Progressive Crop Consultant

The Leading Magazine For Ag Professionals

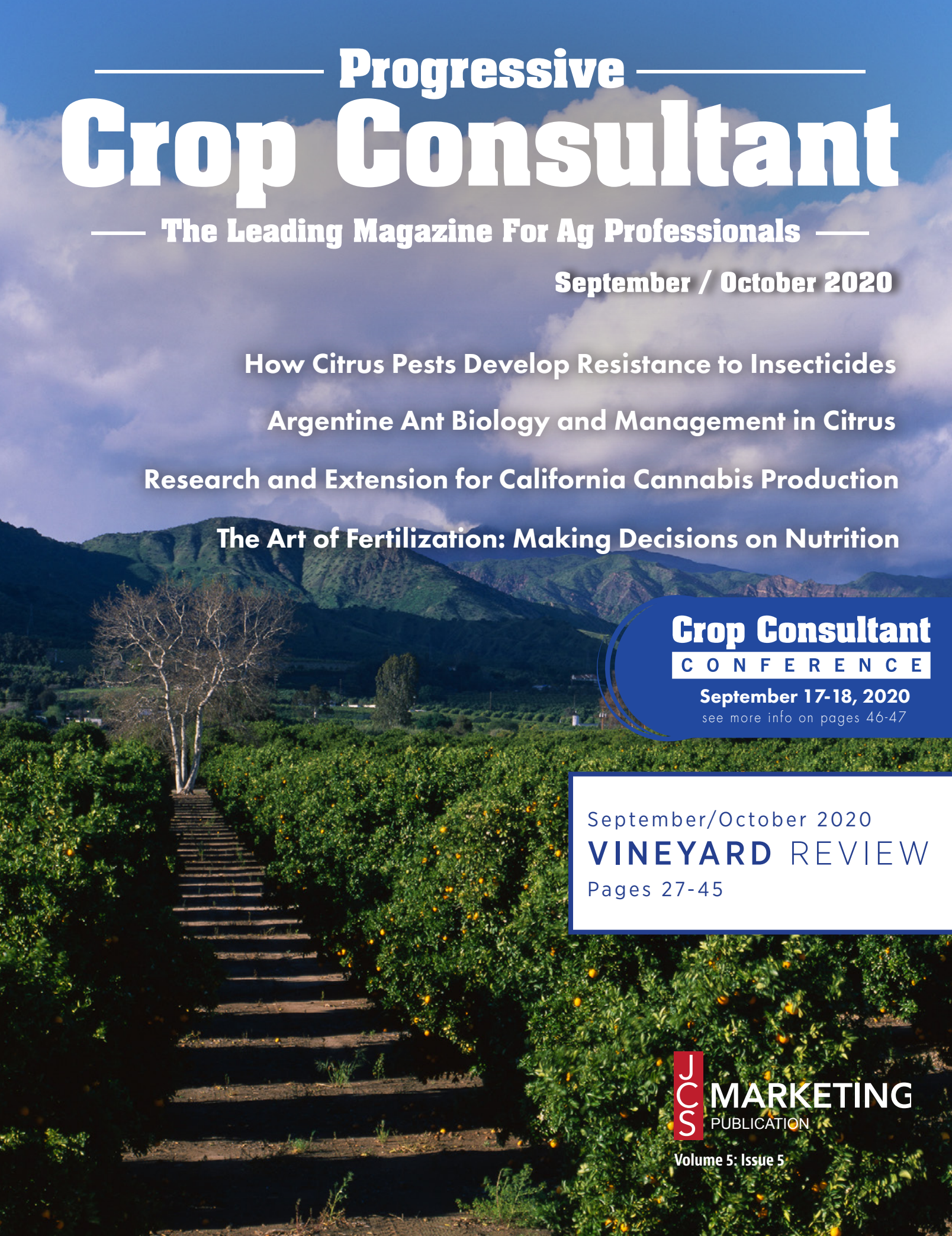
September / October 2020

How Citrus Pests Develop Resistance to Insecticides

Argentine Ant Biology and Management in Citrus

Research and Extension for California Cannabis Production

The Art of Fertilization: Making Decisions on Nutrition



Crop Consultant CONFERENCE

September 17-18, 2020

see more info on pages 46-47

September/October 2020

VINEYARD REVIEW

Pages 27-45

JCS MARKETING PUBLICATION

Volume 5: Issue 5

Control Strategies for Mealybug Pests and Vectored Viruses in Vineyards

By **CRAIG MACMILLAN, PH.D.** | *Macmillan Ag Consulting*
and **KRIS BEAL, M.S.** | *Vineyard Team*

MEALYBUGS, ESPECIALLY THE VINE mealybug, excrete a white waxy substance in clusters that is unacceptable to wineries. They also excrete a sweet honeydew that is a substrate for black sooty mold. Black sooty mold covers the fruit and the rest of the vine with a black coating. In addition, mealybugs spread Grapevine Leafroll-associated Virus 3 (GLRaV-3). Between damage to fruit and vine decline from virus, the economic impacts of the pest are substantial.

Biology of the Pest

The primary species of mealybug causing economic impacts in vineyards is the vine mealybug (*Planococcus ficus*). Other species of economic concern are the grape mealybug (*Pseudococcus maritimus*), obscure mealybug (*Pseudococcus viburni*) and long-tailed mealybug (*Pseudococcus longispinus*). The vine mealybug has five to seven generations per year (more than other species) and can be active year-round in warm areas, making control challenging. It also lays more eggs than other species. Mealybugs hide under bark and on roots during the winter and hot periods during the summer. This makes most contact insecticides ineffective.

Monitoring

Monitoring for mealybugs has four components: Searching under bark, looking for honeydew and sooty mold, monitoring ant activity and pheromone traps. Searching under bark for adults, nymphs and wax can be done any time of the year, but is most successful during the growing season. Look under loose bark at the base of spur positions and along the trunk. If mealybugs cannot be sighted first hand, the presence of the sticky honeydew and black sooty mold on leaves and shoots are an indication they are active.

Pheromone sticky traps attract males when they are in flight. The timing of flights varies by species and region. In general, traps should be monitored in the spring and late summer, and the identification of a flight in progress from elevated trap counts can be used to time mating disruption sprays. Male

Vine mealybug are the main mealybug species causing economic damage in California vineyards (photos courtesy Stephanie Bolton, Lodi Winegrape Commission.)

Mealybug themselves can cause economic damage to grape crops but also vector leafroll diseases, which can spread quickly within a vineyard and region.

mealybugs are extremely small and can only be identified using a dissecting scope.

Another indirect way of monitoring for mealybugs is observing ant activity. Argentine ants tend the mealybugs and collect the honeydew. If a large number of ants are visiting the vine it is likely mealybugs are present.

Control Strategies

Growers have a suite of control measures they can bring to bear against mealybugs and virus. These include insecticides, biological control, mating disruption and the rogueing of infected vines. The choice of strategy varies depending on the severity of the mealybug infestation, the extent of virus infected vines, grower tolerance of both mealybugs and virus, and cost.

"If a vineyard contains a relatively high incidence of leafroll infected vines… it is essential to manage the levels of mealybugs to extremely low levels," said Dr. Gerhard Pietersen of the Department of Genetics at the University of Stellenbosch. A high incidence of leafroll virus may be as low as 10% infected vines depending on mealybug density and the desire of the grower to halt its spread.

"This is because many of the mealybugs in that vineyard will be viruliferous (carry the virus) and can spread the virus to healthy vines," he added. Under these conditions, systemic insecticides are required. Used in combination with the rogueing of infected plants and biological control, it is possible to reduce mealybug densities and the incidence of virus to tolerable levels given time.

Biological Control

"If leafroll infected vines are at very low levels (probably around 0.5%, but dependent on the accepted risk), mealybug control using the more desirable biological control is feasible, as most mealybugs in such a vineyard are not viruliferous, and slightly higher levels of infestation can be tolerated," said Pietersen. "This generally involves the augmentative release of mealybug predators and parasitoid," he said.

The two major biological control agents on mealybugs are *Anagyrus pseudococci* and *Cryptolaemus montrouzieri. Anagyrus pseudococci* is a parasite of the vine mealybug. It lays one egg per host in adult mealybugs. Parasitism rates can run from 20% to 90% depending on the region. The mealybug destroyer lady beetle (*Cryptolaemus montrouzieri)* is a predator of mealybugs, especially on egg sacs. Although found in most grape growing regions of California, mealybug destroyer populations are often augmented with releases of the insects purchased from an insectary. These two biological control agents (plus others) can dramatically reduce mealybug populations, although not below economic thresholds, by themselves.

Insecticides

Three important insecticides for the control of mealybugs are Movento, Admire Pro and Applaud. Movento is spirotetramat. It is a systemic and may take four weeks before results are observed. The most efficacious time to apply is bloom time. It is applied as a spray to the canopy. Admire Pro is an imidacloprid product applied to the soil around bloom time. This product works best when there is a second application 21 to 45 days after bloom. Applaud is a buprofezin, an insect growth regulator. It is best applied when crawler emergence is at its peak. When these products are used in combination with each other and other insecticides such as Venom, Platinum or Belay, mealybug populations can be reduced to levels where biological control and mating disruption have a significant impact. Growers should rotate chemistries as much as feasible to avoid the development of resistance in the mealybug population to any one mode of action.

Mating Disruption

Mating disruption is the practice of spraying female sex pheromones into the vine canopy. This confuses the males and prevents mating. CheckMate VMB-F and CheckMate VMB-XL are pheromone products for vine mealybug. Sprays should be timed based on increased catches of male mealybugs in pheromone traps. It can be applied in 30-day intervals during the late spring to early fall depending on the Preharvest Interval (PHI).

Ant Control

High populations of Argentine ants (*Linepithema humile*) are associated with high populations of mealybugs. Argentine ants interfere with biological control. Tilling the middles for weed control can destroy their nests and

Continued on Page 30

Continued from Page 29

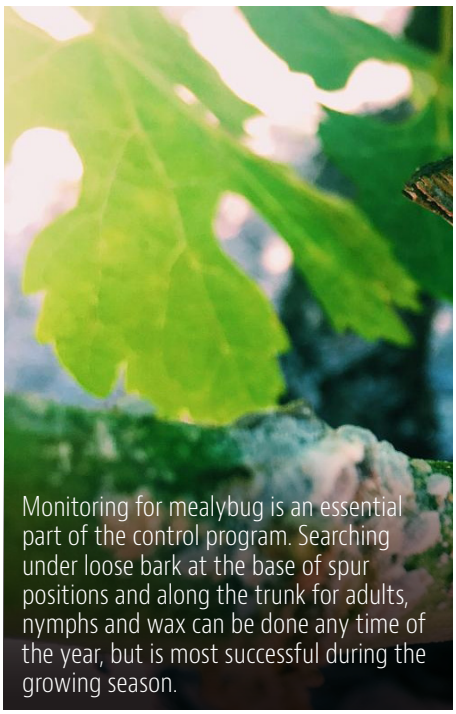
reduce their attention to the mealybugs as they rebuild their nest. Cultivating in-row with an implement such as a French plow can also be effective. Insecticides are best applied in a bait station, which require significant labor to distribute and maintain.

Vine Removal

Removing (or rogueing) a virus-infected vine is one way to reduce the spread of virus within the vineyard. Vines with red leaves should be flagged in the late summer when symptoms are the most dramatic. These vines should be removed as soon as possible after harvest for optimum control. Removing individual mature vines is difficult and expensive.

Areawide Pest Management Programs

In some areas of California, areawide pest management programs (AWPM) have been formed to address widespread infestations of mealybugs and similarly widespread incidence of GLRaV3. AWPMs are coordinated pest management activities over a large geographical area. The concept is that pest populations are not defined on a field-by-field basis. Instead the population of the pest is defined by the extent of contiguous hosts in space. This means the mealybugs in an area with contiguous vineyards need to be managed as uniformly as possible across properties. Mating disruption is very effective when used as part of an areawide pest management program, for example. In Monterey County, this has taken the form of "pest management neighborhoods."



Monitoring for mealybug is an essential part of the control program. Searching under loose bark at the base of spur positions and along the trunk for adults, nymphs and wax can be done any time of the year, but is most successful during the growing season.

"A pest management neighborhood is a group of growers who are physically proximal," said Kim Stemler, Executive Director, Monterey County Vintners and Growers Association. "This proximity means that pests could easily be transported from one vineyard to another. Further, these vineyards are so close that their individual prevention and treatment strategies can be coordinated so that the net effect is mutually beneficial to all vineyards in the neighborhood.

"In Monterey County, the winegrowers defined the neighborhood boundaries and they meet regularly to share and coordinate prevention actions, what they are seeing in the vineyards, and their treatment strategies," she added. "By working together in this way, there is a more effective and integrated cross-county approach to pest management."

Stephanie L. Bolton, Research & Education Director/Sustainable Winegrowing Director of the Lodi Winegrape Commission, described a similar coordinated approach in the Lodi region.

"As a region, we have been successfully using education and outreach—getting all growers to come together to understand why managing for mealybugs and viruses is important to their financial investment in the vineyard –and we're fostering very open, collaborative sharing of management trials and tribulations with their costs," she said.

As part of these efforts, the Lodi Winegrape Commission has promoted a suite of practices. "More specifically, in addition to typical mealybug IPM, we are incorporating extra scouting (for mealybugs, beneficials, and virus symptoms), flagging and mapping mealybug hotspots and virus infections, virus testing, neighborhood communications, and most importantly the removal of leafroll-infected vines as it makes economic sense for each situation," said Bolton.

She added, "The education and outreach has definitely been working—our growers know a lot more about mealybug management, especially biocontrol, and viruses now than they ever have before, and this helps them make more informed financial decisions about their vineyards."

One example of the Lodi Winegrape Commission's education and outreach activities is the *What Every Grower Should Know: Viruses* workbook which includes an extensive chapter on mealybug management. Taken together, these efforts have shown success at reducing mealybug densities in some vineyards in Lodi particularly through biological control and mating disruption.

Without control measures, the pest-disease complex of mealybugs and leafroll virus is devastating. Fortunately, a combination of biological control, insecticides and mating disruption can reduce mealybug populations to tolerable levels. Coordination of pest management activities between growers increases the likelihood of success. Research on this topic is ongoing. As Bolton said, "We always welcome new affordable tools for the toolbox!"

References

Bolton, Stephanie. 2020. What Every Winegrower Should Know: Viruses. Lodi Winegrape Commission.
Daane, K.M. et al. 2006. New controls investigated for vine mealybug. California Agriculture 60(1):31-38.
Daane, K.M., A. Ledesma, and E. Belloli-Ramos. 2020. In Season Drip and Foliar Insecticides for a Mealybug in Grapes, 2019.Arthropod Management Tests. 45(1).
Gutierrez, A.P. et al. 2008. Prospective evaluation of the biological control of vine mealybug: refuge effects and climate. Journal of Applied Ecology 45: 524–536.
Tsai, C.W. et al. 2008. Transmission of Grapevine leafroll virus, Fernandez, L., Bosco, D., Daane, K. M., and Almeida, R. P. P. 2008. Transmission of Grapevine leafroll-associated virus 3 by the vine mealybug (Planococcus ficus). Phytopathology 98:1093-1098.

Comments about this article? We want to hear from you. Feel free to email us at article@jcsmarketinginc.com