Neonicotinoid Regulations & Insect Management

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Neonicotinoid restrictions & current treatment options

- CA regulations affecting Neonicotinoid chemistries in California
- Implications:
  - Beet leafhopper/beet
  - Other insects
- Discussion

New regulations effective 1 Jan 2024

"The Department of Pesticide Regulation has adopted regulations to protect pollinators from the hazards associated with exposure to neonicotinoid pesticide products containing active ingredients:

- clothianidin [Belay]
- dinotefuran [Venom, Scorpion]
- imidacloprid [Admire, generics]
- thiamethoxam [Platinum, Actara]"

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

Some insecticides will be mentioned in this presentation that are not registered on processing tomatoes.

Read all current labels and relevant regulatory information before writing a recommendation.

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

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, Thiacloprid, Thiamethoxam
	4B Nicotine	Nicotine
	4C Sulfoximines	Sulfoxaflor
	4D Butenolides	Flupyradifurone
	4E Mesoionics	Triflumezopyrim Dicloromezotiaz
	4F Pyridylidenes	Flupyrimin

IRAC: MoA-classification, 2023

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	4F Pyridylidenes	Flupyrimin

IRAC: MoA-classification, 2023

The CA DPR regulation does not impact all 4A materials: Assail is in a different class of neonicotinoid insecticides.

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.’

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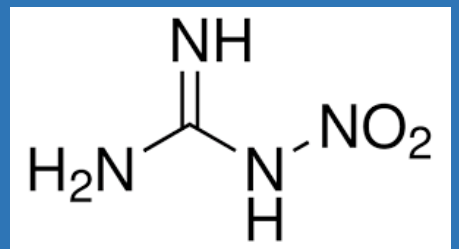

nitroguanidine

Only insecticide with the nitroguanidine group are regulated

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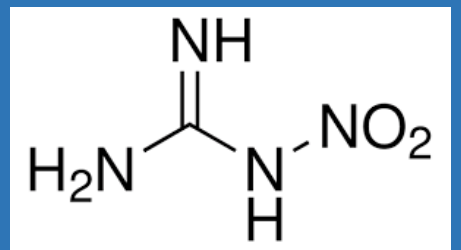

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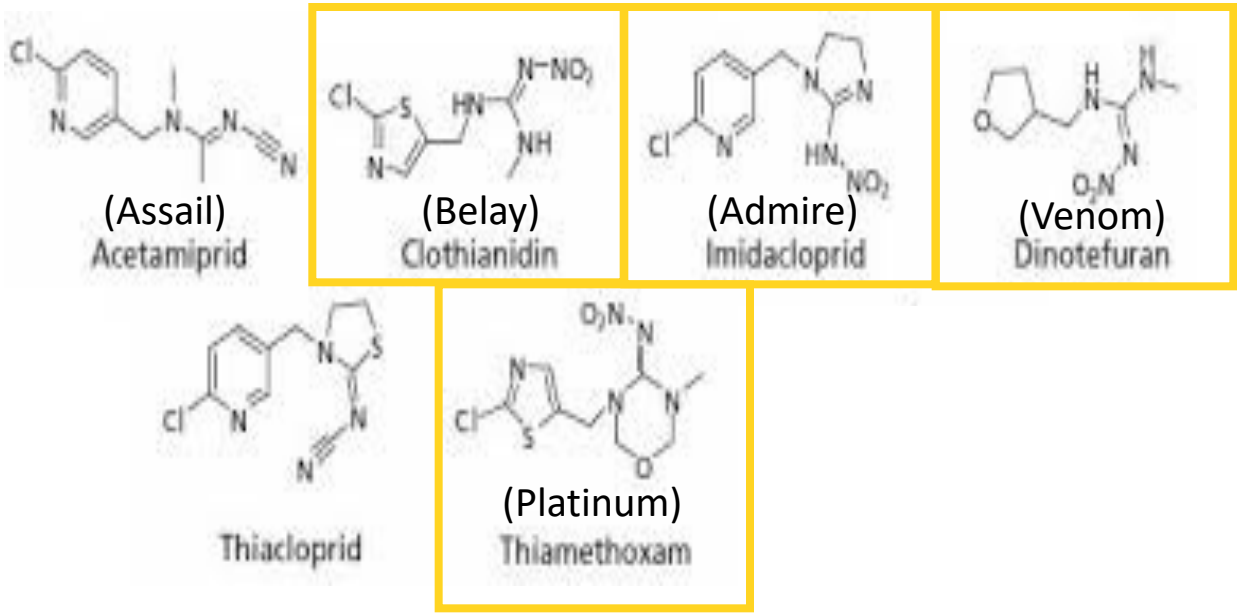

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Neonicotinoid limitations on rates and timing in fruiting vegetables

(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, provided that:

(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 limitations on rates and timing in fruiting vegetables

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

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Neonicotinoid limitations on rates and timing in fruiting vegetables

Rates before changes were (lb ai/A/season):
- 0.200 clothianidin - 0.263 dinotefuran - 0.380 imidacloprid - 0.172 thiamethoxam

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Changes in Neonicotinoid rates in California before and after 1 Jan 2024

active ingredient (AI)	trade name (example)	ai per vol	ai seasonal max lbs/A		formulated product seasonal max lbs/A	
			2023	2024*	2023	2024*
clothianidin	Belay	2.13 lbs/gal	0.2	0.172	12.0 fl oz	10.32 fl oz
dinotefuran	Venom	70%	0.263 ** or 0.523 ***	0.172	6.0 oz ** or 12.0 oz***	3.93 oz
imidacloprid	Admire Pro	4.6 lbs/gal	0.38	0.172	10.5 fl oz	4.75 fl oz
thiamethoxam	Platinum 75SG	75%	0.172	0.172	3.67 oz	3.67 oz

‘* Quantity of regulated neonicotinoid is to exceed total maximum combined rate of 0.172 lbs. ai/A/season

‘** Foliar

‘*** Soil

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Additional Limitations if managed pollinators will be used:

AI	Soil Applications		Foliar Applications	
	Max app.	Required timing	Max app.	Required timing
Clothianidin, Dinotefuran, Imidicloprid, Thiamethoxam	0.172 lbs ai/A/ season	Apply only from pre-planting until third leaf on main shoot unfolded	**Prohibited**	

(d) Exceptions: If managed pollinators will be used for peppers, goji berries, ground cherries,
martynia, okra, roselle, or tomatillos during the growing season, then application of a neonicotinoid is prohibited.
NOTE: Authority cited: Sections From: California Dept. of Pesticide Regulation, 22-001, Final
https://www.cdpr.ca.gov/docs/enforce/neonicotinoid/neonicotinoid_regulations.htm

Insecticide Comparison
beet leafhopper (*Circulifer tenellus*)
beet curly top virus (BCTV)

- Impact on beet curly top virus in tomato
- Impact on resident leafhopper populations – sugar beets to model unmanaged vegetation

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Influence of insecticide programs on beet curly top virus incidence in processing tomato 2015-16

- University of California West Side Research and Extension Center – Five Points
- Sun 6366 processing tomato plants were transplanted 5/22/15, 5/17/16
- 6 treatments were compared in 4 rep RCB design
- Total plants per plot recorded on, BCTV symptomatic plants were recorded at 7-14 day intervals from onset
- Hand harvest 20 row feet and sort for quality

Treatments

2015 Insecticide Comparison at UC West Side Research Extension Center

Untreated Control
Verimark 13.5 oz/A tray drench (21 May)
Admire Pro 4 oz/A transplant water (22 May) Sivanto 2 fl oz directed foliar (22 May) Admire Pro 6.5 Drip (22 Jun)
Admire Pro 10.5 oz/A transplant water (22 May)
Sivanto 2 fl oz directed foliar (22 May) Admire Pro 6.5 Drip (22 Jun)
Admire Pro 6.5 Drip (22 Jun)

BCTV Incidence

2015 Insecticide Comparison at UC West Side Research Extension Center

	BCTV (%)				
	22 Jun	1 Jul	14 Jul	28-Jul	12-Aug
Verimark 13.5 oz/A tray drench (5/21/15)	2.8	3.7	5.7	4.3	4.8
Admire Pro 6.5 Drip (6/22/15)	10.4	11.8	9.7	8.6	6.7
Admire Pro 10.5 oz/A transplant water (5/22/15)	5.3	6.8	8.0	8.4	6.9
Admire Pro 4 oz/A transplant water (5/22/15) Silvanto 2 fl oz directed foliar (5/22/15) Admire Pro 6.5 Drip (6/22/15)	7.8	8.1	10.3	7.5	8.1
Silvanto 2 fl oz directed foliar (5/22/15) Admire Pro 6.5 Drip (6/22/15)	11.7	12.8	11.5	9.9	9.6
Untreated Control	9.9	12.1	13.9	11.5	12.3
$LSD_{0.05}$	4.29	3.18	3.87	4.66	3.58
CV (%)	35.95	22.88	26.06	36.95	29.5

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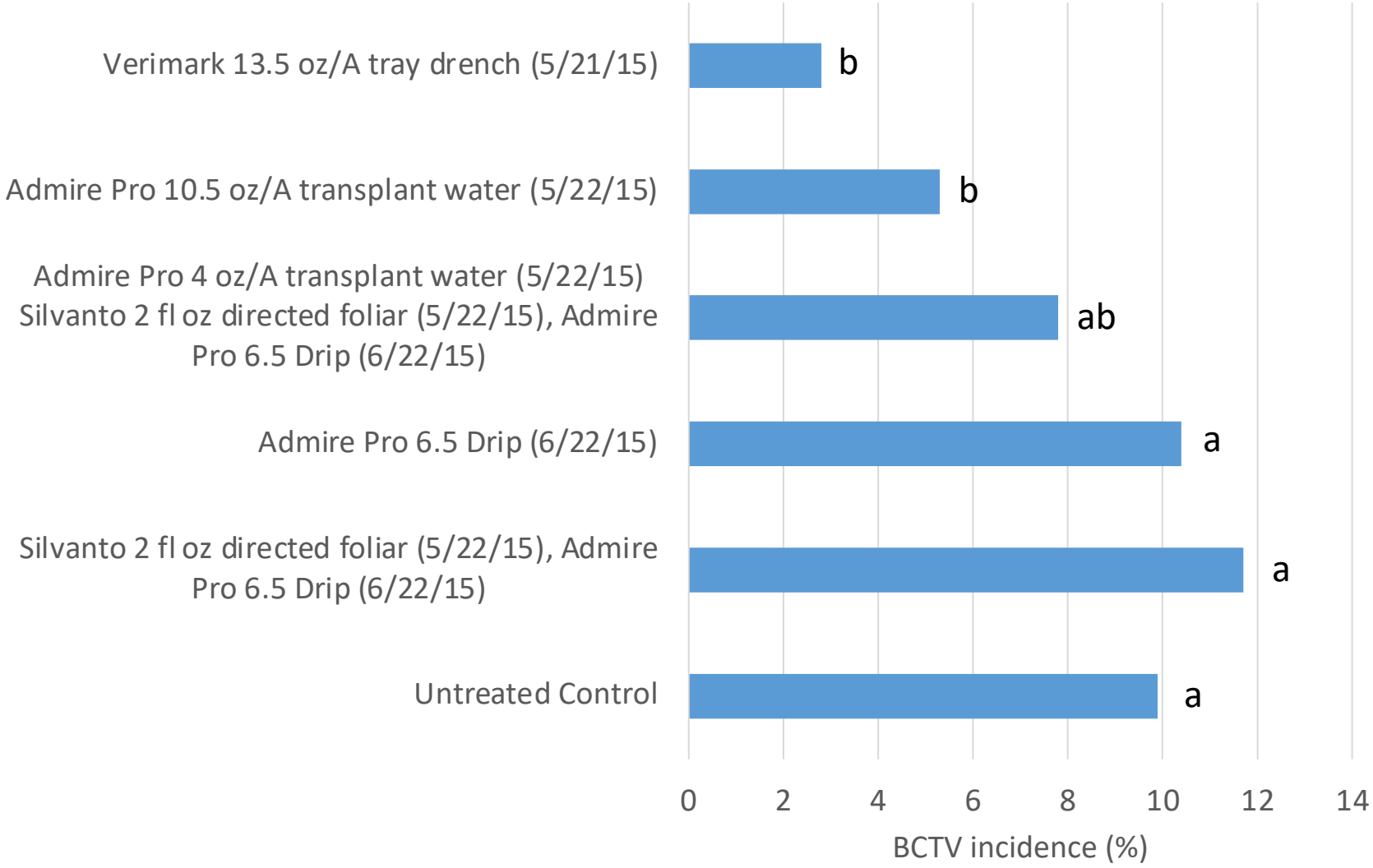
BCTV Incidence on 22 Jun

2015 Insecticide Comparison at UC West Side Research Extension Center



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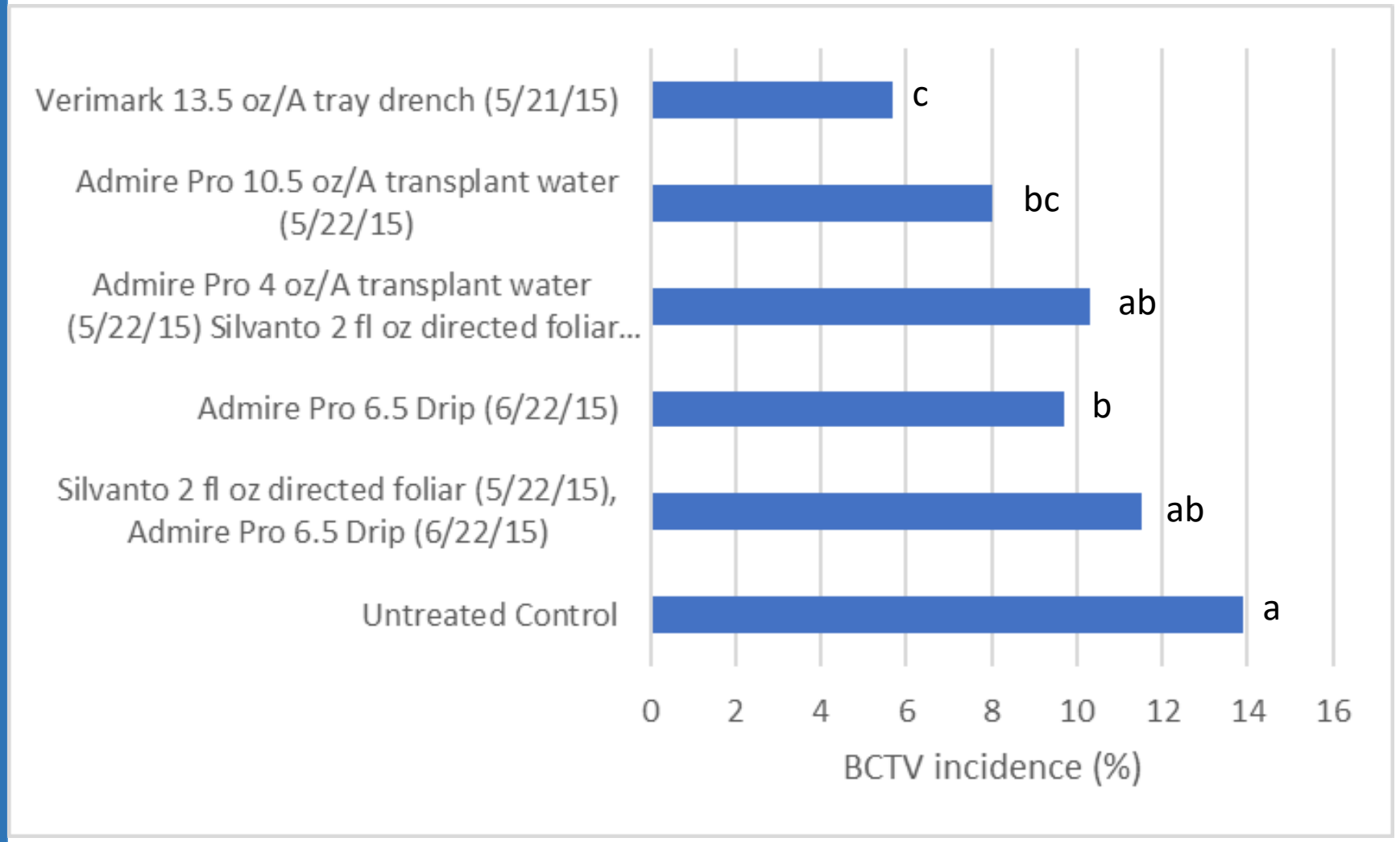
BCTV Incidence on 14 Jul

2015 Insecticide Comparison at UC West Side Research Extension Center



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July 7, 2015 Insecticide Comparison at UC West Side Research Extension Center

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

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Yield and Quality

2015 Insecticide Comparison at UC West Side Research Extension Center

	yld	% based on hand sort				PTAB		
	(t/a)	Red	Grn	Sun	Rot	Col	Sld	pH
Verimark 13.5 oz/A tray drench (5/21/15)	45.6	80.2	7.8	0.2	11.8	28.0	4.725	4.530
Admire Pro 6.5 Drip (6/22/15)	40.0	77.3	11.1	2.1	9.5	28.3	4.850	4.480
Admire Pro 10.5 oz/A transplant water (5/22/15)	42.1	77.6	12.8	1.4	8.2	27.5	4.675	4.545
Untreated Control	36.2	79.4	9.8	0.8	9.9	28.3	4.925	4.510
$LSD_{0.05}$	7.7	NS	NS	NS	NS	NS	NS	NS
CV (%)	11.7	9.8	35.2	93.1	31.5	6.7	5.250	1.700

At UC West Side Research and Extension Center, 6366 transplants were planted on 22 May. Harvested on 11 Sep.

Treatments

2016 Insecticide Comparison at UC West Side Research Extension Center

Verimark 13.5 fl oz product/A Tray Drench 16 May
Admire Pro 4.0 fl oz/a) transplant water 17 May Verimark 10 fl oz/A drip applied 10 Jun Verimark 10 fl oz/A drip applied 28 Jun
Silvanto 10.5 fl oz 6 Jun Platinum 3.67 oz drip applied 10 Jun Venom 6.0 oz drip applied on 28 Jun
Admire Pro 4.0 oz transplant water 17 May Platinum 3.67 oz drip applied 10 Jun Venom 6.0 oz drip applied on 28 Jun
Verimark 13.5 fl oz product/A Tray Drench 16 May Platinum 3.67 oz drip applied 10 Jun Venom 6.0 oz drip applied on 28 Jun
Untreated control

BCTV incidence

2016 Insecticide Comparison at UC West Side Research Extension Center

Treatment, application (date applied)	BCTV (%)				
	10-Jun	17-Jun	23-Jun	30-Jun	6-Jul
Verimark 13.5 fl oz product/A Tray Drench 16 May	0.17	0.97	1.15	3.50	11.25
Admire Pro 4.0 fl oz/a) transplant water 17 May Verimark 10 fl oz/A drip applied 10 Jun Verimark 10 fl oz/A drip applied 28 Jun	0.27	1.37	1.47	4.00	10.75
Sivanto 10.5 fl oz 6 Jun Platinum 3.67 oz drip applied 10 Jun Venom 6.0 oz drip applied on 28 Jun	0.91	3.76	3.58	6.94	17.00
Admire Pro 4.0 oz transplant water 17 May Platinum 3.67 oz drip applied 10 Jun Venom 6.0 oz drip applied on 28 Jun	0.09	1.44	1.53	4.87	12.00
Verimark 13.5 fl oz product/A Tray Drench 16 May Platinum 3.67 oz drip applied 10 Jun Venom 6.0 oz drip applied on 28 Jun	0.62	1.06	1.85	3.87	13.00
Untreated control	1.54	3.37	4.48	9.18	27.25
$LSD_{0.05}$	**1.01**	**1.27**	**1.70**	**1.87**	**2.24**
CV %	**11.89**	42.19	48.05	22.98	27.04

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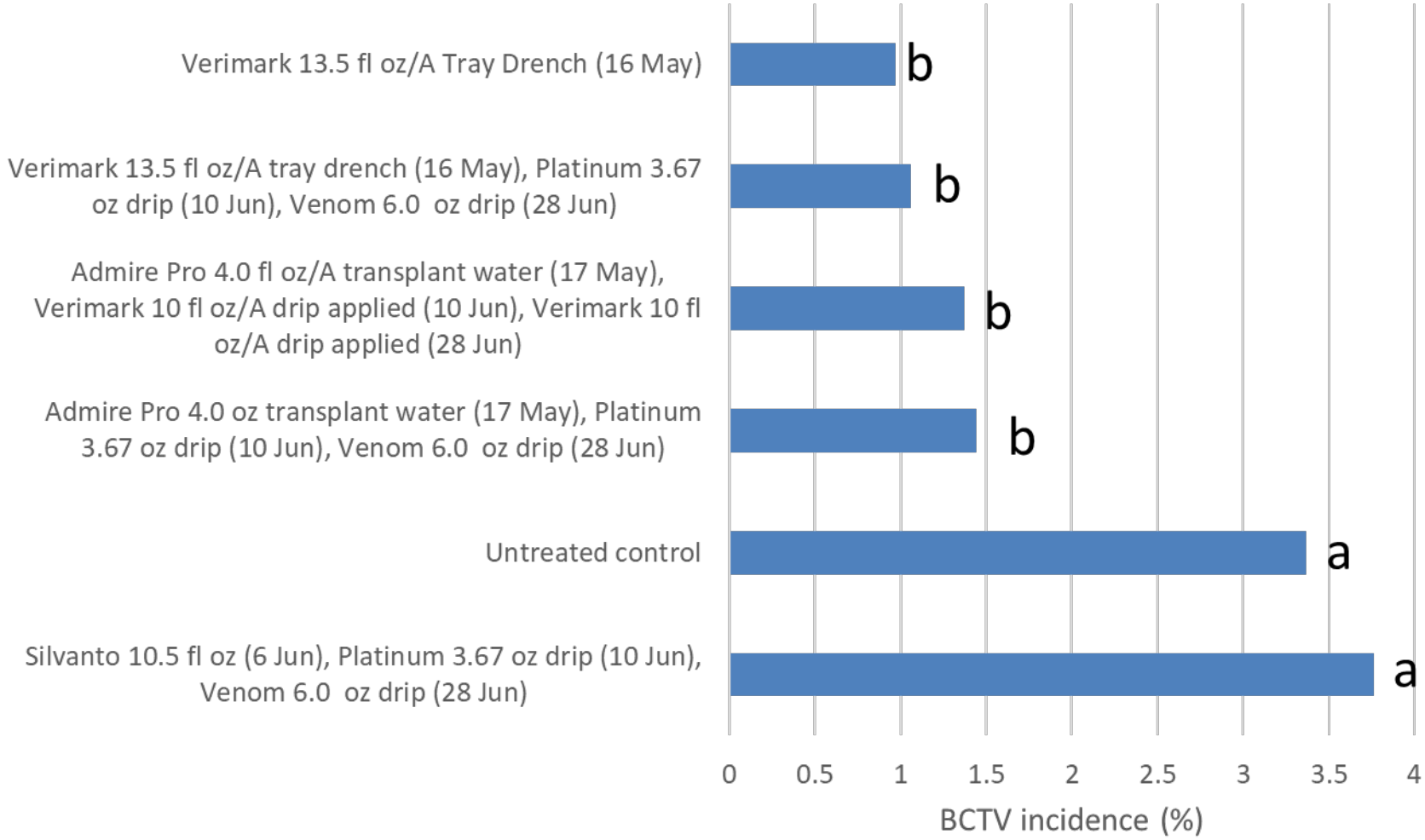
BCTV Incidence on 17 Jun

2016 Insecticide Comparison at UC West Side Research Extension Center



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Treatments

2016 Insecticide Comparison at UC West Side Research Extension Center

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Yield

2016 Insecticide Comparison at UC West Side Research Extension Center

	Yield	% based on hand sort			
	(t/a)	Red	Grn	Sun	Rot
Verimark 13.5 fl oz product/A Tray Drench 16 May	54.94	77.22	3.21	0.82	18.76
Admire Pro 4.0 fl oz/a) transplant water 17 May Verimark 10 fl oz/A drip applied 10 Jun Verimark 10 fl oz/A drip applied 28 Jun	54.78	79.30	2.58	0.46	17.66
Silvanto 10.5 fl oz 6 Jun Platinum 3.67 oz drip applied 10 Jun Venom 6.0 oz drip applied on 28 Jun	54.92	80.70	4.28	2.23	12.79
Admire Pro 4.0 oz transplant water 17 May Platinum 3.67 oz drip applied 10 Jun Venom 6.0 oz drip applied on 28 Jun	45.74	81.26	2.54	1.25	14.96
Verimark 13.5 fl oz product/A Tray Drench 16 May Platinum 3.67 oz drip applied 10 Jun Venom 6.0 oz drip applied on 28 Jun	57.97	81.29	3.20	0.08	15.42
Untreated control	39.50	72.56	4.83	0.32	22.28
$LSD_{0.05}$	12.36	NS	NS	NS	NS
CV %	15.98	10.60	57.93	126.57	41.79

At UC West Side Research and Extension Center, 6366 transplants were planted on 17 May. Harvested on 8 Sep.

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Treatments

2018 Insecticide Comparison at UC West Side Research Extension Center

Material(s) and rate per acre	
Vermark 12.5 fl oz	Transplant drench
Admire Pro 8 fl oz/acre	Drip applied 1 Jun
Sequoia 2.5 fl oz	Transplant drench
Sequoia 4.5 fl oz	Foliar 3 Jun[u]
Sequoia 2.5 fl oz + Radiant 6.0 fl oz	Foliar 3 Jun
Radiant 10.0 fl oz	Foliar 3 Jun
Sequoia 4.5 fl oz	Transplant drench
Untreated control	

At UC West Side Research and Extension Center, H5608 transplants were planted on 22 May.

BCTV Incidence

2018 Insecticide Comparison at UC West Side Research Extension Center

Material(s) and equivalent rate per acre	Timing	BCTV incidence (%)	
		28-Jun	2-Aug
Vermark 12.5 fl oz	Transplant drench	1.8 b	4.0 b
Admire pro 8 fl oz/acre	Drip applied 1 Jun	3.7 ab	3.5 b
Sequoia 2.5 fl oz	Transplant drench	4.4 ab	6.0 ab
Sequoia 4.5 fl oz	Foliar 3 Jun	4.7 ab	7.2 ab
Sequoia 2.5 fl oz + Radiant 6.0 fl oz	Foliar 3 Jun	5.3 ab	6.8 ab
Radiant 10.0 fl oz	Foliar 3 Jun	5.9 ab	7.1 ab
Sequoia 4.5 fl oz	Transplant drench	6.3 a	7.1 ab
Untreated control		7.8 a	8.7 a

At UC West Side Research and Extension Center, H5608 transplants were planted on 22 May.

BCTV Incidence

2018 Insecticide Comparison at UC West Side Research Extension Center

Material(s) and equivalent rate per acre	Timing	BCTV incidence (%)	
		28-Jun	2-Aug
Vermark 12.5 fl oz	Transplant drench	1.8 b	4.0 b
Admire pro 8 fl oz/acre	Drip applied 1 Jun	3.7 ab	3.5 b
Sequoia 2.5 fl oz	Transplant drench	4.4 ab	6.0 ab
Sequoia 4.5 fl oz	Foliar 3 Jun	4.7 ab	7.2 ab
Sequoia 2.5 fl oz + Radiant 6.0 fl oz	Foliar 3 Jun	5.3 ab	6.8 ab
Radiant 10.0 fl oz	Foliar 3 Jun	5.9 ab	7.1 ab
Sequoia 4.5 fl oz	Transplant drench	6.3 a	7.1 ab
Untreated control		7.8 a	8.7 a

At UC West Side Research and Extension Center, H5608 transplants were planted on 22 May.

Treatments

2022 Insecticide Comparison at UC West Side Research Extension Center

Admire Pro at 10 fl oz/a in transplant water 27 May Radiant 10 fl oz/a 10 Jun Dimethoate 1pt 28 Jun
Verimark transplant drench at the equivalent of 13.5 fl oz/a 26 May Radiant 10 fl oz/a 10 Jun Dimethoate 1pt 28 Jun DRIP BeLeaf 4.28 oz/a 12 Jul Exirel 20.5 floz/a 26 Jul
Admire Pro 4.0 oz/A in transplant water 27 May Admire Pro 6.5 oz/A 10 Jun
A21377X 6.16 fl oz/A 15 and 28 Jun
Admire Pro at 10 fl oz/a in transplant water 27 May Radiant 10 fl oz/a 10 Jun Dimethoate 1pt/a 28 Jun DRIP BeLeaf Drip 4.28 oz/a 12 Jul Exirel 20.5 floz/a 26 Jul
Movento 5.0 oz/A 10 and 24 Jun
Verimark transplant drench at the equivalent of 13.5 fl oz/a 26 May Radiant 10 fl oz/a 10 Jun Dimethoate 1pt /a 28 Jun BeLeaf 4.28 oz/a 12 Jul Exirel 20.5 floz/a 26 Jul
Sivanto Prime 7 oz/A in transplant water 27 May Sivanto Prime 21 oz/A 10 Jun
A21377X 5.13 fl oz/A 15 and 28 Jun
Verimark transplant drench at the equivalent of 13.5 fl oz/a 26 May
Sivanto Prime 28 oz/A drip at the first irrigation 3 Jun

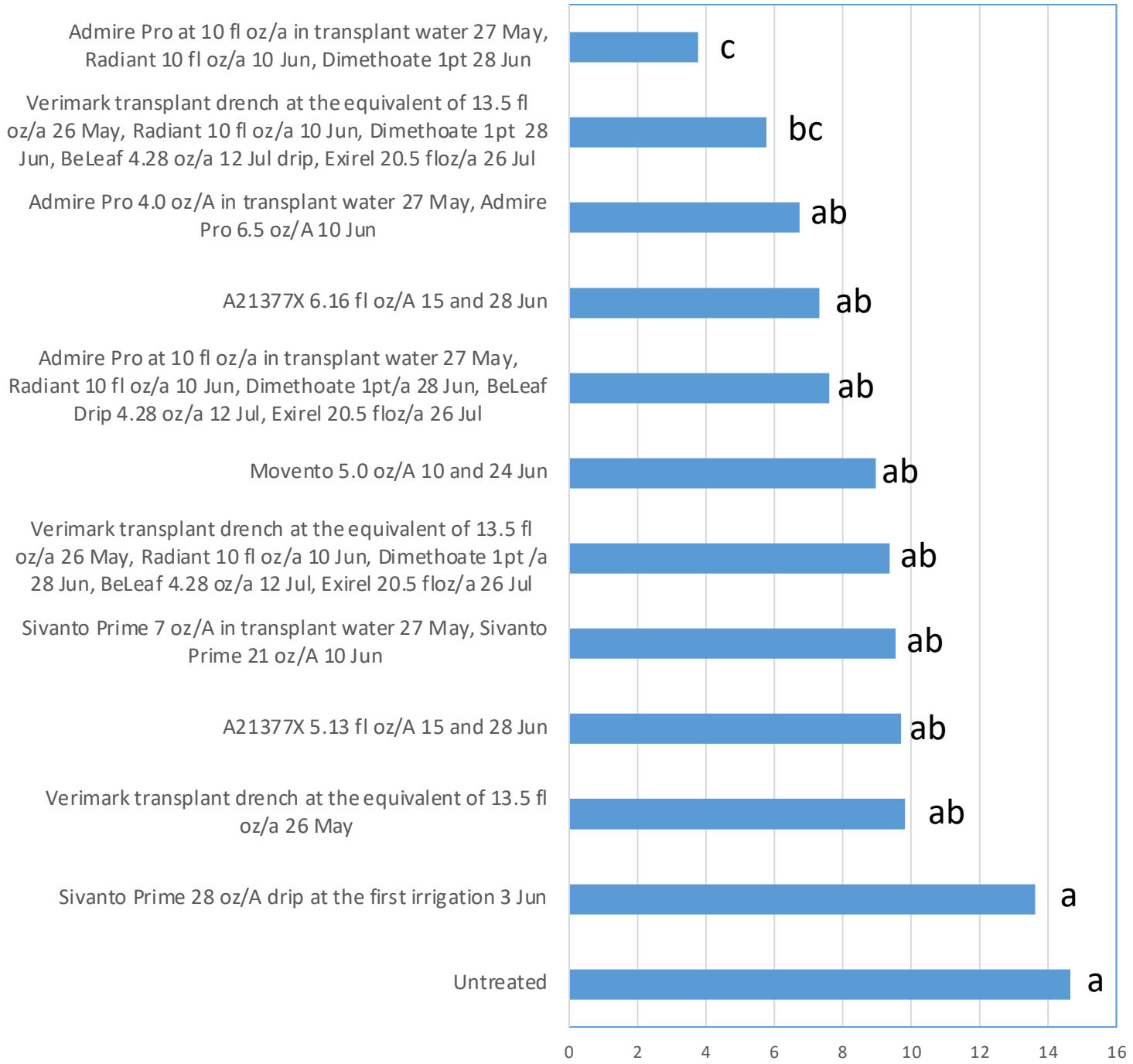
BCTV Incidence

2022 Insecticide Comparison at UC West Side Research Extension Center

Trade name, rate, application details and date	13-Jun	22-Jul	8-Aug
Admire Pro at 10 fl oz/a in transplant water 27 May Radiant 10 fl oz/a 10 Jun Dimethoate 1pt 28 Jun	0.45	3.31	3.77 c
Verimark transplant drench at the equivalent of 13.5 fl oz/a 26 May Radiant 10 fl oz/a 10 Jun Dimethoate 1pt 28 Jun DRIP BeLeaf 4.28 oz/a 12 Jul Exirel 20.5 floz/a 26 Jul	0.00	4.80	5.76 bc
Admire Pro 4.0 oz/A in transplant water 27 May Admire Pro 6.5 oz/A 10 Jun	0.00	7.44	6.74 ab
A21377X 6.16 fl oz/A 15 and 28 Jun	1.42	5.39	7.32 ab
Admire Pro at 10 fl oz/a in transplant water 27 May Radiant 10 fl oz/a 10 Jun Dimethoate 1pt/a 28 Jun DRIP BeLeaf Drip 4.28 oz/a 12 Jul Exirel 20.5 floz/a 26 Jul	0.00	6.93	7.60 ab
Movento 5.0 oz/A 10 and 24 Jun	0.00	8.97	8.97 ab
Verimark transplant drench at the equivalent of 13.5 fl oz/a 26 May Radiant 10 fl oz/a 10 Jun Dimethoate 1pt /a 28 Jun BeLeaf 4.28 oz/a 12 Jul Exirel 20.5 floz/a 26 Jul	0.00	9.37	9.37 ab
Sivanto Prime 7 oz/A in transplant water 27 May Sivanto Prime 21 oz/A 10 Jun	0.63	8.50	9.54 ab
A21377X 5.13 fl oz/A 15 and 28 Jun	0.00	9.22	9.70 ab
Verimark transplant drench at the equivalent of 13.5 fl oz/a 26 May	0.00	9.82	9.82 ab
Sivanto Prime 28 oz/A drip at the first irrigation 3 Jun	1.74	12.37	13.62 a
Untreated	0.96	10.99	14.66 a
Treatment Probability	0.195	0.099	0.041
Coefficient of Variation (%)	265.217	61.165	55.140

BCTV (%)

2022 Insecticide Comparison at UC West Side Research Extension Center



2020-2022:

Comparison of insecticides for control of beet leafhopper in sugar beets

Location: University of California West Side Research and Extension Center in Fresno County

Crop: Beet curly top resistant sugar beets

Experimental design: Four rep RCB with 3 row x 70 ft

Evaluation: 1 to 7 days after treatment, ten sweeps per plot and record counts of nymphs and adult beet leafhoppers.

2020 Beet leaf hopper counts:

Comparison of insecticides for control of beet leafhopper in sugar beets

	Insecticide trade name, rate/acre (active)[z]	BLH[y]
1	Baythroid 2.6 fl oz (cyfluthrin)	0.00
2	Warrior II 1.6 fl oz (lambda-cyhalothrin)	0.00
3	Sevin SL 32 fl oz (carbaryl)	0.25
4	Malathion 5EC 32 fl oz	0.50
5	Mustang 3.0 fl oz (zeta-cypermethrin)	2.00
6	Admire Pro 1.6 fl oz (imidicloprid)	2.25
7	Success 4 fl oz (spinosad)	2.75
8	Untreated control	3.50
	LSD 5%	1.89
	CV (%)	91.35

[z] On 13 Jul, materials were applied.

[y] On 17 Jul, plots were swept with 15 in-daim. net and the number of beet leafhoppers was recorded.

2021 Beet leaf hopper counts:

Comparison of insecticides for control of beet leafhopper in sugar beets

Beet leafhopper/ 10 sweeps

	Insecticide trade name, rate/acre (ai)	28-Jun		29-Jul	
1	Warrior II 1.6 fl oz (lambda-cyhalothrin)	2.00	b	0.00	d
2	Baythroid 2.6 fl oz (cyfluthrin)	1.50	b	0.25	d
3	Malathion 5EC 32 fl oz	1.50	b	0.50	d
4	Mustang 3.0 fl oz (zeta-cypermethrin)	2.75	ab	0.75	d
5	Beleaf 4.3 oz (flonicamid)	2.25	b	4.25	cd
6	Admire Pro 1.6 fl oz (imidicloprid)	6.75	ab	5.75	bcd
7	Success 4 fl oz (spinosad)	3.75	b	6.75	bcd
8	Sefina 14 fl oz (afidopyropen)	7.75	ab	9.50	abc
9	Sivanto Prime 14 fl oz (flupyradifurone)	5.75	ab	10.00	abc
10	Exeril 20.5 fl oz (cyantrilaprole)	6.75	ab	11.25	ab
11	Untreated control	13.75	a	15.75	a
	cv	62.16		47.71	

[z] On 24 Jun and 27 Jul, materials were applied.

[y] On 28 Jun and 29 Jul, plots were evaluated.

2022 Beet leaf hopper counts:

Comparison of insecticides for control of beet leafhopper in sugar beets

Beet leafhopper/ 10 sweeps

	Insecticide trade name, rate/acre (ai)	14-Jul		21-Jul	
1	Malathion 5EC 32 fl oz	1.00	c	0.50	b
2	Warrior II 1.6 fl oz	1.25	c	0.50	b
3	Baythroid 2.6 fl oz	1.00	c	0.75	b
4	Mustang 3.0 fl oz	1.50	c	1.00	b
5	Sefina 10.0 fl oz	2.00	bc	1.00	b
6	Sefina 14.0 fl oz	1.75	bc	2.00	ab
7	Beleaf 4.28 oz	4.00	abc	2.00	ab
8	Admire Pro 1.6 fl oz	2.50	bc	2.25	ab
9	Exeril 20.5 fl oz	6.00	ab	2.50	ab
10	Sivanto Prime 14.0 fl oz	3.00	abc	3.75	ab
11	Success 4.0 fl oz	4.75	abc	3.75	ab
12	untreated	7.25	a	4.75	a
	cv	95.69		97.18	

[z] On 13 and 19 Jul, materials were applied.

[y] On 14 Jun and 21 Jul, plots were evaluated.

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
- Neonicotinoid-treatments reduced curly top incidence.
  - Lower Admire Pro rates in transplant water reduced BCTV incidence at low to moderate pressure.
  - Note that the seasonal allowable quantity of thiamethoxam is unaffected by regulations
  - Assail is unaffected

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CDFA Beet Curly Top Control Board

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