Beet curly top virus: Recent Research and Management

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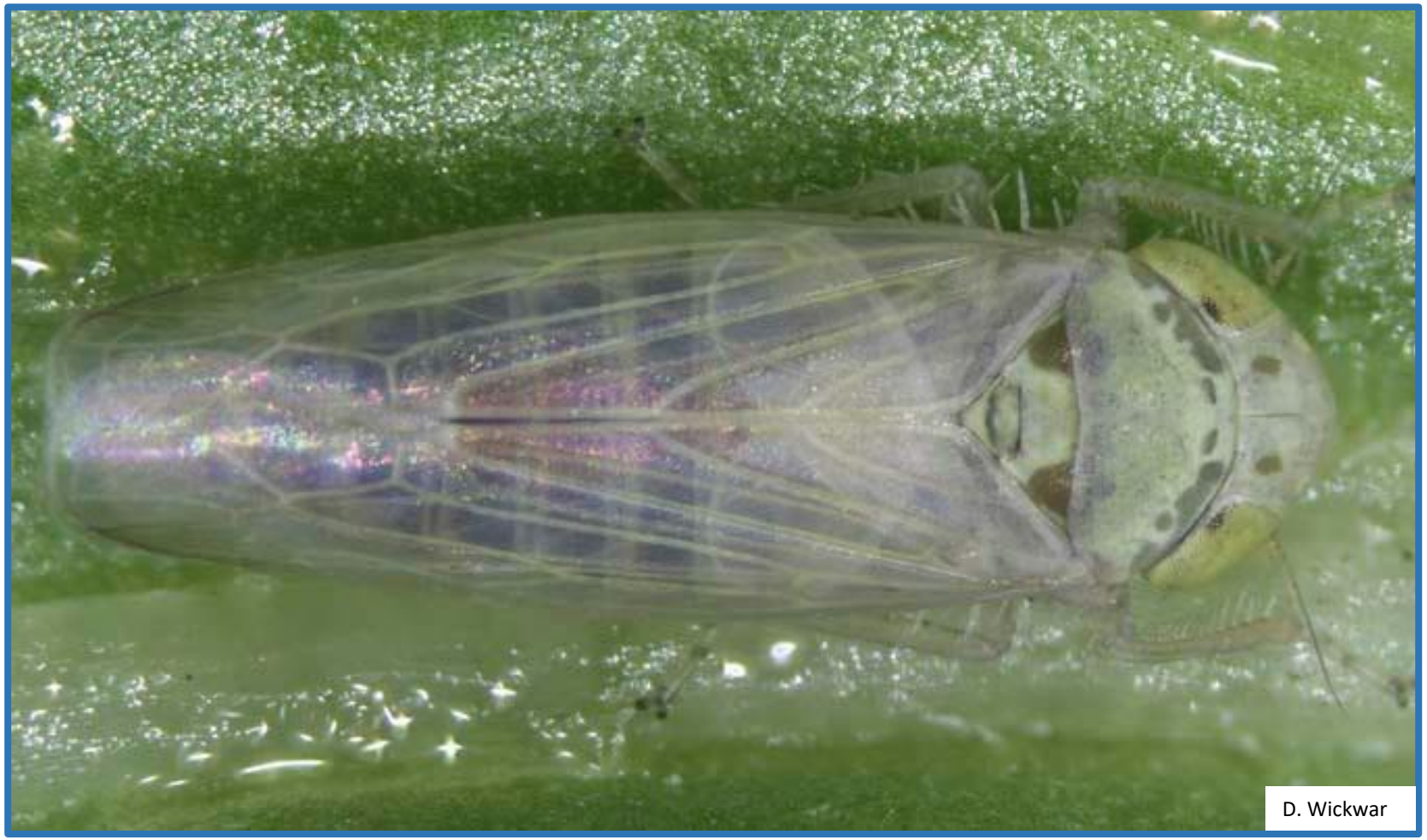
Beet curly top virus in Tomatoes

Beet leafhopper *Circulifer tenellus*



~1/8 inch long, wedge-shaped, and pale green to gray or brown in color.

Beet leafhopper *Circulifer tenellus*

Variations in color of *Circulifer tennelus*

Only beet leafhopper transmits beet curly top virus

Beet leafhopper
Circulifer tenellus

J. Kelly Clark

J. Kelly Clark

Empoasca leafhopper
Always green, without dark markings on body

J. Kelly Clark

Corn leafhopper
Dalbulus maidis
two distinct spots (thyridia) between the eyes

Only beet leafhopper transmits beet curly top virus

Beet leafhopper
Circulifer tenellus

Variegated leafhopper
(*Erythroneura variabilis*)

Grape leafhopper
(*Erythroneura elegantula*)

Beet curly top virus host range includes over 300 plant species

mustards (Brassica spp.), filaree (*Erodium spp.*), perennial pepperweed (*Lepidium latifolium)*, Buckhorn plantain (*Plantago lanceolate)*, Russian thistle (*Salsola spp.),* Shepherd's purse (*Capsella bursa-pastoris*), Bassia (*Bassia hyssopifolia), Kochia (Kochia scoparia)*

Mustard

Goosefoot

Filaree

Russian thistle

Tomato, peppers and melons are not preferred hosts of beet leafhopper

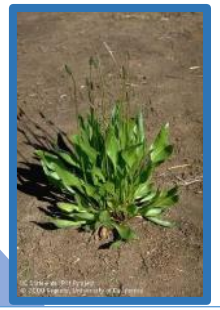
Crops: sugar beet, spinach, tomato, peppers, squash, melon and pumpkin.

Beet curly top virus disease cycle

Beet leafhopper
Circulifer tenellus

Adults BLH migrate to sunny slopes of foothills

fall



winter

Overwinter on vegetation in Coast range.

summer

Reside in weedy areas on the valley floor.

BLH movement in-season results in transmission and disease in tomato

spring

When hills dry, they migrate to weeds and through crops on valley floor.

Insecticide studies

Some insecticides discussed here may not currently be labeled as they appear in the studies.

Carefully read all pertinent labels and be aware of state regulations before writing a recommendation.

Insecticide Comparison at UC West Side Research Extension Center (2014-2022)

Admire Pro 6.5 oz/A drip applied 22 Jun

Verimark 13.5 oz/A transplant drench

Admire Pro 10 oz/A tranplant water

Untreated

Neonicotinoid limitations on rates and timing in fruiting vegetables

"'Bloom" means the period from the onset of flowering until petal fall is complete.'

(a) Application of a neonicotinoid is prohibited during bloom.

(b) If both soil and foliar application methods are used on the same crop, or if multiple neonicotinoid active ingredients are applied to the same crop, a total maximum combined rate of 0.172 lbs. ai/A/season may be applied.

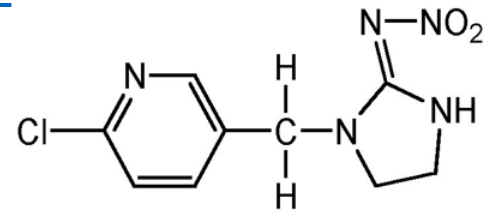
(c) If managed pollinators will be used within the growing season, additional limitations apply.

From: California Dept. of Pesticide Regulation, 22-001, Final
https://www.cdpr.ca.gov/docs/enforce/neonicotinoid/neonicotinoid_regulations.htm

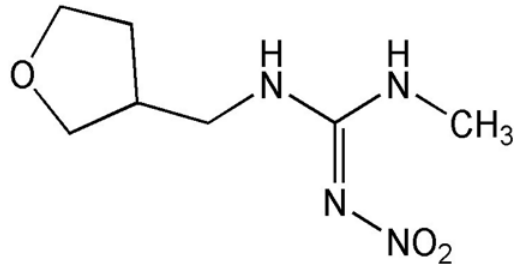
Neonicotinoid CA DPR definition for purposes of this regulatory action

‘”Neonicotinoid” means a pesticide containing any of the following active ingredients in the **nitroguanidine insecticide** Class of neonicotinoids: clothianidin, dinotefuran, imidacloprid, and thiamethoxam.’

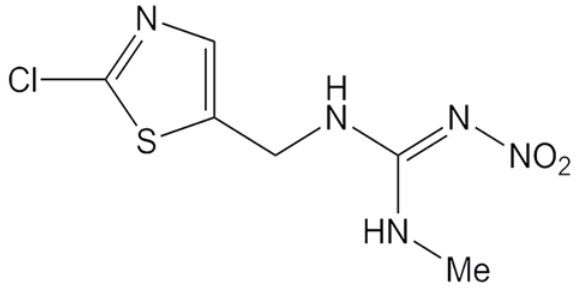
From: California Dept. of Pesticide Regulation, 22-001, Final https://www.cdpr.ca.gov/docs/enforce/neonicotinoid/neonicotinoid_regulations.htm



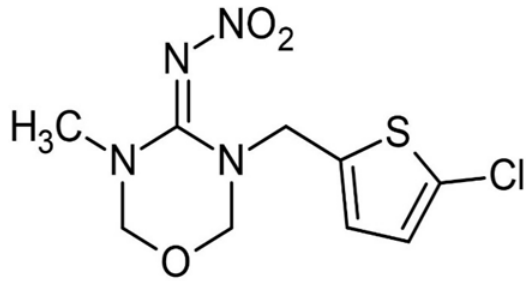
Imidacloprid



Dinotefuran



Clothianidin



Thiamethoxam

Insecticide Resistance Action Committee Mode of Action Main and sub-group classifications

IRAC: MoA-classification, 2023

4 Nicotinic acetylcholine receptor (nAChR) competitive modulators Nerve action {Strong evidence that action at one or more of this class of protein is responsible for insecticidal effects}	4A Neonicotinoids	Acetamiprid, Clothianidin, Dinotefuran, Imidacloprid, Nitenpyram, Thiaclopid, Thiamethoxam
	4B Nicotine	Nicotine
	4C Sulfoximines	Sulfoxaflor
	4D Butenolides	Flupyradifurone
	4F Pyridylidenes	Flupyrimin
9 Chordotonal organ TRPV channel modulators Nerve action {Strong evidence that action at one or more of this class…}	9B Pyridine azomethine derivatives	Pymetrozine, Pyrifluquinazon
	9D Pyropenes	Afidopyropen
28 Ryanodine receptor modulators Nerve and muscle action {Strong evidence that action at this protein complex is responsible for effect	Diamides	Chlorantraniliprole, Cyantraniliprole, Cyclaniliprole, Flubendiamide,
29 Chordotonal organ nicotinamidase inhibitors Nerve action	Flonicamid	Flonicamid

Assail
Belay
Venom
Admire
Platinum
Sequoia
Sivanto
Sefina
Exirel, Verimark
Beleaf

Study Conducted at UC West Side Research and Extension Center

California Tomato Research Institute

- On 2 July 2025 transplant
- cv. H1996
- Panoche clay loam soil
- single plant line on 60-inch-wide beds
- 18-inches plant to plant
- sub-surface drip @ 1”

Experimental:

- Randomized Complete Block
- 4 replications
- 75’ x single bed plots
- Separated by planted untreated buffer between rows

Application:

- Verimark was applied to the transplants on 31 May at a rate of equivalent of 13.5 fl oz/acre based on a plant density
- All drip applied materials were injected with a ¾ inch Mazzei Venturi over 30 minutes, which was followed by 2 hours of additional irrigation time.
- Foliar applications were directed; applied with a CO2-pressurized back-pack sprayer at 30 psi with two TeeJet 8003EVS nozzles 19-inches apart at an equivalent volume of 30 gallons per acre.

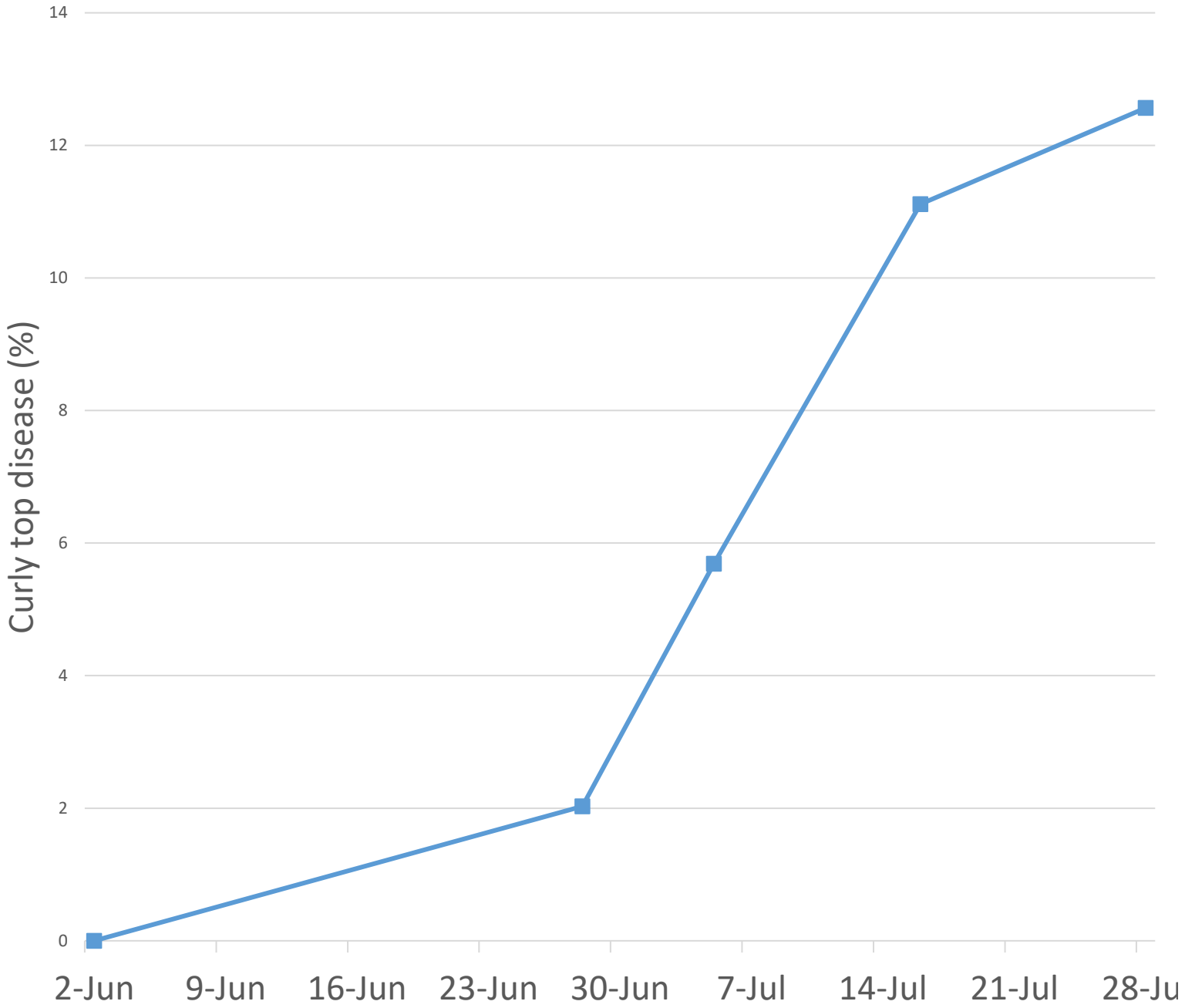
Evaluation:

- Plant with typical curly top disease symptoms were recorded on 28 Jun, and 5, 16 and 28 Jul.
- Representative symptomatic were tested and confirmed to be positive for beet curly top virus (beet severe and beet mild were present)

Rate of Disease Development at Study

(Untreated Control)

California Tomato Research Institute



Evaluation of management options, 2025

	Trnsplnt trt, 31 May	Pre Bloom 16 Jun	3-Jul	16-Jul
1	Verimark 13.5 fl oz		Beleaf 4.2 oz drip	Exirel 20.5 fl oz foliar
2	Verimark 13.5 fl oz		Sivanto 9 fl oz foliar	Sivanto 9 fl oz foliar
3	Verimark 13.5 fl oz		Sivanto 28 fl oz drip	
4	Verimark 13.5 fl oz		Mustang Maxx 4 fl oz foliar	
5	Verimark 13.5 fl oz	Platinum 75SG 1.84 oz		
6	Verimark 13.5 fl oz		Beleaf 4.2 oz drip	Beleaf 4.2 oz foliar
7	Verimark 13.5 fl oz		Beleaf 4.2 oz drip	Beleaf 4.2 oz drip
8	Verimark 13.5 fl oz			
9	Verimark 13.5 fl oz		Assail 30SC 3.4 fl oz foliar	
10		Platinum 75SG 1.84 oz		Assail 30 3.4 fl oz foliar
11		Platinum 75SG 1.84 oz		Mustang Mxx 4 fl oz foliar
12	Untreated control			

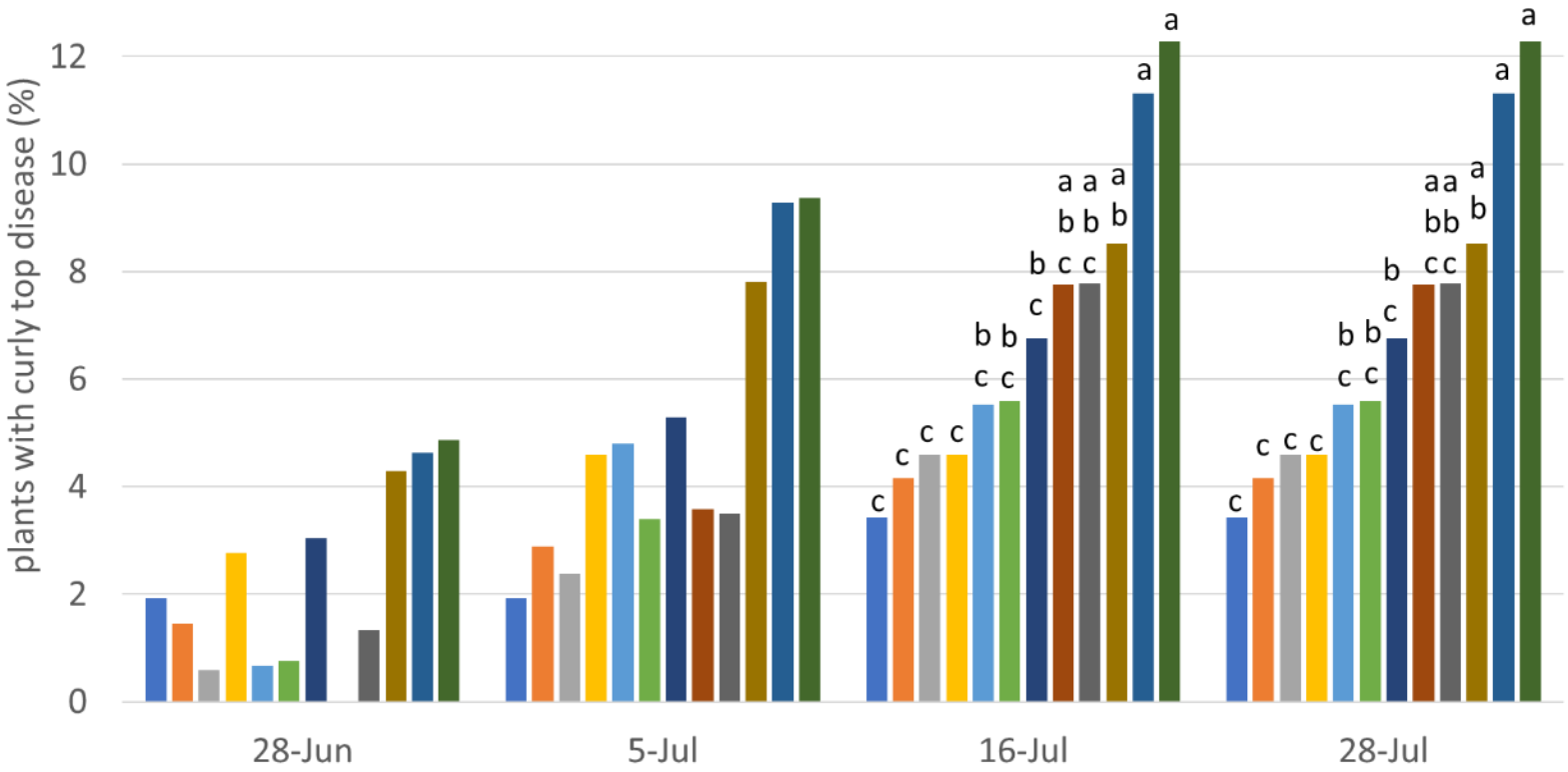
California Tomato Research Institute

Evaluation of management options, 2025

treatments				curly top disease (%)[z]					
Transplant (31 May)	Pre Bloom (16 Jun)	4 weeks post-plant (3-Jul)	6 weeks post plant (16-Jul)	28-Jun	5-Jul	16-Jul		28-Jul	
Verimark 13.5 fl oz		Beleaf 4.2 oz drip	Exirel @20.5 fl oz foliar	0.68	1.92	1.92	c[v]	3.43	c
Verimark 13.5 fl oz		Sivanto 9 fl oz foliar	Sivanto 9 fl oz foliar	0.66	1.44	2.88	c	4.15	c
Verimark 13.5 fl oz		Sivanto 28 fl oz drip		0.58	0.58	2.39	c	4.59	c
Verimark 13.5 fl oz		Mustang Maxx 4 fl oz foliar		0.71	2.77	5.31	c	4.6	c
Verimark 13.5 fl oz	Platinum 75SG 1.84 oz			0.00	0.68	4.79	bc	5.53	bc
Verimark 13.5 fl oz		Beleaf 4.2 oz drip	Beleaf 4.2 oz foliar	0.76	0.76	3.39	bc	5.6	bc
Verimark 13.5 fl oz		Beleaf 4.2 oz drip	Beleaf 4.2 oz drip	0.78	3.03	5.29	bc	6.77	bc
Verimark 13.5 fl oz		Assail 30SC 3.4 fl oz foliar		0.68	1.33	3.5	abc	7.77	abc
Verimark 13.5 fl oz				0.00	0.00	3.58	abc	7.78	abc
	Platinum 75SG 1.84 oz	Assail 30SC 3.4 fl oz foliar		1.43	4.29	8.53	ab	8.53	ab
	Platinum 75SG 1.84 oz	Mustang Maxx 4 fl oz foliar		0.00	4.62	9.29	a	11.32	a
Untreated control				1.46	4.87	12.27	a	12.27	a

Evaluation of management options, 2025

Work is in progress to evaluate novel materials



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12	Untreated control			

California Tomato Research Institute

Evaluation of management options, 2025

Work is in progress to evaluate novel materials

- Verimark 13.5 fl oz transplant 31 May + Platinum 75SG 1.84 oz drip 16 Jun
- Verimark TTD 13.5 fl oz transplant 31 May + Beleaf 50 SG 4.28 oz foliar 3 Jul
- Mustang Maxx 4 fl oz foliar 28 Jun & 5 Jul
- EXP 1 16 Jul
- Assail 30SC 3.4 fl oz foliar 28 Jun & 5 Jul
- Beleaf 50SG 4.28 fl oz foliar 28 Jun & 5 Jul
- Beleaf 50SG 4.28 oz drip 16 Jun & 3 Jul
- Exirel 20.5 fl oz foliar 28 Jun & 5 Jul
- Sequoia 4.5 fl oz foliar 28 Jun & 5 Jul
- Miteus 32 fl oz foliar 28 Jun & 15 Jul
- Sefina 14 fl oz foliar 28 Jun & 5 Jul
- Untreated control

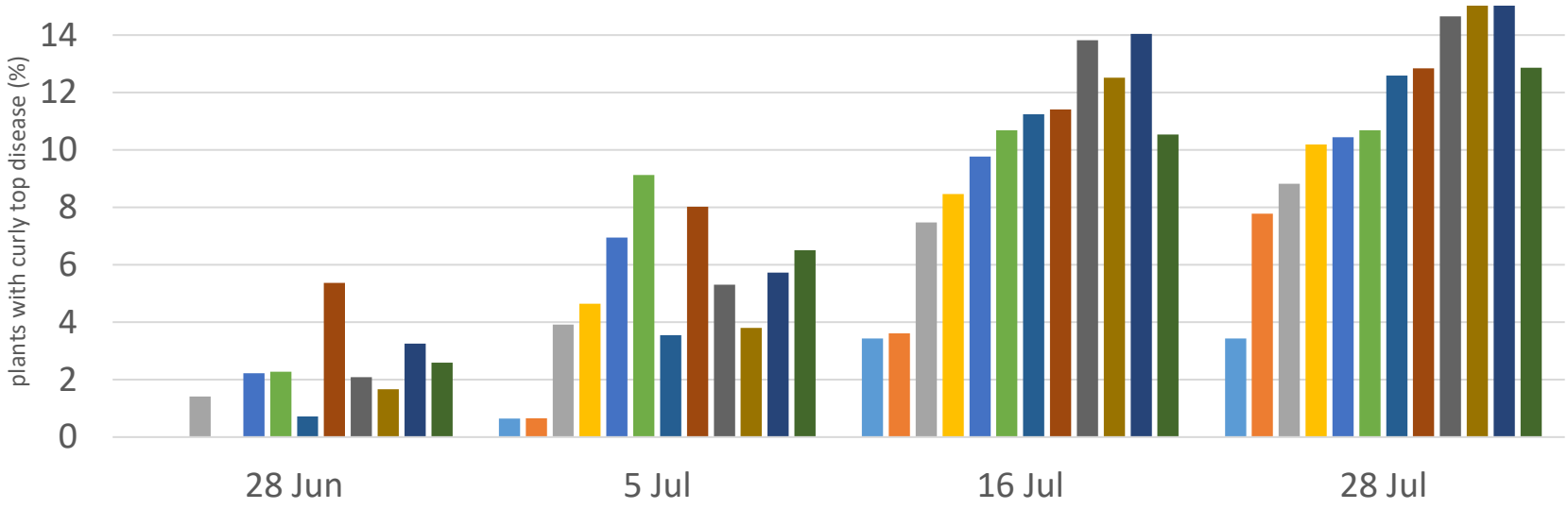
On 2 July 2025 processing tomato transplants (cv. H1996)

Evaluation of management options, 2025

	curly top disease (%)[z]			
Treatment (insecticide, rate, method of application, date(s) of application)	28-Jun	5-Jul	16-Jul	28 Jul
Verimark 13.5 fl oz transplant[y] 31 May + Platinum 75SG 1.84 oz drip[x] 16 Jun	0.00	0.64	1.92	3.44
Verimark 13.5 fl oz transplant 31 May + Beleaf 50 SG 4.28 oz foliar[w] 3 Jul	0.00	0.66	2.85	7.78
Mustang Maxx 4 fl oz foliar 28 Jun & 5 Jul	1.41	3.92	6.8	8.82
EXP 1 drip 27 Jun & 16 Jul	0.00	4.64	7.4	10.19
Assail 30SC 3.4 fl oz foliar 28 Jun & 5 Jul	2.22	6.95	9.77	10.45
Beleaf 50SG 4.28 fl oz foliar 28 Jun & 5 Jul	2.27	9.13	11.33	10.69
Beleaf 50SG 4.28 oz drip 16 Jun & 3 Jul	0.71	3.55	10.5	12.59
Exirel 20.5 fl oz foliar 28 Jun & 5 Jul	5.37	8.02	11.41	12.84
Untreated control	2.60	6.51	9.13	12.86
EXP 2 drip 16 Jul	1.89	8.52	11.24	13.64
Sequoia 4.5 fl oz foliar 28 Jun & 5 Jul	2.09	5.3	15.17	14.65
Miteus 32 fl oz foliar 28 Jun & 15 Jul	1.67	3.8	10.85	15.14
Sefina 14 fl oz foliar 28 Jun & 5 Jul	3.26	5.73	12.02	15.3

Evaluation of management options, 2025

Work is in progress to evaluate novel materials



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- Sequoia 4.5 fl oz foliar 28 Jun & 5 Jul
- Miteus 32 fl oz foliar 28 Jun & 15 Jul
- Sefina 14 fl oz foliar 28 Jun & 5 Jul
- Untreated control

Influence of insecticide applications on beet curly top virus incidence in tomatoes

- Verimark (transplant treatments) consistently reduced curly top under low to moderate pressure early season. Increased yields were observed under moderate pressure.

Impact of 2024 Neonicotinoid regulations on management of insect transmitted

- Management of *beet curly top virus* transmitted at early stages of crop development will be minimally affected.
- Additional risk exists for situations in which BCTV infection at later stages of plant development.
- Where possible, manage weedy areas that may harbor vector populations prior to planting.

Beet Curly Top Virus Control Program

- Integrated Pest Control Branch
- Plant Health and Pest Prevention Services Division
- California Department of Food and Agriculture

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- Newly designed BCTVCP web page: https://www.cdfa.ca.gov/plant/ipc/curlytopvirus/ctv_hp.htm
- NEW – Beet Leafhopper Sighting Report:
  - This report is available using the following web browser link: https://arcg.is/O9LyK (desktop link, Google Chrome recommended)
  - For mobile use, download the **ArcGIS Survey123** app from the **Google Play Store** or **Apple App Store** and use the QR code on the right.
  - A user guide for the BLH Sighting Report is available on the BCTVCP webpage

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County beet leafhopper surveys

from Feb 1 to Feb 7, 2026

County	Avg. # BLH/ sweep set	Hillside sweeps	Roadside & fallow surveys	Surveys w/ zero BLH
Fresno	0.1	72	28	75/100
Kings	0.2	26	----	15/26
Kern	0.2	34	----	25/34
Yolo	0.2	----	5	3/5
Sacramento	0.0	----	2	2/2
Stanislaus	0.1	----	11	9/11
San Joaquin	0.004	----	9	8/9

https://www.cdfa.ca.gov/plant/ipc/curlytopvirus/ctv_hp.htm

Beet Curly Top Virus Control Program

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Beet curly top virus results by county

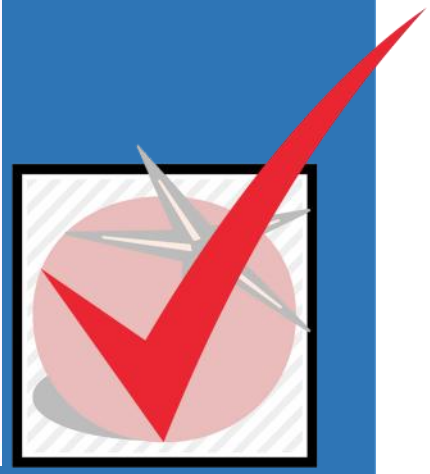
Received week of Feb 1 to Feb 7, 2026

County	Beet leafhopper + BCTV	Beet leafhopper - BCTV	Host plants + BCTV	Host plants - BCTV
Fresno	3	1	0	6
Kern	----	----	0	48
Yolo	----	----	0	3
Colusa	----	----	0	1
Sutter	----	----	0	2
Butte	----	----	0	2
Solano	----	----	0	2

https://www.cdfa.ca.gov/plant/ipc/curlytopvirus/ctv_hp.htm

BCTV management

- Field selection
- Sanitation
- Treatment of sources of the virus/vector with effective insecticides (CDFA BCTVP)
- Treatment of the tomatoes with materials that reduce transmission (Verimark on transplants or neonicotinoids pre-bloom).
- Practices encouraging early dense canopy development may reduce risk.



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- Scott Stoddard

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Agrochem industry

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- Bayer
- Corteva
- FMC
- Syngenta

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Questions

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