

IR-4 Evaluation of alternatives to regulated neonicotinoid insecticides for reduction of beet curly top virus incidence in processing tomato in California, 2024

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**Executive Summary:**

*Beet curly top virus (BCTV)*, which is vectored by beet leafhopper, occurs annually in California, occasionally causing massive economic losses. In research sponsored by CTRI, *BCTV* incidence was significantly lower in treatments that included insecticides within two modes of action that include anthranilic diamides [Verimark (cyantraniliprole)] and neonicotinoids [Admire (imidacloprid), Platinum (thiamethoxam) and Venom (dinotefuran)]. Verimark was consistently effective when applied to transplants 72- to 24-hours before planting, but did not demonstrate efficacy when drip-injected. Neonicotinoids were effective applied in transplant water or injected into the sub-surface drip irrigation systems. However, on 1 January 2024, The Department of Pesticide Regulation adopted regulations restricting use of nitroguanidine neonicotinoid insecticides, which include imidacloprid, thiamethoxam, and dinotefuran as well as all commercial products containing those active ingredients. This substantially limits usage, which includes prohibiting application of any regulated neonicotinoid after flowering. Flowering typically occurs during one to three weeks post-plant depending upon transplant age and environmental conditions. Alternatives as identified through my efforts, those of registrants and IR-4 personnel were tested in 2024.

Due to low disease pressure, the results of the 2024 study were inconclusive. However, the issue remains critical and similar studies should be conducted in 2025.

**Introduction:**

IR-4 supported evaluations of alternatives to neonicotinoids for reduction of beet curly top virus in processing tomatoes. For treatment details, see the table below.

On 1 Jan 2024, use of neonicotinoid insecticides in California were restricted. California Department of Pesticide Regulation released 'Text of Final Regulation' Neonicotinoid Pesticide Exposure Protection Section 6990 that reduces both the maximum allowable rate of restricted neonicotinoids per season and limits applications to pre-bloom stage of crop development. Total allowable rate of any combination of neonicotinoid insecticide, or one material applied to both soil and foliage is not to exceed 0.172 lbs active ingredient per acre per season. Before this regulation, it was permissible to use up to 0.38 lbs imidacloprid, 0.172 lbs thiamethoxam and 0.263 lbs dinotefuron per acre per season and it could be applied regardless of the presence of bloom. A single active ingredient applied either to the soil or to the foliage may be applied at the previous label rates. However, prior to the regulation, neonicotinoids were used in sequence through the season to reduce transmission of *BCTV* when there was risk of beet leafhopper migrations at later stages of crop development.

Only regulated neonicotinoid insecticides have shown efficacy in reducing beet curly top virus incidence in tomatoes when applied mid-season. It is unlikely that Verimark would have efficacy 45 days after

application, and the neonicotinoids that were applied pre-bloom are also unlikely to have efficacy under heavy pressure five weeks post-plant, which is likely to be approximately 31 to 35 days after the latest possible application before bloom.

**Main Goal and Objectives:**

Generation of efficacy data for materials not fully tested for potential to mitigate impacts of beet curly top virus in processing tomato when applied at early stages of crop development.

**Methodology and Results:**

Commercially produced transplants (H5608) were mechanically planted into 60-inch beds with sub-surface drip tape injected at a 10-inch depth into Panoche clay-loam soil at the University of California West Side Research and Extension Center on May 23. Because there is greater risk of infection under low to moderate pressure before the canopy closes due to leafhopper behavior, the transplant spacing was placed at 16-inches rather than the typical 12-inch spacing between plants.

The experimental design was a randomized complete block with four replications. Each plot was a single bed x 60 ft. Experimental plots were separated by one untreated, planted row and there was a 10 ft planted buffer within the row between plots.

Application details are as follows: Verimark was applied to the transplants on May 22 at a rate of the equivalent of 13.5 fl oz per acre based on a plant density of 6534 plants per acre. Each 192 cell tray was treated with 12 ml Verimark in 275 ml water. All materials applied through the sub-surface drip irrigation were injected with generator-powered electric metering pumps (A-1600 FlexFlo® Peristaltic Pump Blue and White Industries, Huntington Beach, CA) over 30 minutes, which was followed by 2 hours of additional irrigation time. Dyne-Amic 0.25% v/v was included in all foliar tank mixes. On the 21 Jun, sprays 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 20 gallons per acre. On 5 and 23 July, broadcast applications were made with CO2-pressurized back-pack sprayer at 30 psi with three TeeJet 8003EVS nozzles 19-inches apart at an equivalent volume of 30 gallons per acre.

	14-Jun	26-Jun	2-Aug	26-Jun	2-Aug
Product	BCTV	BCTV	BCTV	TSWV	TSWV
Untreated control	%	%	%	%	%
Verimark TTD 13.5 fl oz + Platinum 75SG 1.84 oz	0.75	0.75	0.75	0	0.37
Sefina 14 fl oz	0	0	0.32	0	0.32

Apply Verimark (REI\* = 4 hours) as a transplant tray drench no earlier than 72 hours prior to planting followed by one applications of Platinum (REI = 12 hours) via drip starting 1-2 weeks after transplant

Apply twice as a foliar spray at an interval of 7

		days starting 1-2 weeks after transplant				
Beleaf 50SG		1.0331727	1.0331727	1.0331727		
4.28 fl oz		21	21	21	0	0
Assail 70WP	<i>14 and 21 Jun</i>					
1.75 oz		0.67	1.01	1.39	0	1.77
Exirel 20.5						
fl oz		0.34	0.73	0.73	0	0
Mustang						
Maxx 4 fl oz		1.35	1.44	1.81	0.32	1.83
Sequoia 4.5		0.3571428				
fl oz		57	0	0	0	1.35
Verimark	Apply Verimark (REI* = 4 hours) as a transplant tray drench no earlier than 72 hours prior to planting followed by one application of Beleaf 50SG (REI= 12 hours) as a foliar spray 28- 30 days after transplant.					
TTD 13.5 fl oz +		0	0	0	0	1.68
Beleaf 50 SG 4.28 oz						
	Apply twice via drip at an interval of 14 days starting 1-2 weeks after transplant 13 and 26 Jun					
Beleaf 50SG 4.28 oz		0	0	0.32	0	1.75
	Apply twice via drip at an interval of 7 days starting 1-2 weeks after transplant; PHI = 1 day 13 and 20 Jun					
EXP A		0	0.35	0.35	0	1.74
	Apply <u>twice</u> via drip at an interval of 7 days starting 1-2 weeks after transplant; PHI = 21 day					
EXP B		0	0	0	0	0.35

<sup>z</sup> Verimark was applied to transplants on 22 May at a per acre equivalent of 13.5 fl oz.

<sup>y</sup> All drip-injected materials were applied with electric metering pumps over 30 minutes, which was followed by 2 hours additional irrigation.

<sup>x</sup> Broadcast foliar treatments were applied with a CO<sub>2</sub>-pressurized back-pack sprayer at 30 psi in the equivalent of 30 gallons per acre with Dyne-Amic surfactant 0.25% v/v.

<sup>w</sup> Directed foliar treatments were applied with a CO<sub>2</sub>-pressurized back-pack sprayer at 20 psi in the equivalent of 30 gallons per acre with Dyne-Amic surfactant 0.25% v/v.

**Discussion:**

Disease through the production area was relatively low in 2024. Although *beet curly top virus* was present in the trial, it remained at very low levels throughout the season, so treatment differences were not present.

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