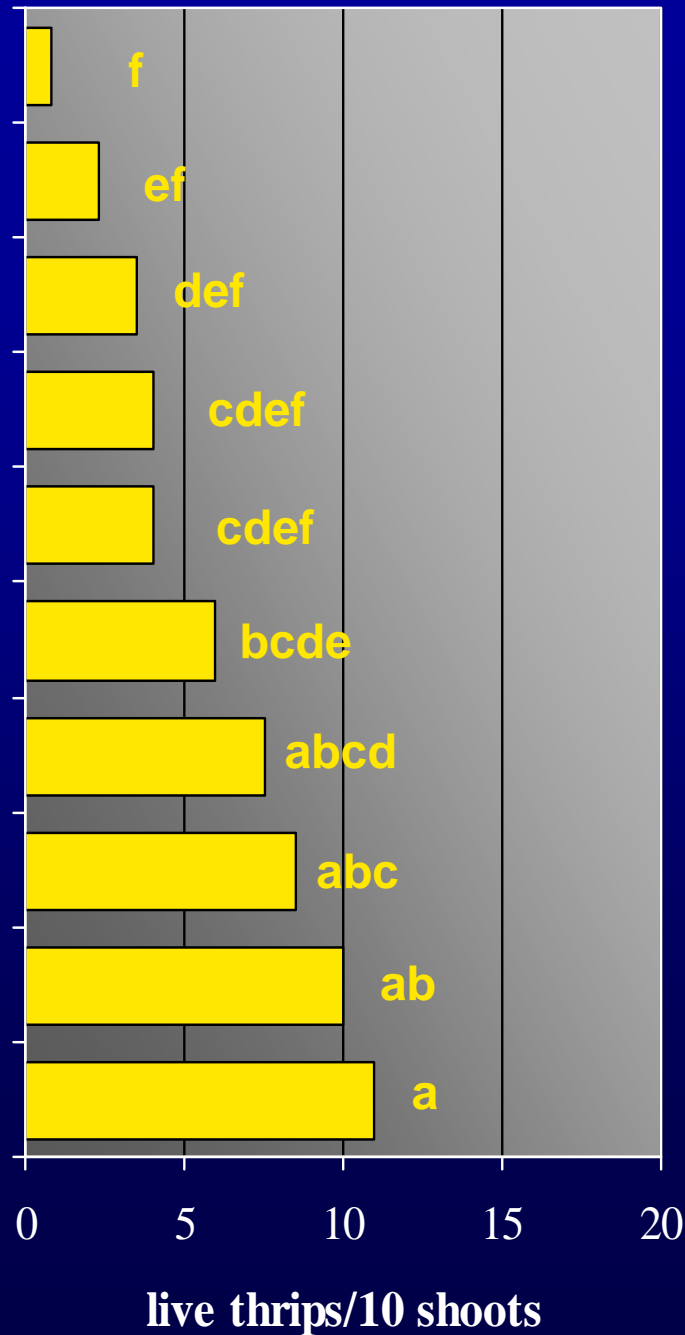


All materials were  
applied on with  
Induce 0.25% on 24  
Jul

2009

HGW86 10SE 13.5 fl oz + Brigade 6.4 fl oz

Radiant 6.0 fl oz  
Hero EW 11.2 fl oz  
Surround 25 lbs  
Beleaf 50SG 2.8 oz  
Agrimek 12 oz  
Requiem 2.0 qts  
Leverage 5.1 fl oz/a  
Requiem 3.0 qts  
Untreated control



## Thrips Counts (4 days after treatment)



All materials were  
applied on 17 Jun with  
Induce 0.25% v/v



# Materials Showing Efficacy Against Thrips in Multiple Fresno Co. Trials

- Dimethoate (2/2)
- Lannate (2/2)
- Radiant (3/3)
- Beleaf + Mustang (2/2)
- Surround (2/2)

# Insecticide Programs

8004 transplanted on 14 May 2009

## Main Plot Treatments (drip injected into three 66 in bed, 315 ft long)

- Platinum 11 fl oz (3 Jun)
- Platinum 11 fl oz (3 Jun) and Venom 3.0 fl oz (7 Jul)
- Untreated

## Sub-plot treatments (applied in 20 gal water/acre @ 30psi)

# apps.	17 Jun	1 Jul	16 Jul	21 Jul
4	Radiant 6 fl oz	Dimethoate 4EL 1pt	Lannate WP 1lb	Radiant 6 fl oz
3 early	Radiant 6 fl oz	Dimethoate 4EL 1pt	Lannate WP 1lb	
3 late		Dimethoate 4EL 1pt	Lannate WP 1lb	Radiant 6 fl oz
Untreated				



# Experimental details

- Four replications, 4 Main plot treatments, 5 sub plot treatments;
- 3 beds per main plot treatments
- 75 ft sub plots

# Five Replication Split-Plot Experimental Design

[illegible]



# Five Replication Split-Plot Experimental Design

[illegible]

# Five Replication Split-Plot Experimental Design

[illegible]



Twenty-Five flowers/plot  
collected and thrips counted



# Number of plants expressing symptoms on 14 Sep





# Affect of Subsurface drip applications on thrips densities

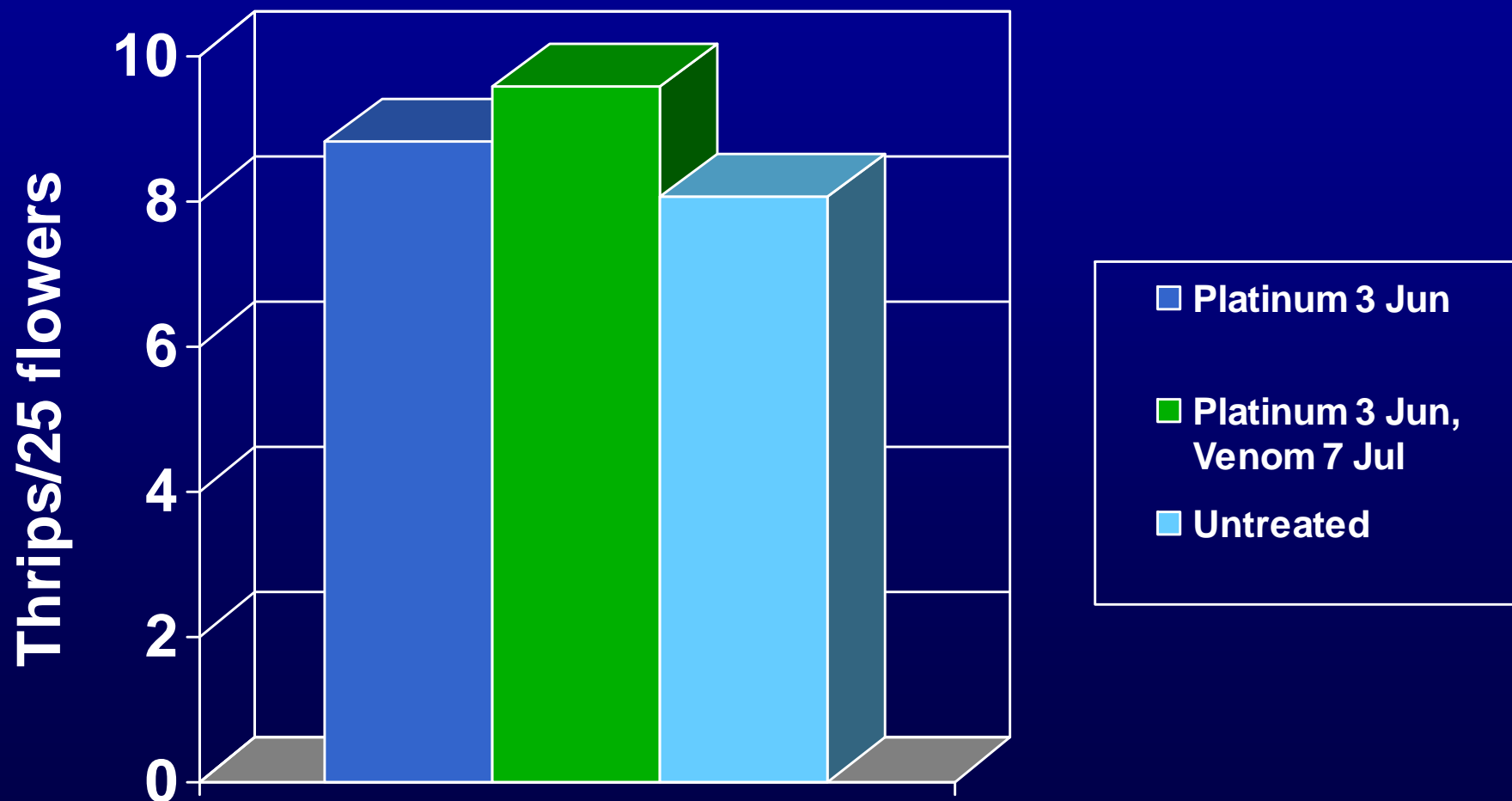
16 Jun (13 days after treatment)

Treatment	Thrips/25 flowers
Platinum 11 fl oz on 3 Jun	82.37
Untreated	110.25
P (group comparison)	0.052

# Thrips Densities

## Soil-Applied Insecticide

(flowers collected 15 Jul)



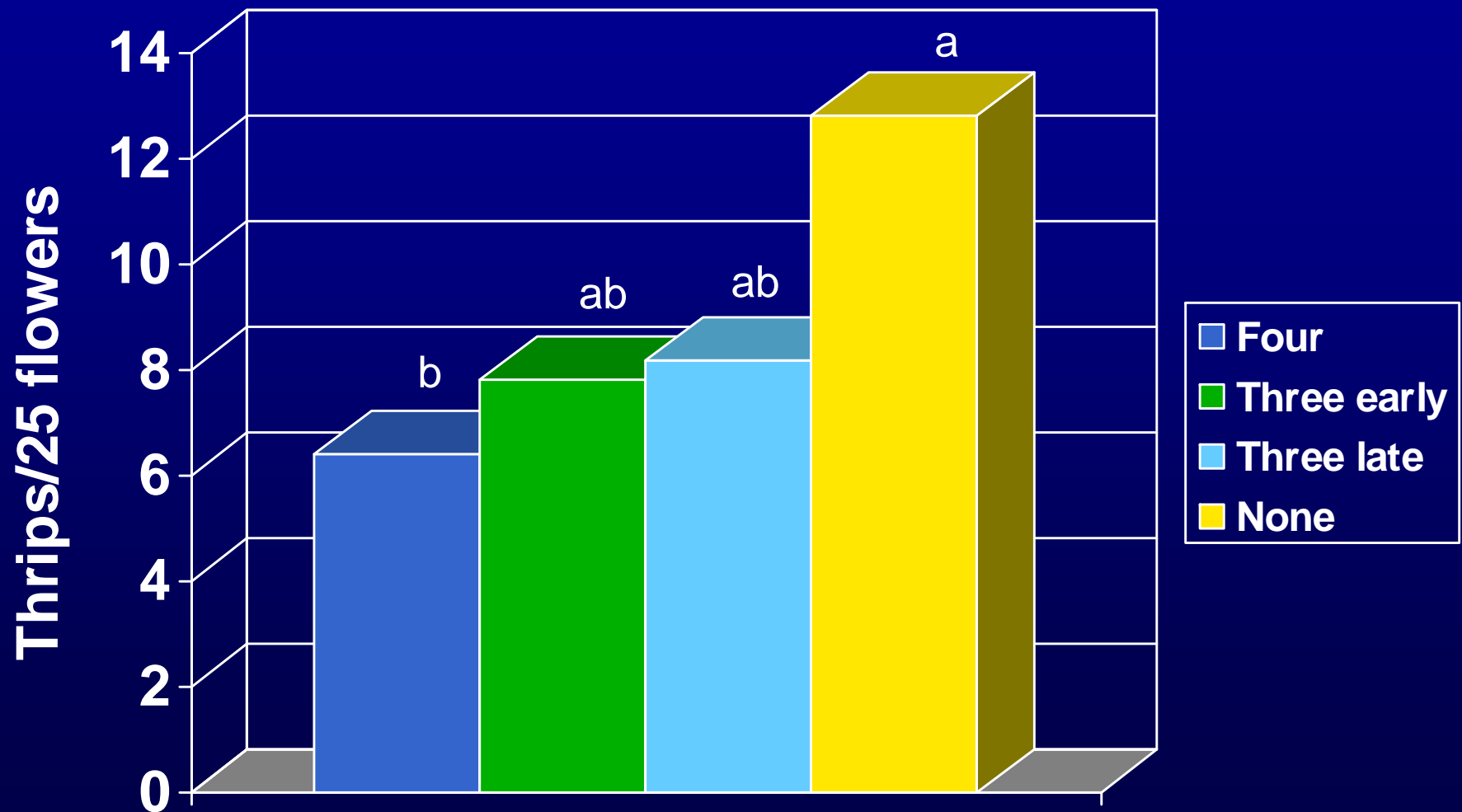
NO SIGNIFICANT DIFFERENCE  $P=0.05$



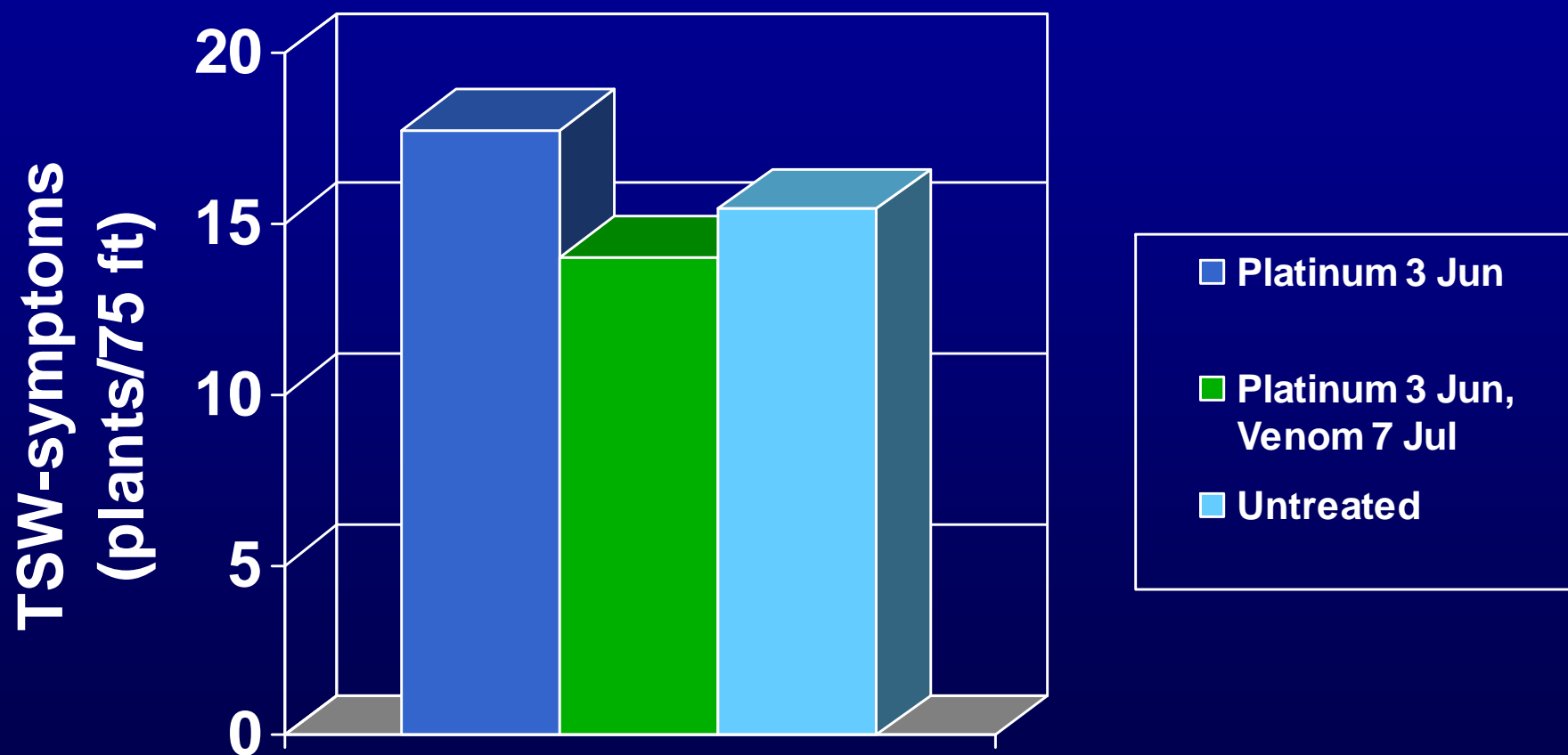
# Thrips Densities

## Foliar-Applied Insecticide

(flowers collected 15 Jul)



# TSW-Symptom Incidence Soil-Applied Insecticide

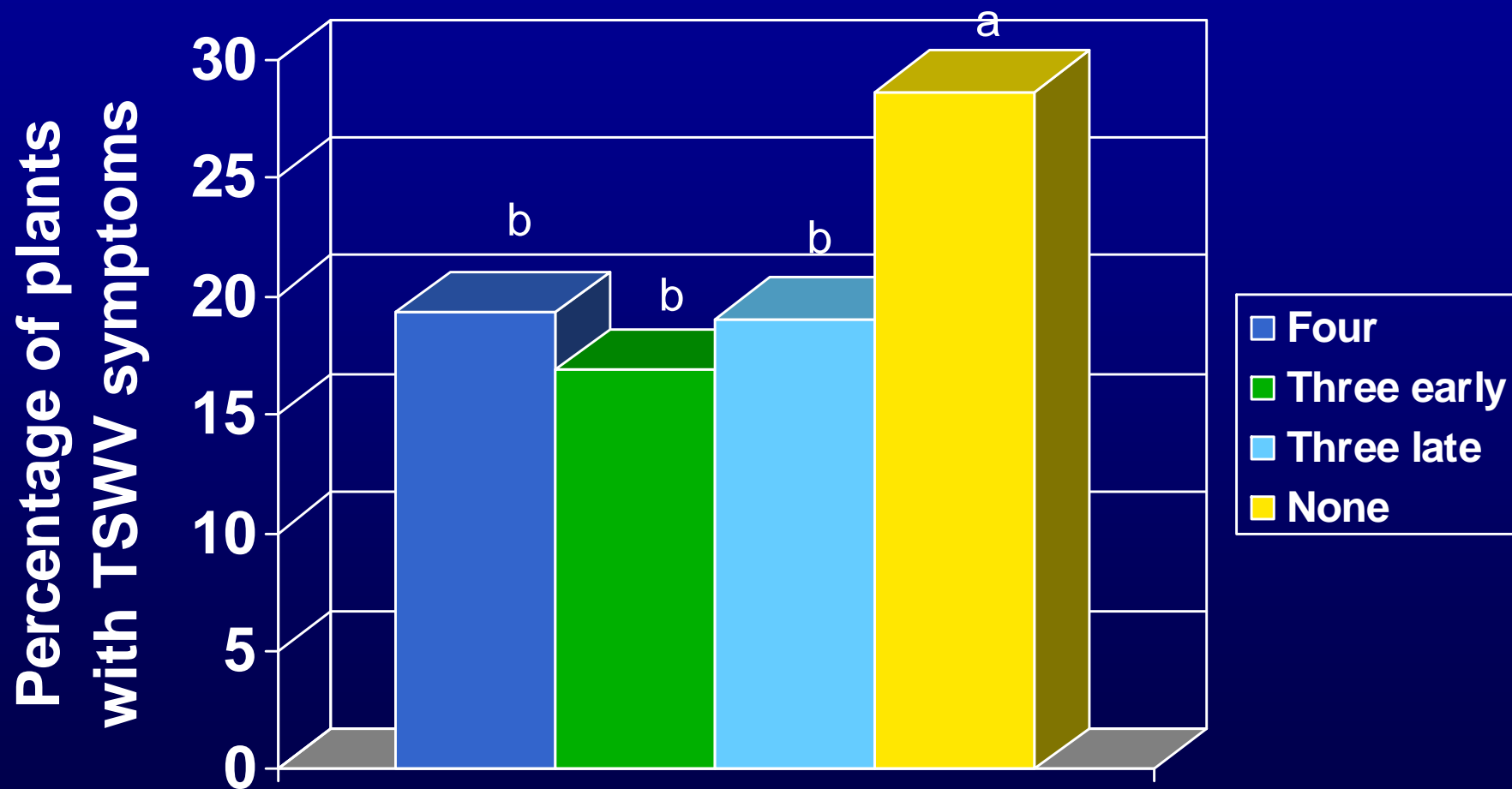


NO SIGNIFICANT DIFFERENCE  $P=0.05$



# TSW-Symptom Incidence

## Foliar-Applied Insecticide Programs

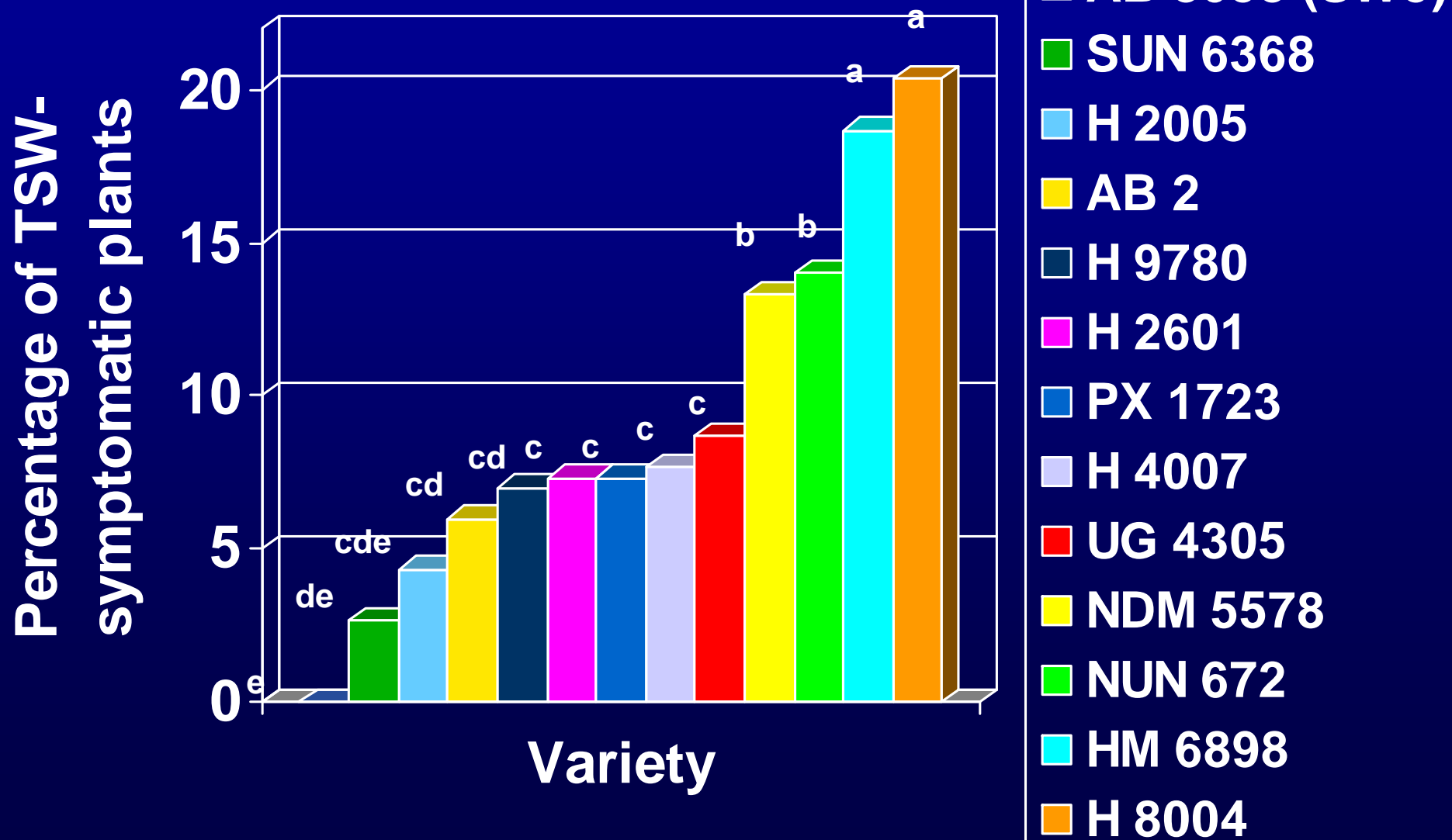


# Recent Research

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# TSWV-Incidence in Mid-Season Processing Tomato Varieties at WSREC, 2008

Transplanted 16 Apr

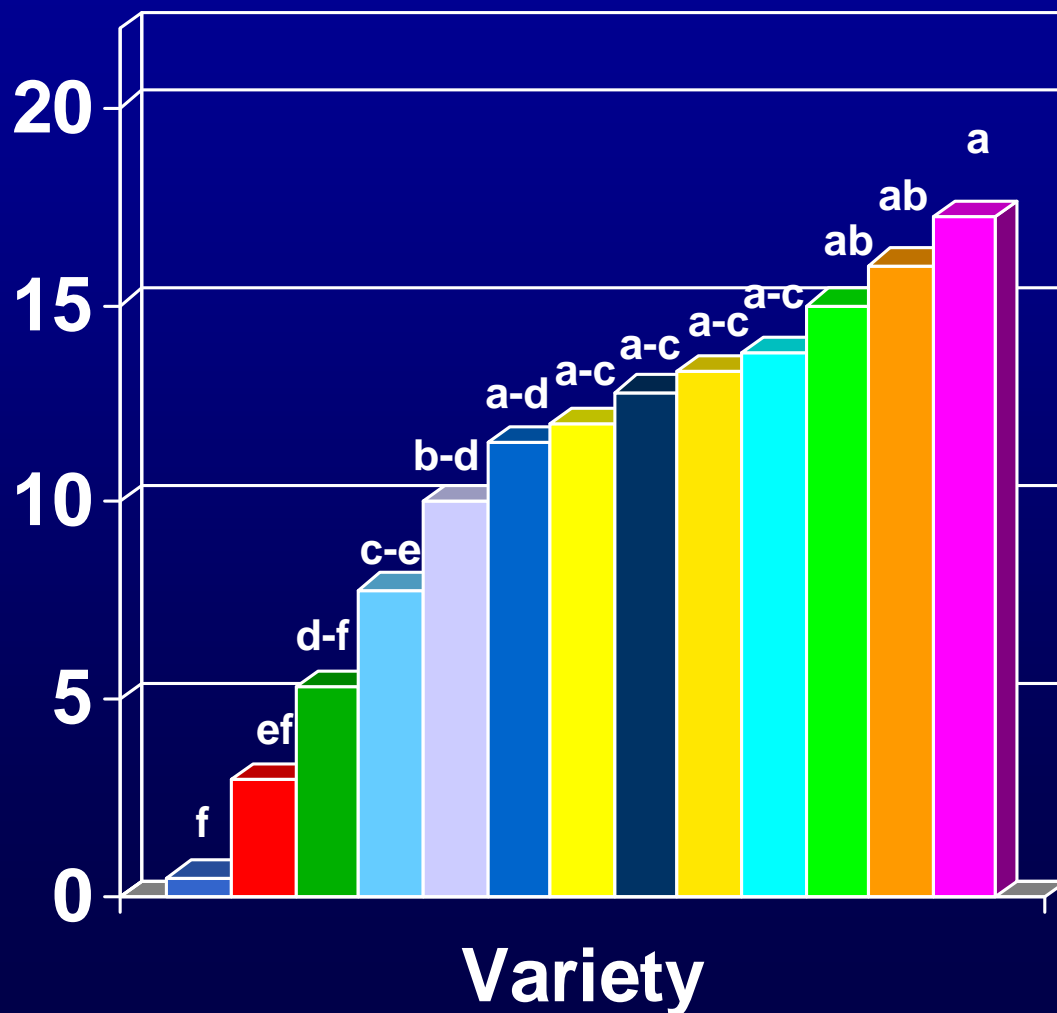




# TSWV-Incidence in Mid-Season Processing Tomato Varieties at WSREC, 2008

Transplanted 15 May

Percentage of TSWV-symptomatic plants

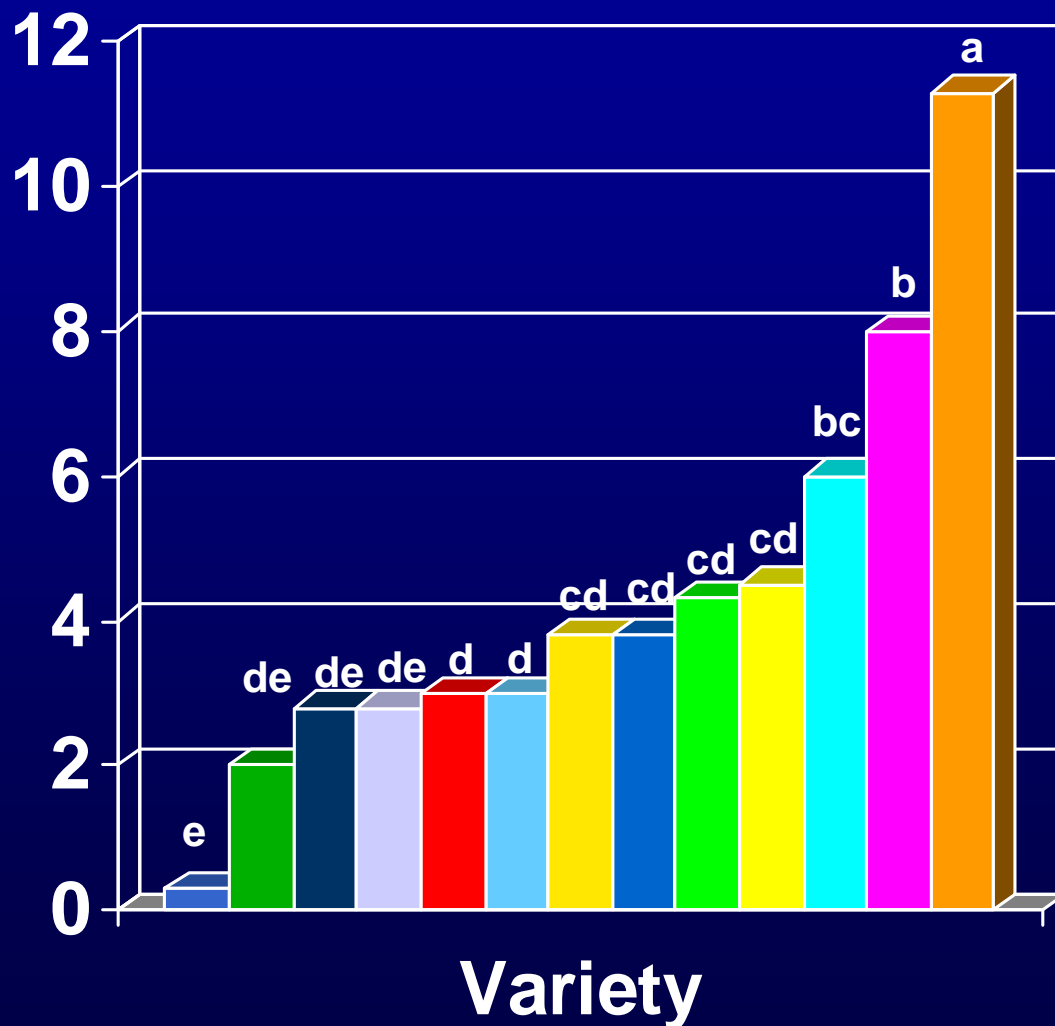


- AB 8058 (SW5)
- UG 4305
- SUN 6368
- H 2005
- H 4007
- PX 1723
- NDM 5578
- H 9780
- AB 2
- HM 6898
- NUN 672
- H 8004
- H 2601

# TSWV-Incidence in Mid-Season Processing Tomato Varieties at WSREC, 2008

Direct Seeded 12 May

Percentage of TSWV-symptomatic plants

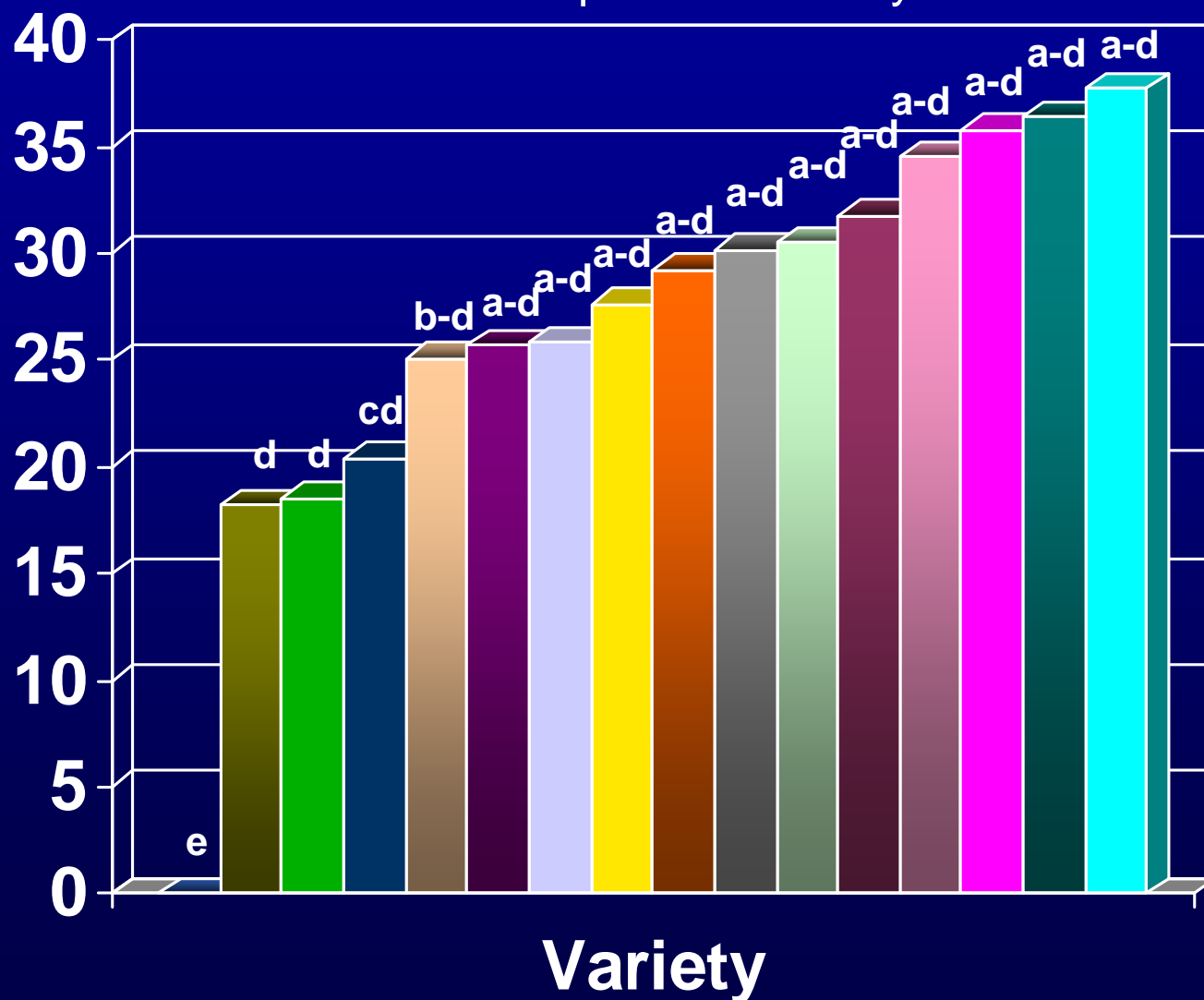


- AB 8058 (SW5)
- SUN 6368
- H 9780
- H 4007
- UG 4305
- H 2005
- AB 2
- PX 1723
- NUN 672
- NDM 5578
- HM 6898
- H 2601
- H 8004

# TSWV-Incidence in Mid-Season Processing Tomato Varieties at WSREC, 2009

Transplanted 22 May

Percentage of TSWV-symptomatic plants



- PX 002
- HMX 7883
- SUN 6366
- H 9780
- AB 3
- N 6390
- H 4007
- AB 2
- HMX 6903
- CXD 255
- PX 650
- CXD 282
- HMX 7885
- H 2601
- H 8504
- HM 6898



# *Processing Tomato Variety Response*

- Dramatic differences in incidence of TSWV symptoms exist among varieties.
  - These differences have been relatively consistent in Fresno Co. trials.
    - H 2005\* and SUN 6368\* had lower incidence.
    - AB 2, H 4007 and H 9780, had lower to medium incidence.
    - H 2601\*\*, H 8004\* and HM 6898 tended to have higher incidence.
- \* Not included in the 2009 trial
- \*\* H 2601 had higher incidence in 3 of 4 trials, but medium incidence in the 16 Apr 2008 trial.

## *Summary*

- Documentation of TSWV in sowthistle and prickly lettuce in early spring in western Fresno Co.: These weeds in uncultivated areas are potential source of the virus.
- Materials that demonstrated thrips efficacy include Radiant, dimethoate, Lannate, Beleaf with Mustang and Surround.
- Foliar applications of effective insecticides reduced TSWV incidence in replicated trials.
- Response of processing tomato varieties to TSWV differ.

# **Acknowledgements**

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