New Troubles From the Glassy-Winged Sharpshooter

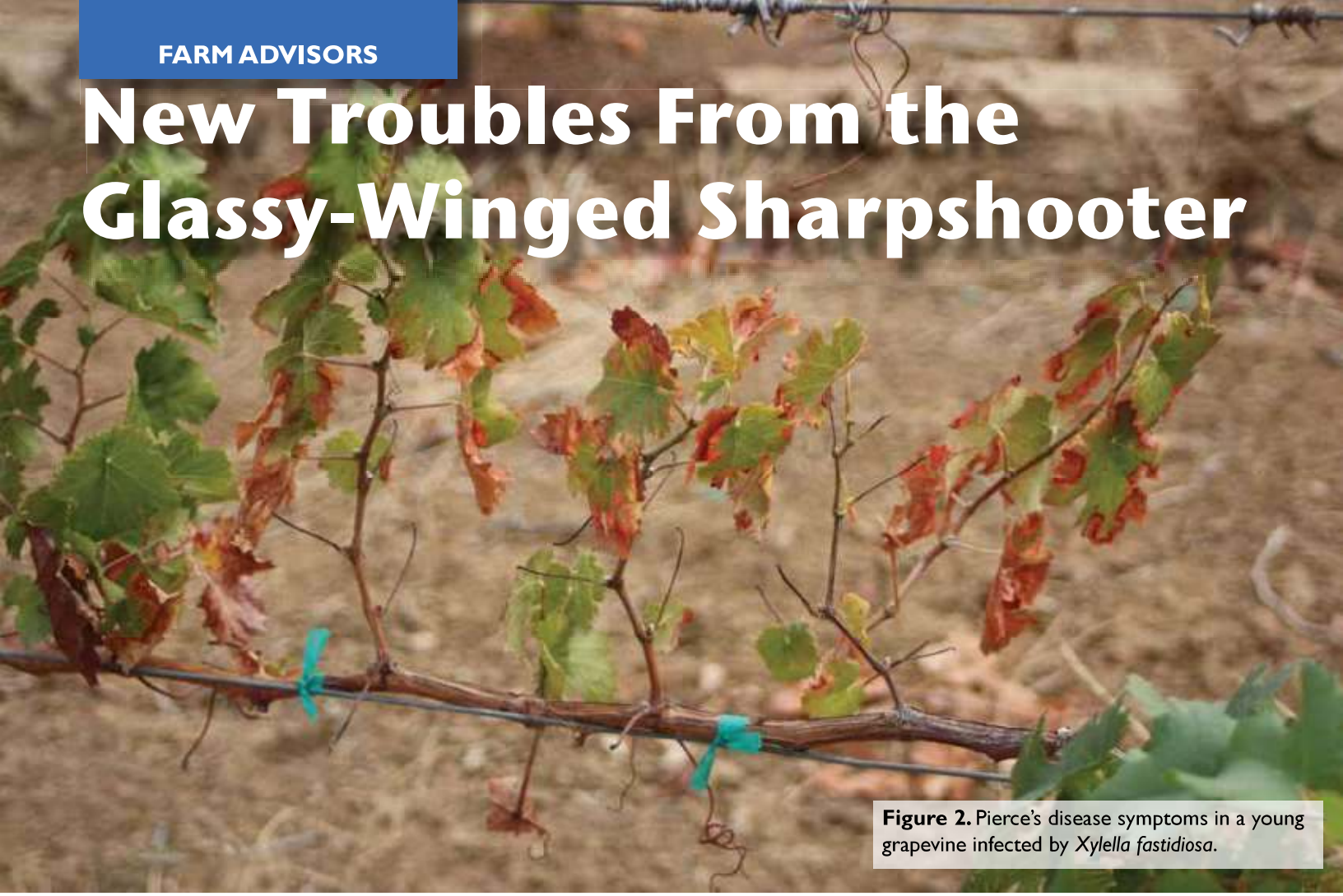

Figure 2. Pierce's disease symptoms in a young grapevine infected by *Xylella fastidiosa*.

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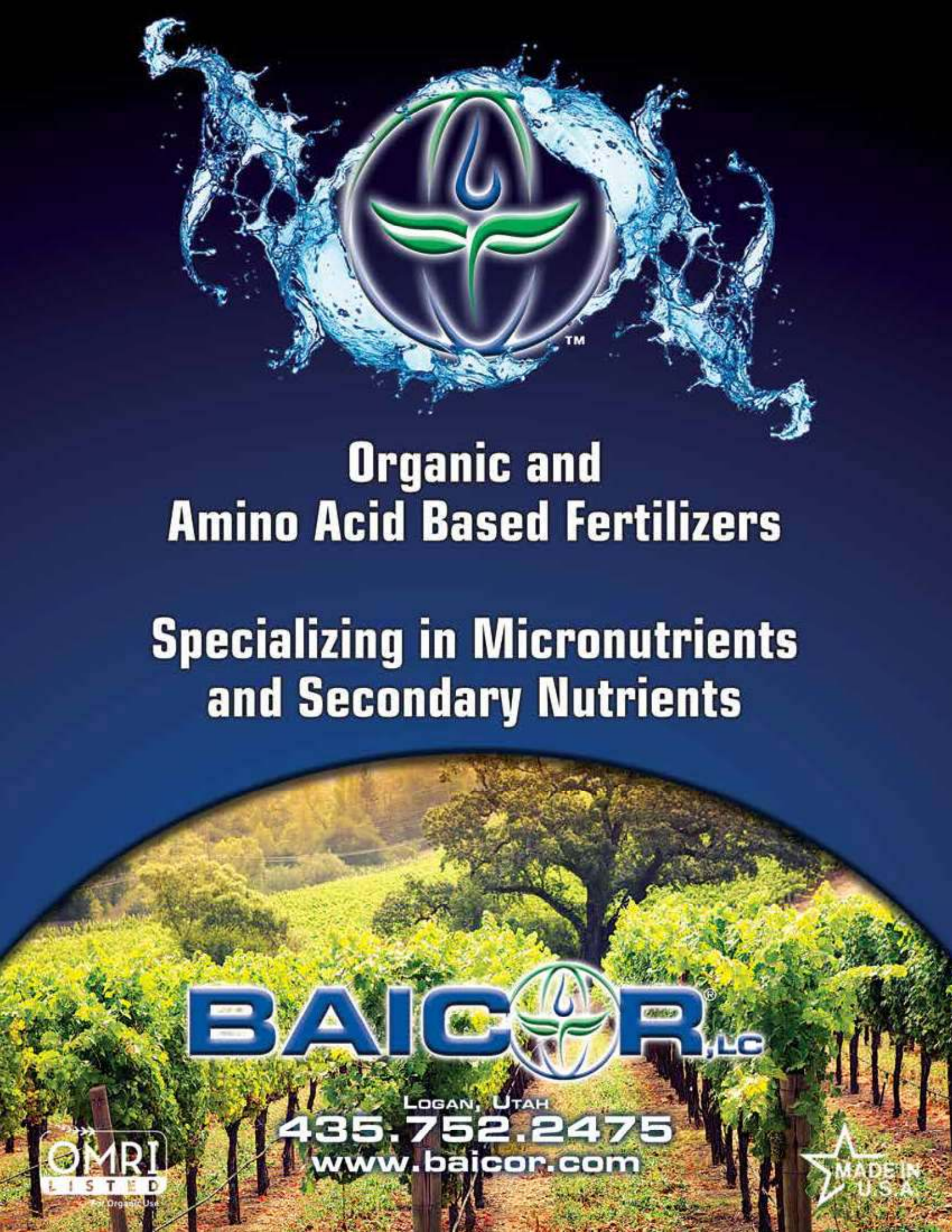
Figure 1. Glassy-winged sharpshooter (*Homalodisca vitripennis*) adult. *Photo: R. Krugner*

Invasions by new arthropod vectors can bring with them new pathogens, causing novel disease outbreaks in an area. Alternatively, new vectors can alter the dynamics of existing diseases – in some cases causing more frequent or more severe disease outbreaks. The latter scenario unfolded following the establishment of the glassy-winged sharpshooter (GWSS; *Homalodisca vitripennis*) in California approximately 20 years ago. Glassy-winged sharpshooter (Fig. 1) is native to the southeastern US, where it is one of the main vectors of the bacterium *Xylella fastidiosa* that causes a range of plant diseases, including Pierce's disease (PD) of grapevines. All commonly grown varieties of grapevines are susceptible to this bacterium, which causes progressive leaf scorch, defoliation, and ultimately vine death (Fig. 2). Pierce's disease has likely been a problem for as long as grapes have been grown commercially in California, having been first identified here in the late 1800s. Yet following the invasion of GWSS, outbreaks occurred that were more severe than usual.

GWSS was first detected in Southern California in the late 1980s. A decade later PD outbreaks began to occur in Temecula Valley. A few years after that, portions of the southern San Joaquin Valley faced similar PD outbreaks associated with the establishment of GWSS there. Although not as efficient at transmitting *X. fastidiosa* to grapevines as some vectors, particularly the native blue-green sharpshooter (GWSS; *Graphocephala atropunctata*), GWSS is notable for its use of a wide range of plants for feeds and reproduction. This broad host range likely favors its establishment in new areas, and high abundance of certain favored plants contributes to its ability to reach far greater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densities than native vectors. During the outbreaks in the Temecula Valley approximately 15 years ago there were anecdotal reports of "100s" of GWSS per vine. The most significant PD problems occurred in vineyards adjacent to citrus plantings, which are preferred host plants for GWSS.

In response to the PD outbreaks driven by GWSS's invasion, state and federal regulators, in conjunction with researchers and extension personnel, initiated area-wide control programs in affected areas of California: Temecula Valley and Coachella Valley in Southern California, along with portions of Kern, Tulare, Fresno and eventually Madera County. This included extensive monitoring for the vector, area-wide insecticide applications targeting primarily citrus to reduce GWSS spillover into vineyards, and mass rearing and releasing of multiple species of parasitoids that attack GWSS eggs (*Gonatocerus* spp.). Other steps included regulating the movement of nursery stock to minimize its potential for inadvertently contributing to GWSS spread, and eradication efforts around GWSS detections in new areas of the state. Finally, grape growers in affected areas took an increasingly active role in disease management in their vineyards via chemical control of GWSS and removal of infected vines. Collectively, these steps reduced greatly GWSS pressure and Pierce's disease prevalence. For example, trapping data from Southern California in the late 1990s showed peaks of more than 20 GWSS per trap per day compared to peaks a few years ago of under 0.1 GWSS. Similarly, surveys of Temecula Valley vineyards completed in 2012 estimated that just 0.5% of vines in the region had Pierce's disease. Moreover, regulatory steps taken to slow the spread of GWSS outside of heavily infested areas in the southern half of the state appear to have been largely successful in as much as its distribution remains restricted generally to where it has been for nearly 10 years (Fig. 3).

Figure 3. Glassy-winged sharpshooter distribution in California. From the California Department of Food & Agriculture: *https://www.cdfa.ca.gov/pdcp/Maps/GWSS_Distribution_2016.jpg*

The current situation

Despite notable successes with managing Pierce's disease for more than a decade, it remains one of the most significant challenges for grape production in California, in part due to GWSS, with total losses and management costs estimated to be more than $100 million per year. Indeed, over the last few years troubling trends have emerged suggesting a resurgence in Pierce's disease severity in several major grape-growing regions of the state. In areas where GWSS is widely established, its abundance appears to be on the rise again. For example, in Temecula Valley the area-wide trapping data so far in the summer of 2016 has shown peak trap catches that are 2-3 times higher than have been seen since 2009. Far more problematic, however, is the clear rebound in GWSS populations

"In areas where GWSS is widely established, its abundance appears to be on the rise again."

in the Southern San Joaquin. For example, GWSS trap catch from the Kern County area-wide monitoring program has increased more than 10-fold since 2008 (Fig. 4), with marked increases in PD prevalence in the area as well.

The reasons for the apparent resurgence in GWSS populations in parts of California are not definitively known. One potential explanation is tied to climate – specifically, temperate winter and spring conditions the last few years. GWSS stop feeding below approximately 50°F, and desiccate and die if exposed to low temperatures for several days. Therefore, warmer and less foggy winters may have contributed to higher GWSS abundance. A second

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potential explanation relates to ineffectiveness of chemical control programs. Such problems may manifest due to a reduction in efforts to target GWSS, shifting timing of applications to target other pests that is less effective at managing GWSS, or the evolution of insecticide resistance. The last of these potential explanations is currently being studied to reevaluate the efficacy of some of the common systemic and foliar insecticides that have been used against GWSS since its invasion. In the meantime, until the reasons for the resurgence in GWSS populations are clarified, it is increasingly important to renew efforts to manage this important vector and disease.

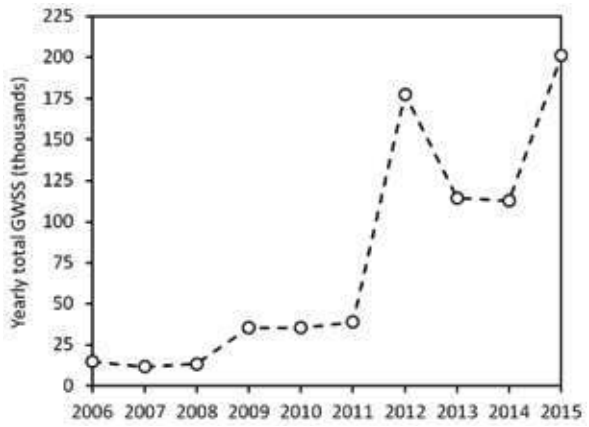

Figure 4. Resurgence in the number of glassy-winged sharpshooters caught in Kern County.

Pierce's disease management

Pierce's disease management employs the same general set of tools as for other vector-borne plant pathogens. Because there are not yet any truly PD-resistant wine grape, table grape, or raisin varieties that are widely available, management relies on a combination of controlling vectors and reducing pathogen supply. The challenge with managing Pierce's disease is that both the pathogen and the vectors, particularly GWSS, have broad host ranges – meaning there are potentially several targets for management.

The area-wide programs continue to be an important element of GWSS control and Pierce's disease management. Yet, some details have changed over time. In the San Joaquin Valley, the programs continue to include extensive monitoring, application of systemic and foliar insecticides targeting primarily GWSS populations in citrus, and releases of GWSS egg parasitoids in select areas. Meanwhile, the Southern California programs involve primarily monitoring for the vector. Area-wide chemical control and biological control releases are no longer occurring in the region – though observations indicate that the parasitoids are widespread and are likely an important part of sharpshooter suppression later in the season.

In addition to any ongoing area-wide management, grape growers can actively contribute to Pierce's disease management in multiple ways. These include the following:

Vine roguing: Particularly in warmer regions, infected vines aren't likely to recover from infection. Therefore, diseased vines should be removed to minimize their potential to contribute further to pathogen spread. Vines should be inspected in the fall when PD symptoms are most apparent. Suspected vines, particularly those with severe PD symptoms, should be flagged for later removal. Areas within vineyards that have persistent PD problems should be replanted with relatively less susceptible varieties.

Vegetation management: Several species of plants, in addition to grapevines and citrus can be sources of the pathogen or vector. This includes several common weedy forbs and grasses in and around vineyards, which should be managed via tilling, mowing, or herbicide applications to minimize their roles in contributing to pathogen spread. Similarly, GWSS readily uses many common ornamental species as reproductive hosts. Vineyards and wineries should avoid landscaping with certain plants, including olive, citrus, roses, photinia, and other key GWSS reproductive hosts. An extensive list of GWSS host plants can be found at the Pierce's Disease Control Program site listed below.

Vector control: Multiple insecticides are available for use in vineyards to control GWSS. For conventional growers, soil applications of systemic neonicotinoids are regularly used in most areas where GWSS is established as long as the soil type allows for rapid uptake into vines. Application timing may vary among areas, but typically should occur by the end of spring to allow for GWSS-effective concentrations in vines for much of the remainder of the season. For organic growers, options include kaolin clay and pyrethrins. Given the short residual efficacy, especially for the latter, successive applications at 1-2 week intervals are recommended starting in the late spring or early summer depending on the results of vector monitoring. More information of chemical control can be found in the UC IPM site listed below.

For more information

- Area-wide monitoring maps: *http://apps4.cdfa.ca.gov/PiercesMaps/*
- Pierce's disease control program: *https://www.cdfa.ca.gov/pdcp/*
- UC IPM pest management guidelines for sharpshooters on grape: *http://ipm.ucanr.edu/PMG/r302301711.html*

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