

Comparison of certified organic and conventional materials for beet leafhopper control, 2021

Beet leafhopper transmits *beet curly top virus*. In tomatoes, this virus causes the plant to stop growing, produce no fruit or small, unmarketable fruit, depending upon the stage of plant development when infection occurs. Throughout Central California, this virus causes substantial crop loss. Malathion is used to reduce beet leafhopper population densities in non-cropped areas to mitigate the risk posed by this virus.

To evaluate alternatives to malathion for reduction of beet leafhopper population densities in the foothills or along roadsides, sugar beet was used as the model for the weed hosts commonly treated. Sugar beets were selected for the test because, like weed species of concern, they will support resident populations and reproduction of beet leafhoppers. Furthermore, management of a sugar beet field at the University of California West Side Research and Extension Center provides an opportunity to establish uniform plant populations, manage drying of the host and have control over the site that would not be possible in a non-cropped weedy area.

On 9 Feb, B18GH72005-25 beet curly top-tolerant sugar beet seed was sown into a Panoche clay loam soil at the University of California West Side Research and Extension Center. The field was sprinkler irrigated for two weeks. Then, the beets were furrow irrigated. No insecticides were applied during the season except for the materials being evaluated.

Two studies were conducted within the same field, but separate: The specific treatments in each study were as follows:

Conventional	Organic
Baythroid 2.6 fl oz (cyfluthrin)	Pyganic 34 fl oz (pyrethrins)
Mustang 3.0 fl oz (zeta-cypermethrin)	Spray Oil 50 fl oz
Warrior II 1.6 fl oz (lambda-cyhalothrin)	Sil Matrix 32 fl oz (potassium silicate)
Sefina 14 fl oz (afidopyropen)	Trilogy 32 fl oz (clarified hydrophobic extract of neem oil)
Admire Pro 1.6 fl oz (imidicloprid)	Entrust SC 8 fl oz (Spinosad)
Beleaf (flonicamid)	Venerate 128 fl oz per acre
Exeril (cyantrilaprole)	Grandevo 48 oz/acre
Success 4 fl oz (spinosad)	untreated control
Sivanto Prime 14 fl oz (flupyradifurone)	
Malathion 5EC 32 fl oz	
Untreated control	

Treatments were arranged in a four-replication randomized complete block experimental design. Each plot was three 30-inch beds center-to-center by 70 ft. All treatments were applied with a CO₂-pressurized sprayer at 30 psi in the equivalent volume of 40 gallons per acre. The sprayer boom was equipped with four Teejet 8003 EVS. All data was taken from the center bed of each three-bed plot with 10 ft within-row buffers between plots. On 17 Jun, an average of 7 leafhoppers were captured per ten sweeps with a 15 in diameter sweep net within the trial area. Treatments were applied on 24 Jun and 27 Jul. On 28 Jun and on 29 Jul, the beet

leafhopper population densities were quantified, each plot was swept ten times with a 15-in diameter sweep net.

Table 1. Performance of conventional insecticides against beet leafhopper in sugar beets at UC West Side Research and Extension Center in 2021.

Insecticide common name, rate/acre (active ingredient)	Beet leafhoppers per 10 sweeps			
	28-Jun		29-Jul	
Warrior II 1.6 fl oz (lambda-cyhalothrin)	2.00	b	0.00	d
Baythroid 2.6 fl oz (cyfluthrin)	1.50	b	0.25	d
Malathion 5EC 32 fl oz	1.50	b	0.50	d
Mustang 3.0 fl oz (zeta-cypermethrin)	2.75	ab	0.75	d
Beleaf 4.8 oz (flonicamid)	2.25	b	4.25	cd
Admire Pro 1.6 fl oz (imidicloprid)	6.75	ab	5.75	bcd
Success 4 fl oz (spinosad)	3.75	b	6.75	bcd
Sefina 14 fl oz (afidopyropen)	7.75	ab	9.50	abc
Sivanto Prime 14 fl oz (flupyradifurone)	5.75	ab	10.00	abc
Exeril 20.5 fl oz (cyantrilaprole)	6.75	ab	11.25	ab
Untreated control	13.75	a	15.75	a

^z Treatments were applied on 24 Jun and 27 Jul in the equivalent of 30 gal per acre tank mix.

^y Means within the same column followed by a different letter are significantly different at $p=0.05$ Tukey's Test.

Table 2. Performance of organic insecticides against beet leafhopper in sugar beets at UC West Side Research and Extension Center in 2021.

Insecticide common name, rate/acre (active ingredient) ^z	Beet leafhoppers per 10 sweeps ^y	
	29-Jun	
Pyganic 34 fl oz (pyrethrins)	6.75	
Spray Oil 50 fl oz	6.50	
Sil Matrix 32 fl oz (potassium silicate)	6.25	
Trilogy 32 fl oz (clarified hydrophobic extract of neem oil)	8.50	
Entrust SC 8 fl oz (Spinosad)	9.75	
Venerate 128 fl oz per acre	8.00	
Grandevo 48 oz/acre	8.25	
untreated control	9.25	

^z Treatments were applied on 25 Jun in the equivalent of 30 gal per acre tank mix.

^y Means were not significantly different at $p=0.05$ as determined by Tukey's Test.

Discussion:

Currently, the insecticide used for beet leafhopper treatments of non-cropped areas or rangeland is malathion. Availability of an additional chemistry would reduce the risk of compromised efficacy of malathion due to resistance development in the insect and would provide an alternative should regulatory restrictions be imposed on this insecticide. In 2020 insecticide trial conducted at the UC West Side Research and Extension Center, the beet leafhopper population densities were low and although counts were only 3.5 per 10 sweeps in the untreated control and variability was high, Baythroid, Warrior II, malathion and Sevin significantly reduced population densities. In 2021, beet leafhopper numbers in the trial were higher. In the conventional insecticide comparison, Warrior II 1.6 fl oz, Baythroid 2.6 fl oz, Malathion 5EC 32 fl oz and Mustang were among the best performing materials. Based on the results of the first two seasons of data, the materials that have consistently performed similarly to malathion over both seasons are limited to the pyrethroids, Warrior II, Baythroid and Mustang. Unfortunately, these materials may have limitations from a regulatory perspective. Success performed well one year out of

two and Beleaf was only included in the study in 2021, but reduced beet leafhopper densities as compared to the untreated control.

While the pyrethroids performed well in the insecticide efficacy comparisons at the UC West Side Research and Extension Center, none of the certified organic products included in the study reduced the beet leafhopper population densities as compared to the untreated control. Work to evaluate additional organic materials and re-evaluate the materials that have previously showed promise in this study as well as any other conventional materials that have to this point not been evaluated in this setting could generate data that will provide a more reliable position regarding alternatives to malathion for beet leafhopper control and management of beet curly top virus.

Acknowledgements:

California Tomato Research Institute, University of California West Side Research and Extension Director, Robert Hutmacher and staff including Merf Solorin



References:

- Chen, Li-F., Brannigan, K., Gilbertson, R.L. (2010) Characterization of Curtoviruses associated with Curly top disease of tomato in California and monitoring for these viruses in beet leafhoppers. *Plant Disease*: Jan., v. 94, no. 1, pp. 99-108.
- Creamer, R. (2003) Incidence of the beet leafhopper, *Circulifer tenellus* (Homoptera:Cicadellidae) in New Mexico chile. *Southwestern entomologist*. 2003 Sept., v. 28, no. 3: p. 177-182.
- Davis, R.M., Miyao, G., Subbarao, K.V., Stapleton, J.J. and Aegerter, B.J. (2013) *Beet curly top virus*. UC IPM Pest Management Guidelines: Tomato: UC ANR Publication 3470. <https://www2.ipm.ucanr.edu/agriculture/tomato/Curly-Top/>
- Lehnhoff, E. and Creamer, R. (2020) Prediction of Early Season Beet Leafhopper Populations in Southern New Mexico. *Plant Disease*.
- Magyarosy, A.C. and J.E. Duffus. (1976) Feeding preference and reproduction of the beet leafhopper on two Russian thistle plant species. *Journal of the American Society of Sugar Beet Technologists*. Mar. 19 (1).
- Strausbaugh, K.A., Wenninger, E.J., Eujayl, I.A. (2014). Control of Curly top in sugarbeet with seed and foliar insecticides. *Plant Disease* Aug., v. 98 no. 8 pp. 1075-1080.