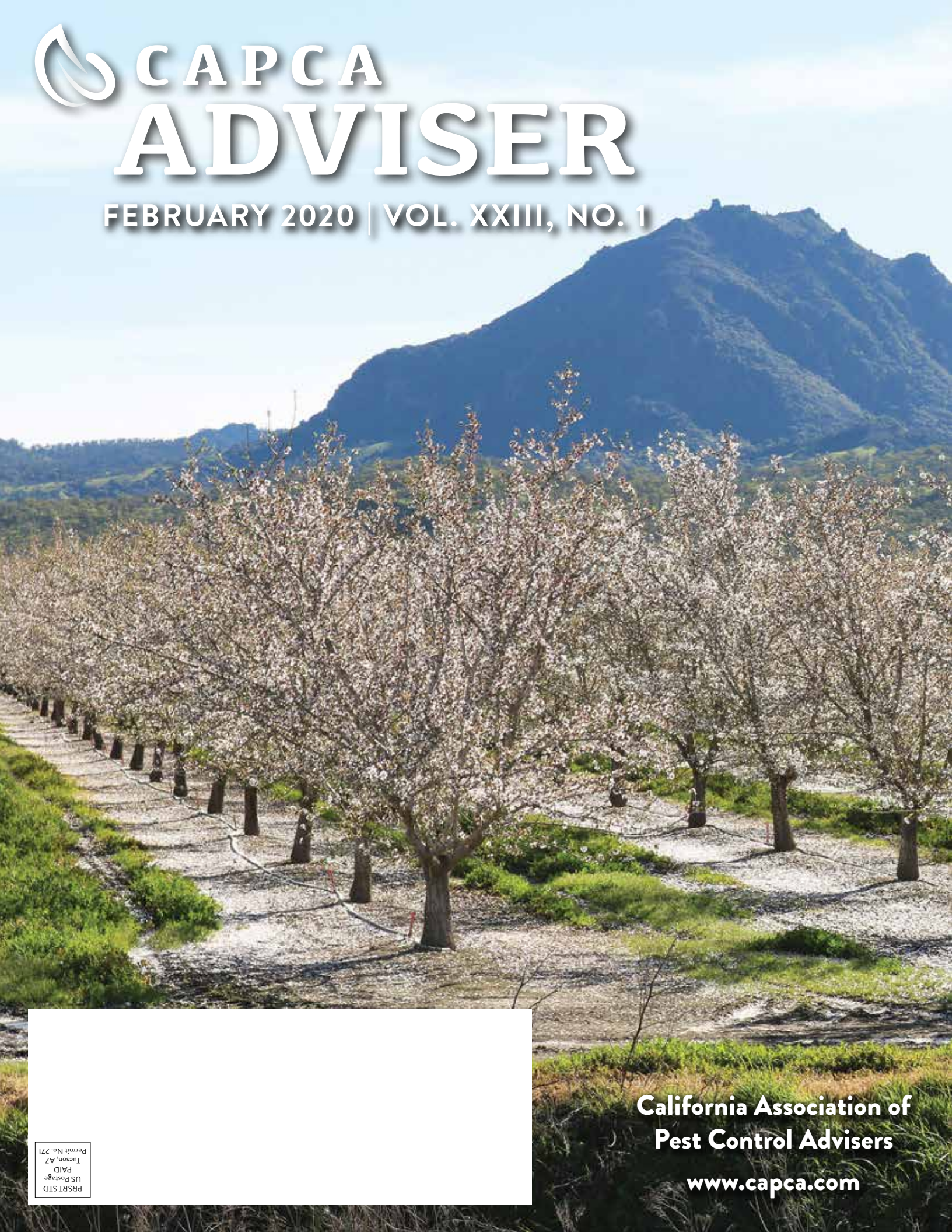
# CAPCA ADVISER

FEBRUARY 2020 | VOL. XXIII, NO. 1



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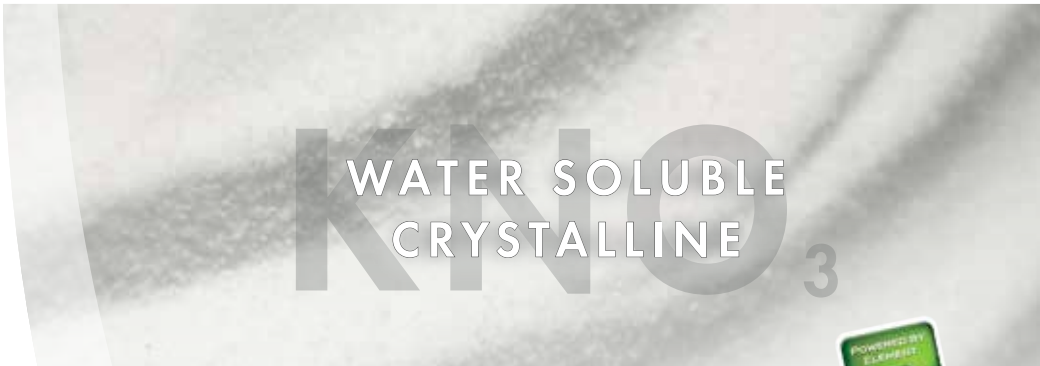


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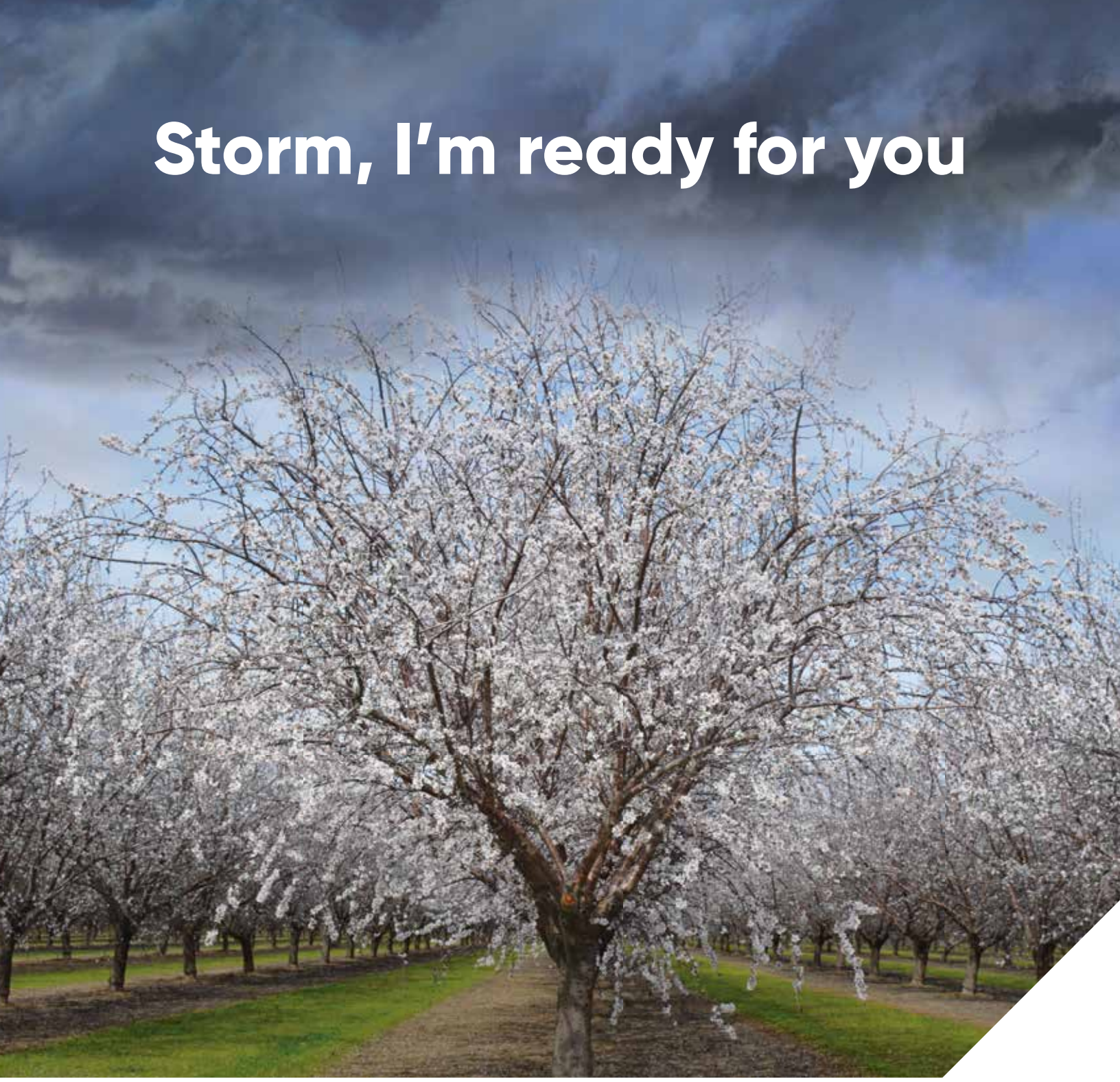

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# From the Editor

## Why Your PAC Contribution Counts

What does the CAPCA PAC (Political Action Committee) do and why is it important?

CAPCA plays an active role in the State legislative process through communication with California policy makers about the state's agricultural and horticultural industries. Our messaging has always been focused on the professionalism and important role PCAs provide in the production of food, fiber and ornamental crops.

The CAPCA PAC raises funds for support of political issues and initiatives that may impact CAPCA members. CAPCA employs professional legislative advocates in Sacramento, assisting us in watching over legislation and regulations pertaining to PCAs. Our PAC helps us have a greater influence in state and local legislation and with our dedicated leaders. CAPCA is equally involved in the regulatory process normally found under the CAL EPA umbrella, specifically California Department of Pesticide Regulation (DPR).

A portion of your $160.^{00}$ Dues ($7.^{00}$) automatically go to the CAPCA PAC (unless you chose to opt out*). Some of the PAC activities your $7.^{00}$ contribution allows CAPCA to do include financial support of candidates, fund raising for legislative events, and interaction at the Capitol and the local level to tell our story to legislators/representatives. CAPCA's Government Relations Committee has established objectives and goals to make the voice of the PCA heard in the state and local political arenas and the funds collected for the PAC are instrumental in helping CAPCA achieve these objectives. With over 80% of PCA members contributing annually, your $7.^{00}$ does make a difference when combined with all members (over $16,000.^{00}$ annually).

It is important to keep in mind that you do have the option of individually contributing additional funds to the PAC. A little can go a long way. For example, imagine each of our contributing members donated just an additional $10.^{00}$ to the PAC beyond their $7.^{00}$ - that would raise the annual contributions from $16,000.^{00}$ to over $39,000.^{00}$! You can see that although the increase per member would not be exorbitant, the combined effort would produce a sizable benefit. Even a small pebble dropped into a pond creates some ripple effect. As members your contributions can make a difference.

**Note: On your dues form CAPCA always gives the option to those joining/renewing their membership to opt out of contributing to the CAPCA PAC. Speak to your employer regarding their company policy if they are paying for your dues. Depending on the overall financial contribution your company makes, they may be required to file additional reporting if this contribution is made on your behalf and will instruct you to opt out of this contribution.*

Ruthann Anderson, Editor
ruthann@capca.com



**MISSION & PURPOSE**
California Association of Pest Control Advisers (CAPCA) is a non-profit voluntary mutual benefit association that represents 75% of the 4,000 California EPA licensed pest control advisers. *CAPCA's purpose is to serve as the leader in the evolution of the pest management industry through the communication of reliable information.* CAPCA is dedicated to the professional development and enhancement of our members' education and stewardship which includes legislative, regulatory, continuing education and public outreach activities.

**PUBLISHING INFORMATION**
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# 2020 Goals

Rick Harrison, CAPCA Chair

Welcome to a new decade with CAPCA. We are headed into 2020 with our continued support and enhancement of our local chapters along with strengthening the advocacy of California PCAs through our Government Relations Committee.

Continuing our support of local chapters in setting and accomplishing a "Chapter Purpose" is essential to the development of strong chapters that support CAPCA members. As a twenty-year member of the Ventura chapter, for example, I can say that our purpose to promote the PCA through continuing education and fundraising for scholarships awarded to students pursuing the PCA career in Ventura County is being accomplished. Ventura holds three CE meetings each year with approximately one hundred and fifteen to one hundred and forty attendees. Another fundraiser is an annual Golf Tournament that we have sponsored for approximately 37 years where we award an average of three to five scholarships per year.

Other chapters may have a different purpose and we offer chapters tools to accomplish them. For example, chapters can utilize CAPCA's Chapter Resource Budget. Through the Chapter Resource Budget, chapters are given opportunities to have the state CAPCA office facilitate CE meetings in a variety of ways, including contacting and arranging speakers, invitation mailings, DPR CE hours submission, and even running the CE meeting. Along with holding a Chapter President Summit this year, we will develop chapter CE Coordinators through a CE Coordinator training, which will make it easier for new CE Coordinators to begin putting on CE meetings.

2019-2020 CAPCA Executive Board members (L-R) Rick Wescott, Ex-Officio; Paul Crout, Vice Chair; Rick Harrison, Chair; Patrick Dosier, Treasurer; Matthew Bristow, Secretary

Last year all chapters designated their Chapter Champions who are being trained in building relationships with their local government officials. Because we have chapter engagement throughout the state, I expect the Chapter Champions to hold continued dialogue with local officials who will take information back to Sacramento and allow our voices to be heard when policies are being created. As I have said before, we are very unique in that our association has a voice throughout the state. It is up to the Chapter Champions and the rest of us to continue to be a resource in guiding elected officials when making policies that affect our jobs.

As for strengthening advocacy for California PCAs, last November, CAPCA executives along with the Government Relations Committee created and held the first meeting of our Sustaining Member Council (SMC). This council is a collaboration of pivotal representatives from the agricultural community including PCAs, growers, chemical manufacturers, retailers, Ag Commissioners, and the Department of Pesticide Regulation. As an advisory council, the SMC supports PCA interests, maintenance of the PCA license, and considers issues affecting active ingredients in our toolbox.

Additionally, SMC provides employers and PCAs a venue for engaging with CAPCA on critical issues. A recent example involved a study that claimed PCAs and Ag Commissioners are not documenting the use of alternative measures taken prior to recommending or allowing the application of Restricted Materials. Rather than maintaining the obvious, that this study is unfounded, SMC chooses to address these issues and be proactive in researching and creating a policy that will be mutually beneficial in the short and long term. Our license, continuing education, and recommendations are continually being scrutinized; it is up to CAPCA, our Government Relations Committee and our Sustaining Member Council to provide sound advice based on science and collaboration. ■




# Jennifer De Jong: Dedicated to California Agriculture

CAPCA Staff

Jennifer De Jong graduated from Cal Poly, San Luis Obispo with a Bachelor of Science degree in Crop Science and double minor in Plant Protection Science and Soil Science in 2007. She obtained her PCA license in 2008, and consulted primarily in potatoes, carrots, corn (grain), turfgrass, watermelons, pumpkins, squash, asparagus, grapes, and wheat before her current position where she consults on any and all crops, concentrating more heavily on permanent crops (almonds, walnuts, grapes and pistachios).

After graduating from college, Jennifer began working as a PCA in Stockton for five years. She says, "I learned a great deal working hands-on with growers, irrigators, and applicators. It prepared me to be able to understand my customers better in my current role." Since April of 2013, Jennifer has been with Miller Chemical and Fertilizer, LLC as the Northern California Territory Manager which covers Livingston to the Oregon border.

Describing her work, it's clear that she's proud to be a part of Team Agriculture here in California. Her story began well before her current position. "My grandfather and father were both farmers. I grew up working at farmers markets and selling peaches and almonds at our fruit stand, and I loved it," she shares. "I loved being outside, making our customers happy, and being part of the family-like agricultural community." She recalls the early decisions that lead her into a PCA career, "In 4th grade I took my horse to a camp at Cal Poly, SLO and decided then and there that I was going there for college. As a freshman at Cal Poly, the hands on "Learn By Doing" motto allowed me to get my hands dirty – literally – learning about each crop. I knew that year I wanted to be a PCA because it would allow me to keep getting my hands dirty and continue to be a part of the family-like Ag community I loved growing up."

Jennifer is pleased to point out that her company has been in the specialty agricultural and horticultural business for over 80 years and eagerly talks about what she gets to do in her role, "It's my job to communicate with PCAs and growers and advise them on products. I organize and evaluate field trials, host product update and educational outreach meetings, and work with over forty retail outlets in my territory." Talking with others outside Agriculture about what she does, Jennifer says "I often use the 'doctor writing a prescription' analogy... I tell people unfamiliar with agriculture that we help plants grow better, and more efficiently."

She cites one of the satisfying highlights of being a PCA and manufacturer rep is getting calls from other PCAs and growers who use their products and have a successful outcome. "I love doing what I do for those calls."

Asked about the experiences that really help in her career now, Jennifer credits the internships and her first job out of college. "I believe every job helps you in your current role. We all learn, whether good or bad, from our experiences. I will say my summer internships in college had a huge impact on my career today. The great thing about internships is they allow you to try different aspects of our industry and see if they are right for you. They often also teach you to recognize and respect every role within the industry. My internships helped me realize geographically where I wanted to be."

Jennifer is pleased to share that her association with CAPCA began early in her career. "My first CAPCA Conference was as a college student. I actually found my job after graduation posted at the Conference that year. For me, CAPCA was my way to connect

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with other PCAs and to gain knowledge on how to become a better PCA. Sure, we all take the tests and pass the categories, but there's more to it than that." She candidly recognizes the body of industry knowledge that CAPCA members represent, "When I graduated college the average age of a PCA in California was over 55 years old. Think of all that knowledge that will one day be gone?! A lot of these PCAs have forgotten more than I'll ever learn! If I can soak up any of their knowledge by being part of CAPCA then I'll show up every time." And she's quick to look to the future, acknowledging the value of being involved with CAPCA, "At the same time, the world is evolving, and I believe new, young PCAs have a lot to offer to CAPCA. We need to blend the seasoned PCAs with the new ones, to learn from each other to find the balance to take us into the next decade and beyond. The future of Ag and the PCA in California is constantly under attack, we need to work together to maintain our passion and livelihood in a state that doesn't necessarily see the value in what we do."

Giving action to her values, Jennifer currently serves as the Central Valley CAPCA Chapter Vice President and State Board Representative, as well as Continuing Education Chair of her Chapter. She's looking forward to the events and activities her CAPCA Chapter has planned for the coming year: a Continuing Education meeting in February in Tracy; the Bug Shooters Sporting Clay Shoot the last Friday in March and Bug Stompers Golf Tournament the first Friday in August to benefit student sponsorships; and their fourth annual fall Label Update to help local licensees get a few last minute CE hours before the end of the year. "My goal for our chapter of CAPCA is to be there for our community of PCAs, and to give back to the community and to the next generation. Every year our events allow us to sponsor students interested in becoming PCAs to attend CAPCA's Annual Conference. We also make donations to our surrounding community when the request arises."

Asked why PCAs should become CAPCA members and get involved, Jennifer brings it down to numbers and making a difference: "Our industry and way of life are continuously being scrutinized, and we have an organization that is 3,000+ strong that can be our united voice. Alone our voice is not very loud, but together we can surely be heard." ■

*Jennifer and her husband Chad have been married since 2011. They have 3 kids and are expecting their 4th in April 2020. She enjoys time with family, camping, and is very involved in their church as nursery coordinator and volunteer with several children's programs.*

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# Paraquat Dichloride New Label Certification Requirements

**RESTRICTED USE PESTICIDE**

**DUE TO ACUTE TOXICITY**

FOR USE ONLY BY CERTIFIED APPLICATORS – NOT TO BE USED BY UNCERTIFIED PERSONS WORKING UNDER THE SUPERVISION OF A CERTIFIED APPLICATOR.

If an uncertified individual handles a paraquat product bearing this labeling restriction pictured above, the use is in conflict with the registered labeling and in violation of Food and Agricultural Code section 12973. This requirement applies equally to both growers and pest control businesses using products with labeling bearing this requirement.

A grower or grower employee applying paraquat in accordance with the revised labeling must have a:

- Private Applicator Certificate (PAC),
- Qualified Applicator Certificate (QAC) with Category D, or
- Qualified Applicator License (QAL) with Category D.

Pest Control Business (PCB) employees must have a:

- QAC in the appropriate category,
- QAL in the appropriate category, or
- Journeyman Pest Control Pilot Certificate (apprentice pilots are not certified applicators).

A PCB employee may NOT use paraquat under a PAC. In Title 3 of the California Regulations (3 CCR) section 6000, a PAC is defined as:

> **"Private applicator"**:
>
> **(a)** an individual who uses or supervises the use of a pesticide for the purpose of producing an agricultural commodity as defined by Title 40 Code of Federal Regulations, section 171.2(a)(5) (July 1, 2013) on property owned, leased, or rented by him/her or his/her employer; or
>
> **(b)** a householder who uses or supervises the use of a pesticide outside the confines of a residential dwelling for the purpose of controlling ornamental, plant or turf pests on residential property owned, leased, or rented by that householder.

The private applicator definition in 3 CCR is written in accordance with the restrictions placed upon a private applicator federally. Under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) a Private Applicator is defined as:

> A ''private applicator'' is a certified applicator who uses or supervises the use of any pesticide which is classified for restricted use for purposes of producing any agricultural commodity on property owned or rented by the applicator or the applicator's employer or (if applied without compensation other than trading of personal services between producers of agricultural commodities) on the property of another person.

Therefore, allowing an employee of a PCB to obtain a PAC to apply paraquat under the new label requirements is in direct conflict with FIFRA.

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# CAPCA continues to seek added value for members

CAPCA Staff

Over the years CAPCA has added an Ag Alert subscription through the Farm Bureau and this past year piloted Agri-Pulse, with an Ag News and Policy focus, to help our members stay engaged on news and policies that would impact California Ag and the PCA license.

As CAPCA has taken a more targeted focus on Advocacy, we believe that informing members on statewide and federal issues that are relevant and could impactful to their jobs is key to foster member engagement. One of the ways we can do this is through partnerships with experts like the writers at Agri-Pulse and Ag Alert to bring ag news and policy directly to you.

CAPCA, in sponsorship with FMC, will continue to provide Ag Policy news via Agri-Pulse to members in 2020. CAPCA members can use this valuable resource to engage on legislative and regulatory discussions impacting the industry not only today, but the future of Agriculture.

In 2019, some items of highlight that Agri-Pulse brought to CAPCA members included breaking news on the state's ongoing efforts to cancel and replace the insecticide chlorpyrifos, a legislative session involving nearly 2,000 bills and escalating tensions over California's strict air and water regulations.

Additionally, Agri-Pulse provided a comprehensive wrap up of the Legislative Year and the impact decisions would have on California Ag starting in 2020.

Our partnership with Agri-Pulse also includes articles in the Adviser magazine which spotlighted some of the key challenges we currently face in our state and industry to aid in keeping the conversation on important issues in the forefront.

The pilot project with Agri-Pulse was via direct email delivery for members over the past year, but through various feedback surveys and conversations with members we are modifying this member benefit starting March 1, 2020 to better serve all our members. Some of these changes include:

- Members will continue to receive a more streamlined version of the Weekly Newsletter. CAPCA is asking our members to stay informed by scanning these headlines and reading further on items of interest on www.Agri-Pulse.com. To help CAPCA members strengthen their voice to regulators and legislators in California, CAPCA may from time to time use this weekly newsletter to not only educate members but give them a call to action to respond to a pressing issue.

- Top news will be accessible through the CAPCA Website on the Members Only portal when CAPCA member is signed in as well as on www.Agri-Pulse.com

- Podcasts will be available for subscription via iTunes by searching for Agri-Pulse West. ■


Photo: Fred Rehrman, Elysian Fields

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# Economic report makes a case for extension funding

Brad Hooker, Agri-Pulse West Associate Editor

The University of California Division of Agriculture and Natural Resources (ANR) is deploying a new report detailing the "massive economic juggernaut" that is the California agricultural industry to order to build a case for reviving extension funding.

The November reported revealed that agriculture contributed more than $263 billion to the economy in 2018 through direct sales and employed more than 1.2 million people, while benefiting urban and rural regions alike.

The entire "working landscape" also includes fishing, forestry, mining, outdoor recreation and renewable energy. Together, the sectors represent $333 billion in sales, 1.5 million jobs and 6.4% of the total California economy.

The direct sales for agriculture are five times the value of what has been the benchmark for calculating the ag economy. CDFA's most recent annual reporting of cash receipts totaled about $50 billion.

"I keep hearing this unbelievably ridiculous statement from a wide range of people that agriculture is less than 2% of the state's (gross domestic product)," ANR Vice President Glenda Humiston told *Agri-Pulse* in an interview. "You really can't use GDP to look at the economy anyway. It's just not an apples-to-apples comparison."

UC ANR is also working on a report factoring in the immense value of ecosystem services. This could bump working lands up in the rankings to overtake finance as the fifth largest sector, according to Humiston.

"When we don't have that quantified, it's hard to make investments to make sure those ecosystem services are maintained," she said.

Humiston sees the lack of state funding for the division's Cooperative Extension (UCCE) program as "a huge issue."

"I hope (the report) makes a case for all the investments that California needs to make in these working lands," she told *Agri-Pulse*. "That would include things like Cooperative Extension, which is a critical infrastructure to support a lot of this."

About half of UC ANR's budget comes from federal, state and county funding. More than 40% of its costs go to county-based research and extension.

In 1990, UCCE had 202 specialists and 326 advisors. Today those numbers are about half, as funding has lagged for the entire UC system. This has been felt hardest with UCCE staffing costs, which depends on general funds from the state budget rather than endowments, grants or contracts. In the 10 years leading up to 2012, UC ANR saw $23 million in cuts from state funding. Since then it also struggled with unfunded obligations totaling more than $12 million.

UC ANR is operating this year with a flat budget of $73 million, while salaries and other costs increased by $5 million over last year.

"Despite a 20-year slide in funding from the state and federal government, we have been able to retain academic numbers through partnering more on shared appointments and redirection of administrative funds to programs," said Humiston in August.

This has helped continue the division's research into safe and effective pest control for agriculture, as well as training programs and support for pest control advisors.

The UC ANR report is likely being considered by Gov. Gavin Newsom's administration. He is set to release the first budget draft of the year by Jan. 10.

Newsom vetoed a bill in October that would have enabled CDFA to study and report on the role of agriculture in rural economies. His veto message suggested he would be including in his budget an economist position with these responsibilities. This position could shed new light on the direct benefits of extension research and advisors.

UC ANR will also be making a case for bridging agricultural policies with urban districts. The report revealed that agricultural processing – which topped the sales income category at $113 billion – generated $30 billion in sales and 63,000 jobs in the Los Angeles and Orange County region alone and $25 billion and 58,000 jobs in the Bay Area.

Humiston had timed the release of the report to coincide with the California Economic Summit, in order to get it "in front of the economic development professionals, the finance world, the elected officials, the urban public – a lot of interest groups who don't always see this kind of message," she said.

The report is also a valuable messaging tool for farmers and advisors in their discussions with partners outside of agriculture.

"If people start understanding the importance of working landscapes to the state's economy," said Humiston, "I have to hope we're going to get folks willing to invest in it much more than they have in the past." ■

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Wednesday: 8:00am-12pm




# Prepare for your 2020 renewal now

CAPCA Staff

Planning for your year-end renewal can save you time and frustration down the road. As you move into the new year, it is imperative that you know how many continuing education (CE) hours have been completed toward your license as well as if those hours were obtained during the valid dates of your current license.

When DPR issues your license, they also include an issue date. If your issue date is after January 1st and you completed a CE course prior to the issue date, that CE course hour(s) may not be used toward your renewal. To prevent any surprises, review your CE printout to verify information. As an active member benefit, CAPCA sends unofficial CE printouts to renewing members in February of their renewal year. This gives our active members time to review the information on file and address any possible shortage of hours. When you receive your CE printout from CAPCA, look for the "**Most Recent Renew Date (Valid on or after)**". This is the date that DPR has issued your license to be valid. Please look at the example below:

Joe Apca's renewal cycle is 2019-2020.

Joe's "issued" date on his license is 01/15/2019.

Joe attended a CE course on 01/10/2019 for 5.0 hours.

Joe cannot use the hours from the 01/10/2019 meeting toward his renewal at the end of 2020. He will need to make up those 5.0 hours during his valid period of 01/15/2019-12/31/2020.

Below are a few of DPR's renewal FAQs to be aware of as you plan:

**Can my excess CE hours for "Laws and Regulations" be used to meet the "Other" CE requirements?**
Yes. Excess CE hours for "Laws and Regulations" can be used to meet the "Other" CE requirements.

**If I have submitted my renewal application, fee(s), and required information to DPR, but have not received my license/certificate, can I continue to work?**
No. You cannot use or supervise the use of pesticides without a current valid license/certificate issued by DPR. This applies even if you have submitted your renewal application, fees, and any other required information to DPR. Renewal processing can take up to 60 days from the date your payment clears your financial institution. You can check if your renewal has been processed at: http://www.cdpr.ca.gov/docs/license/currlic.htm

**How long after expiration will I be able to renew?**
As long as you meet all requirements, you have 12 months after your license/certificate expires to renew and pay the late fee. CE hours must be completed by December 31 of your expiration year. If you have been expired for more than 12 months you will need to reexam as a new applicant in "Laws and Regulations" and all categories.

Still got questions about your 2020 renewal? Additional FAQs can be found on DPR's website at https://www.cdpr.ca.gov/docs/license/renwal_packets/renewal_faq.pdf. Or, contact the Licensing and Certification Program at 916-445-4038.

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# Bacteriophages: Advancing Agriculture's Crop Protection Future, Today

Jeremy Adamson, Product Manager, Certis USA

Bacteriophages, or "phages", are the most numerous beneficial viral organisms on the planet. It is estimated that there are more phages in the environment than all other organisms combined.

Already, scientists, researchers and doctors have found success utilizing bacteriophages in a number of industries, including human health where they have helped patients to fight infections that have become resistant to common antibiotic treatments. Since then, bacteriophages have been introduced into agriculture, another space where chemical and antibiotic resistance issues are threatening the common practices that are used to help feed the growing world.

## Bacteriophages: a timeline

Bacteriophages may be gaining in use, but they are far from new technology. In fact, shortly after World War I, scientists in both Britain and France noticed that bacterial infections among wounded soldiers were the primary cause of amputations and death in the post-trauma clinical setting. These scientists discovered that wound cultures of the disease-causing bacteria that were exposed to air would occasionally have small "dead zones" where the bacteria wouldn't grow. This led to the conclusion that a very tiny unseen virus-like particle was infecting the disease-causing bacterial cells resulting in their death. These organisms were aptly named bacteriophages, the Latin derivation of bacteria-eaters. This promising "phage therapy" discovery quickly developed into treatments for many different bacterial ailments after scientists were able to successfully cure a man infected with dysentery.

However, the discovery of more shelf-stable antibiotic compounds such as penicillin quickly displaced this course of treatment and phage therapy was all but abandoned in the USA. Concurrently, continuing work in Eastern Bloc countries such as Georgia, Ukraine and Russia spawned a variety of bacteriophage products ranging from toothpaste to household cleaners. To this day, Eastern European citizens incorporate multiple phage products into their daily lives.

## Bacteriophages: the science

Phages work in a way that is very similar to most viruses. They're not "alive" in the traditional sense but exist in an inert state until they encounter a "host" bacterial organism. If the phage is compatible with that host, attachment occurs and the bacteriophage attacks the bacterial cell. Once inside, the DNA incorporates into the bacterial genome and effectively hijacks the metabolic machinery of the cell forcing it to make new viral particles. Those particles assemble into new bacteriophages and when the metabolic energy of the cell is spent, hundreds of new viral particles burst from the cell ready to infect new bacterial cells. This provides a multiplicative effect and phage numbers, or titers, will increase steadily over time as long as the target bacterial disease is present.

## Bacteriophages: in agriculture

When phage therapy adoption was replaced by antibiotics in the USA, the use of antibiotics skyrocketed without much thought about resistance. New compounds were discovered that could take the place of compounds that lost efficacy. This was a huge boon to

overall health in the West and has been a major factor in the rise of life expectancy in the 20th and into the 21st century. But, every silver-lining also has a cloud.

Because of the ability of bacteria to rapidly reproduce, the formation of resistance to single compounds is inevitable. Currently the discovery of novel and effective antibiotics has slowed dramatically. It is estimated by the Centers for Disease Prevention and Control that antibiotic resistance to our most effective antibiotic treatments could end within a decade.

We see this same trend in the agricultural sphere where there is overexposure to a single compound, whether it's a conventional chemistry or an antibiotic compound such as Streptomycin. As a result, evidence exists in both human health and in agriculture where continued overuse and over-exposure of products has resulted in disease causing bacteria to adapt to overcome the control mechanisms. Bacteriophages, based on their development, offer a greater ability to adapt to changes in the host bacteria.

### Bacteriophages: the solutions

Currently, multiple bacteriophage products exist on the market for use in commercial agriculture. A phage solution for tomato spot and tomato speck along with pepper spot was approved for use on tomato and pepper crops by the EPA in 2005. Since that time, the EPA has approved additional agricultural phage products for control of tomato canker (*Clavibacter michiganensis* pv. *michiganensis*) as well as citrus canker (*Xanthomonas axonopodis* pv. *citri*) and for Fire Blight (*Erwinia amylovora*).

Certain precautions must be taken in the tank-mixing process to avoid inactivating the bacteriophages by combining them with a select incompatible chemicals, but the majority of IPM products on the market are tank-mix compatible.

### Bacteriophages: the future

The future of agricultural bacteriophage therapy continues to brighten as researchers, growers and organizations from all over the world come to see this technology as a viable and exciting tool harnessed from nature.

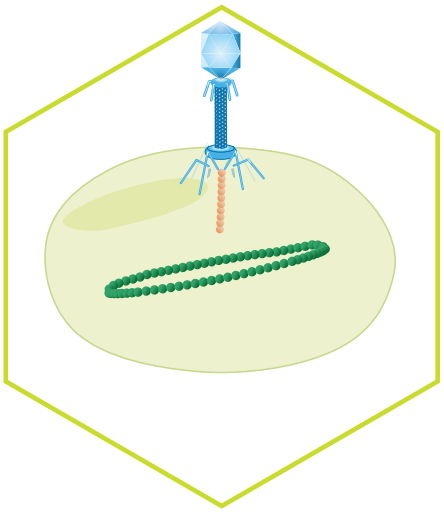
Using this innovative new technology, work continues to identify a fit to control many other bacterial diseases that are difficult to control effectively with traditional chemicals, including Almond Blast, Cherry Canker and Walnut Blight.

In addition, the possibility of broader uses as a food safety product that could be applied pre-harvest on crops for control of E. coli and Salmonella, as an equipment sanitization measure, or even as a water treatment could be a key solution and beneficial to growers.

Antibiotic resistance continues to be a significant concern for many growers, requiring the constant evolution of IPM programs and the rotation of different disease control strategies. Bacteriophages are proving to be an important strategic defense tool with growing importance and positive impact in agriculture today. ■

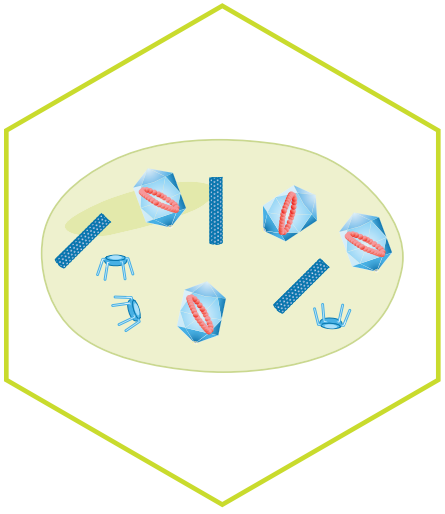
## The Bacteriophage Process

Bacteriophages destroy bacteria through a process called "lysis." The infection process begins the moment a phage comes into contact with a bacterium. Bacteriophages infect host bacteria on contact and convert them into tiny virus factories. Within 30 minutes of infection, the host cell disintegrates, releasing the phage progeny to infect other host bacteria.



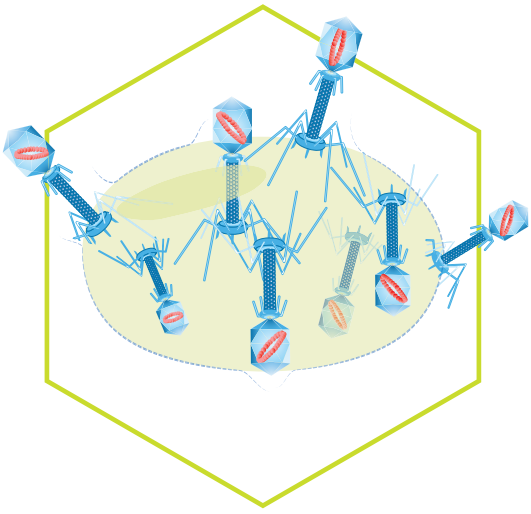
### Phase I

Infection occurs when a phage encounters a bacterium, attaches its tail fibers and injects its own DNA into the bacterium. This action can begin immediately upon application of a bacteriophage product.



### Phase II

New phage begin replicating immediately and assembling within the bacterial cell, multiplying at a steady rate.



### Phase III

Destruction of the host bacterium is complete as the cell disintegrates in a process called lysis.

# Organic herbicides and glyphosate for weed control: results of coordinated experiments in urban landscapes

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Karey Windbiel-Rojas, Area IPM Advisor, UC Cooperative Extension, Sacramento, Yolo, & Solano County and UC Statewide IPM Program

**Introduction**

Weeds in urban landscapes can be detrimental since they compete with native and desirable plants, contribute to wildland fire fuels, reduce functions of recreational areas like turf and pavement, hinder visibility in transportation networks, impact human health via allergen exposure, and promote other pests like rodents. While integrated pest management (IPM) provides many nonchemical options for controlling weeds—tools, steaming, flaming, weed-eating animals and others—situations may still require the application of herbicides. For several decades, glyphosate has been used to control weeds in both agricultural and nonagricultural areas. Glyphosate is relatively inexpensive, effective on a wide range of weeds, and has a low risk of offsite movement (Henderson et al. 2010).

Recent concerns about public health risks of glyphosate have led to increased bans or restrictions in California cities, counties, and school districts. At the state level, glyphosate is included in California's Proposition 65 list as an identified carcinogen. Landscape managers and other practitioners who aim to reduce or eliminate glyphosate from their IPM programs are looking for alternatives to controlling weeds and invasive plants.

One approach is to use other conventional or organically acceptable herbicides. This approach may be easiest for pest management practitioners; swapping herbicide formulations does not require new application equipment or knowledge of how to use new equipment. Despite contemporary interest, there is little research on organic/alternative herbicide efficacy in urban landscape systems. We designed experiments to address this need and provide information about organic herbicides. Our trials build on previous work examining natural herbicides in California landscapes by Wilen (2012, 2016).

The objective of our experiments was to compare herbicides certified by the Organic Material Review Institute (OMRI) as "organically acceptable" and alternative herbicides to conventional standards like glyphosate. Neal and Senesac (2018) noted that organic herbicides are most effective at higher temperatures and full sun. The timing of the two experiments discussed in this article occurred during the high summer temperatures of California's Sacramento and Central Valley.

**FIG. 1.** Image of field trial conducted in Dinuba (Experiment 1). Pictured treatments also included mechanical sod removal and solarization (data not discussed). *Photo: Maggie Reiter, UCCE*

**Experiment 1**

**Methods**

This trial was conducted in summer 2019 on a sward of 'TifSport' hybrid bermudagrass (*Cynodon dactylon* × *C. transvaalensis*) at Ridge Creek Golf Club in Dinuba, near Visalia (Fig. 1). The trial area was managed as a lawn or golf course rough and contained about 5% swinecress (*Coronopus* spp.) cover. Herbicide treatments were applied on July 31 (Table 1), and treatments included an untreated control. Glyphosate and fluazifop were included as industry standards for control of bermudagrass. Citric acid + clove oil; d-limonene; ammoniated soap of fatty acids; caprylic acid + capric acid; and acetic acid were included as organic herbicides. Plots 5 ft x 5 ft were arranged in a randomized complete block with 4 replications. Herbicides were applied with a $CO_2$ backpack sprayer with 100 gal/acre water. Application was made around 12 p.m. with zero percent cloud cover and an air temperature of approximately 90°F.

Bermudagrass injury was measured with normalized difference vegetation index (NDVI). NDVI is a plant health indicator that measures green reflectance of vegetation, with values ranging from 0 to 1. Higher values indicate dense, green leaves. NDVI data were collected with a handheld sensor. Data were collected before herbicide application and every 1 to 7 days after application. Statistical analysis was conducted in R, using Dunnett's test to compare herbicide differences from the untreated control at each rating date.

**Results**

No herbicide treatments were significantly different from the control on the first rating date prior to herbicide application (Fig. 2). This is a positive result and ensured a uniform bermudagrass field before treatments were applied.

The organic herbicides d-limonene, ammoniated soap of fatty acids, caprylic acid + capric acid, and acetic acid showed significant injury 2 days after treatment (DAT), compared to untreated control plots. Caprylic acid + capric acid and ammoniated soap of fatty acids plots completely recovered by 19 DAT, while d-limonene and acetic acid plots recovered by 28 DAT. Throughout the entire trial, citric acid + clove oil induced no injury compared to controls (Fig. 3).

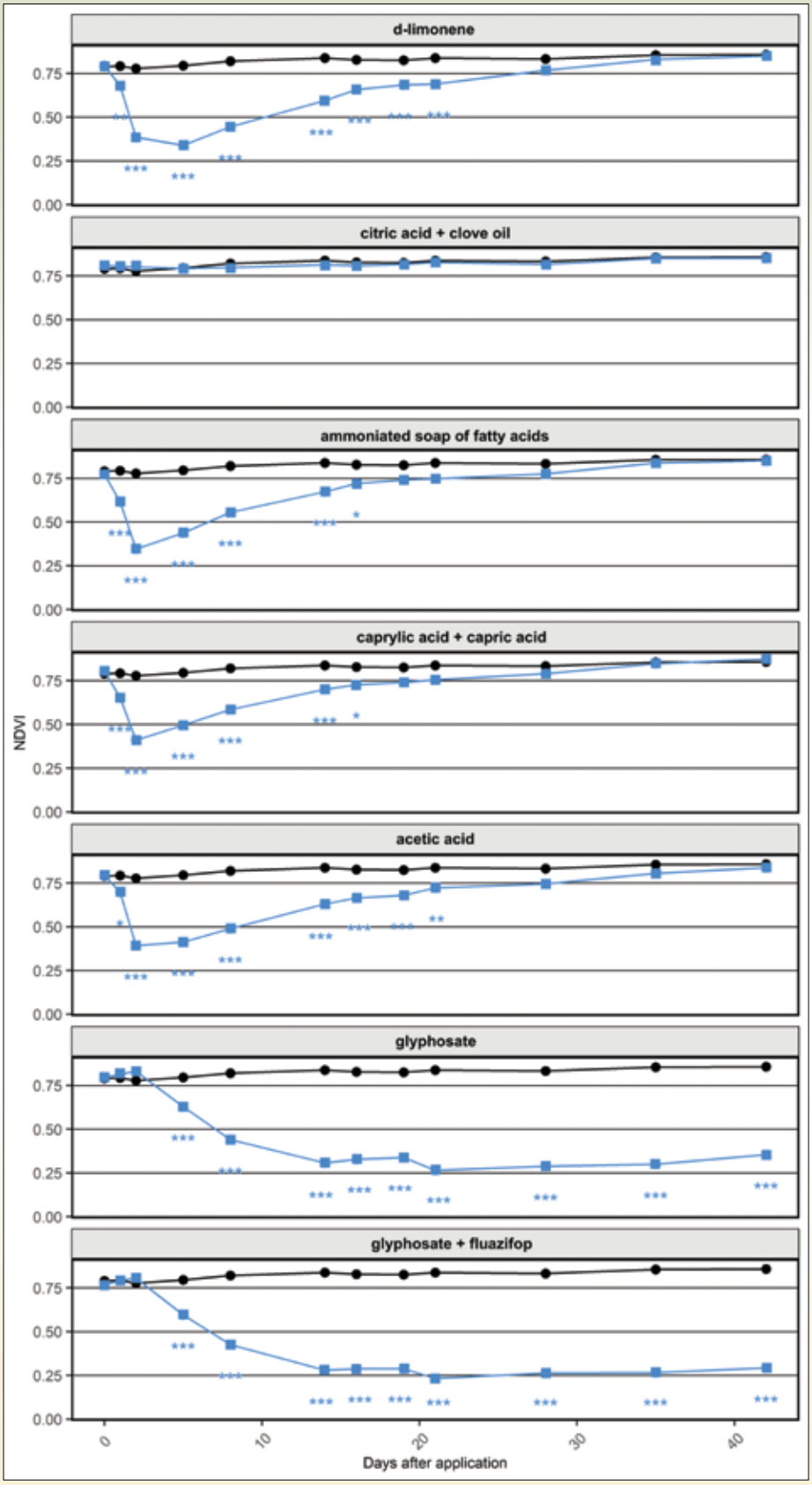
It took several days before injury was observed in glyphosate and glyphosate + fluazifop plots, where there was no significant injury

**TABLE 1.** Herbicides active ingredients and application rates for each experiment.

| Dinuba Experiment 1 | | |
|---|---|---|
| **Active ingredient** | **Percentage active ingredient in formulated product** | **Application rate[1]** |
| d-limonene | 70% | 25% v/v solution |
| Citric acid + clove oil | 8% + 2% | 25% v/v solution |
| Ammoniated soap of fatty acids | 22% | 17% v/v solution |
| Caprylic acid + capric acid[2] | 47% + 32% | 9% v/v solution |
| Acetic acid | 20% | 100% solution (no dilution) |
| Glyphosate[3] | 41% | 5 qt/acre (1.25% v/v solution) |
| Glyphosate + fluazifop[3] | 41% + 24.5% | 5 qt/acre + 24 fl oz/acre |
| **Sacramento Experiment 2** | | |
| **Active ingredient** | **Percentage active ingredient in formulated product** | **Application rate[1]** |
| d-limonene | 70% | 6% v/v solution |
| Ammonium nonanoate | 40% | 10% v/v solution |
| Citric acid + clove oil | 8% + 2% | 25% v/v solution |
| Iron HEDTA | 26.52% | 4% v/v solution |
| Glufosinate-ammonium | 11.33% | 1% v/v solution |
| Ammoniated soap of fatty acids | 22% | 17% v/v solution |
| Pelargonic acid + fatty acids | 57% + 3% | 6% v/v solution |
| Caprylic acid + capric acid[2] | 47% + 32% | 6% v/v solution |
| Eugenol + rhamnolipid biosurfactant | 6% + 35% | 1 qt/acre (treatment 1); 3 qt/ac (treatment 2) |
| Clove oil + cinnamon oil | 45% + 45% | 6% v/v solution |
| Glyphosate | 41% | 1% v/v solution |

[1]v/v = volume/volume; qt = quart; fl oz = fluid ounce
[2]An organic acidifier was added at a rate of 1% volume/volume solution
[3]A nonionic surfactant was added at a rate of 0.25% volume/volume solution

**FIG. 2.** Normalized difference vegetation index (NDVI) for herbicide treatments (blue squares) compared to untreated control (black circles) ***p<0.001, **p<0.01, *p<0.05 according to Dunnett's test.




until 5 DAT. The glyphosate-containing treatments maintained significant injury throughout the duration of data collection, up to 42 DAT (Fig. 3).

**Experiment 2**

**Methods**

This trial was on the campus of the California State University, Sacramento between August and September 2019. The site received little foot-traffic, was heavily irrigated, regularly mowed, and largely shaded underneath trees for most of the day. Weeds present at the site were a mixture of broadleaves, grasses, and sedge with predominant species being broadleaf plantain (*Plantago major*), dandelion (*Taraxacum officinale*), wild strawberry (*Fragaria vesca*), bermudagrass (*C. dactylon*), and clovers (*Trifolium* spp.).

Plots were 5 ft x 10 ft, arranged in a randomized complete block with 4 replications. Herbicides were applied with a CO2 backpack sprayer with an output of 50 gal/acre. The trial included 11 herbicide treatments and an untreated control (Table 1). Of the products listed, the active ingredients pelargonic acid + fatty acids, iron HEDTA, glufosinate, and glyphosate are not organically acceptable materials.

The first application was made on August 9. The average high temperatures in Sacramento in the months of August and September 2019 were 92°F and 89°F, respectively. A second application was performed on day 23, after we started to see regrowth or recovery of weeds that only had some of their leaves or tips burned. We did not spray a second application of glyphosate or glufosinate.

Phytotoxicity of the plants was rated by visual inspection using a scale of 0 (no observable plant injury) to 10 (complete plant injury).

**Results**

Many products tested showed burndown activity on both grasses and broadleaves that was visible after the first day after treatment (DAT). Figure 4 shows that by 3 DAT, ammoniated soap of fatty acids, pelargonic acid + fatty acids, ammonium nonanoate, and caprylic acid + capric acid showed the best control of all types of weeds in the plots. Citric acid + clove oil, d-limonene, and clove oil + cinnamon oil did not perform well in this trial even after the second treatment. Iron HEDTA is formulated to control only broadleaves so the results are not included in the chart for grasses. For the purpose of this article we also omitted results for glyphosate and glufosinate since they are neither organic nor new products and practitioners are generally familiar with their effectiveness.

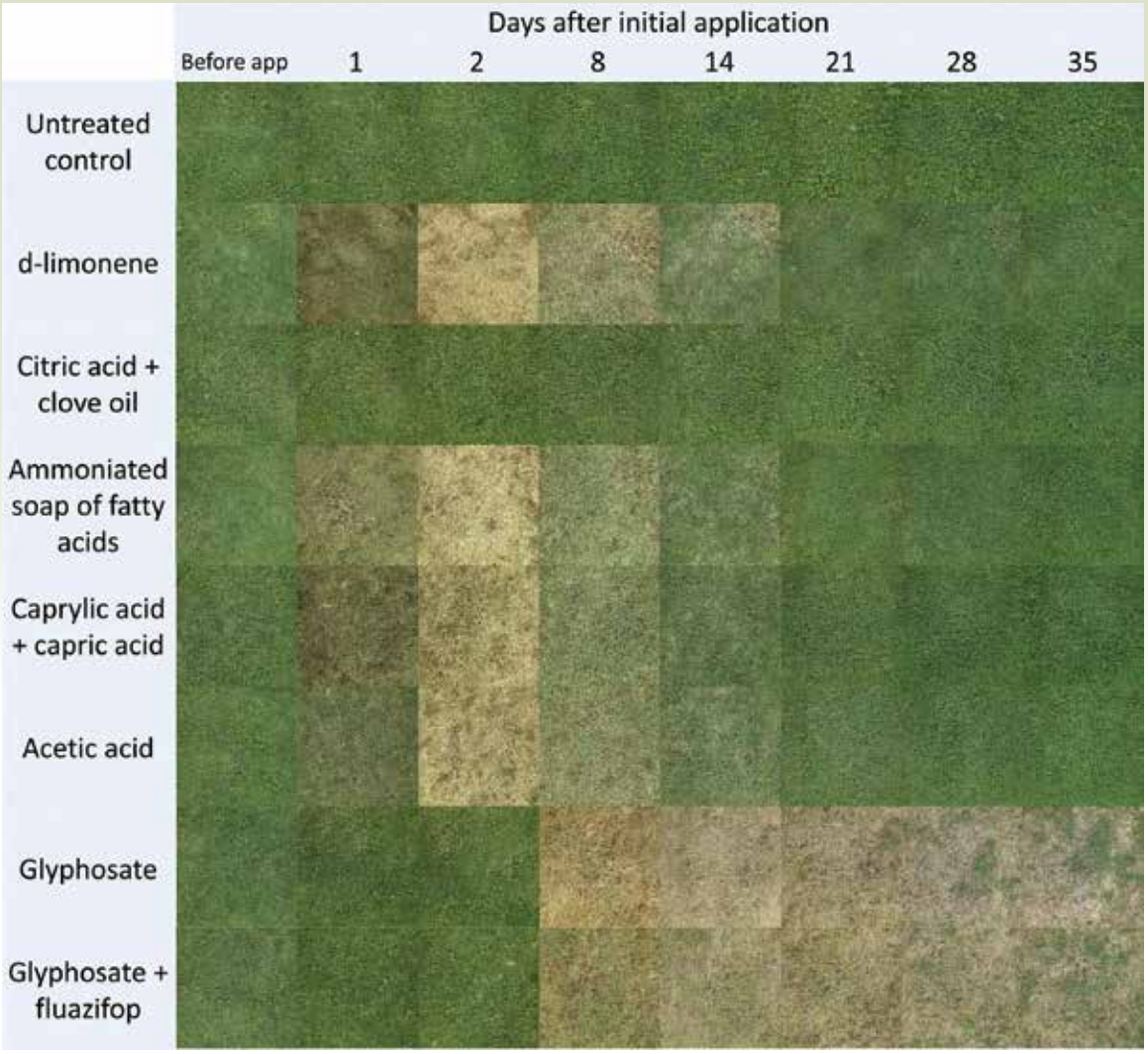
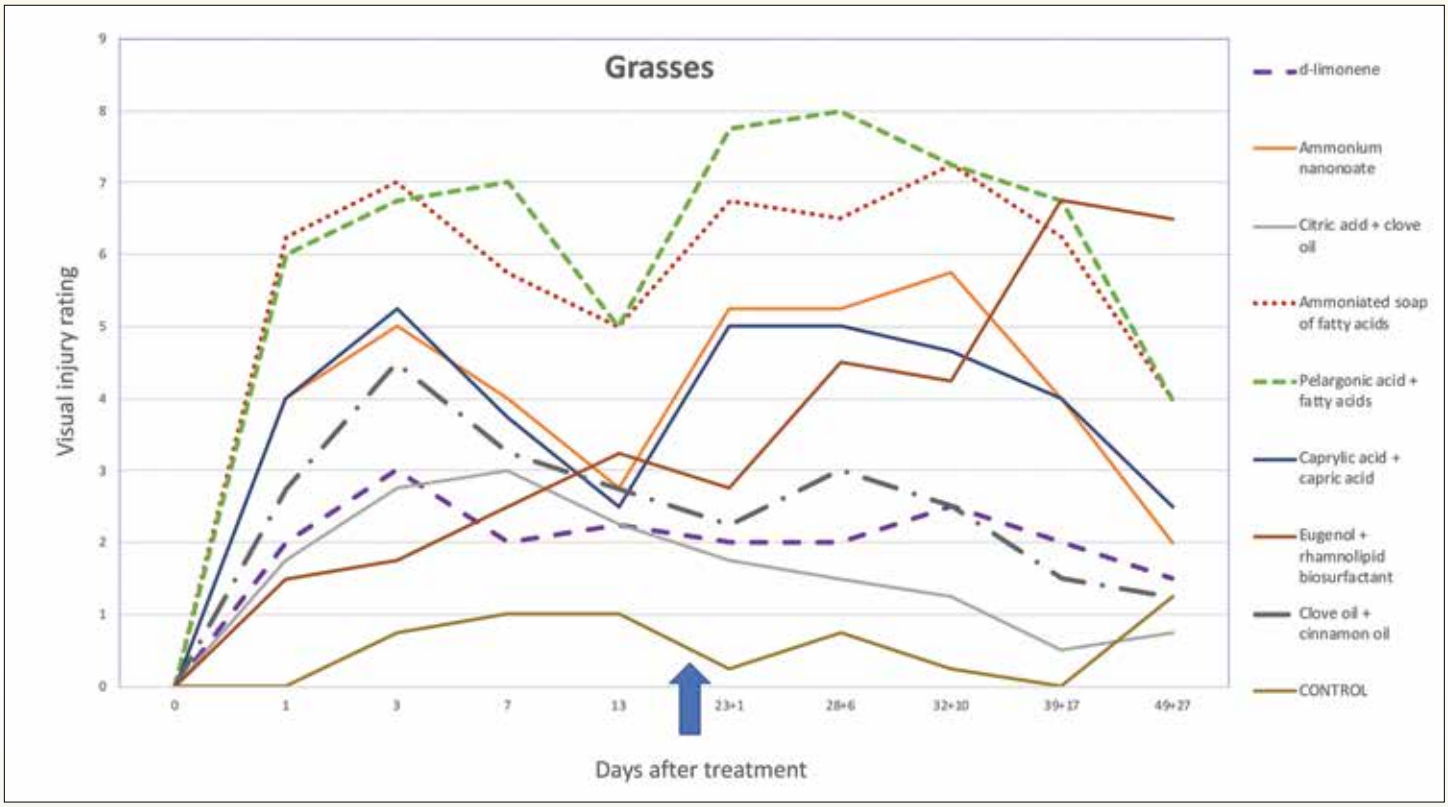


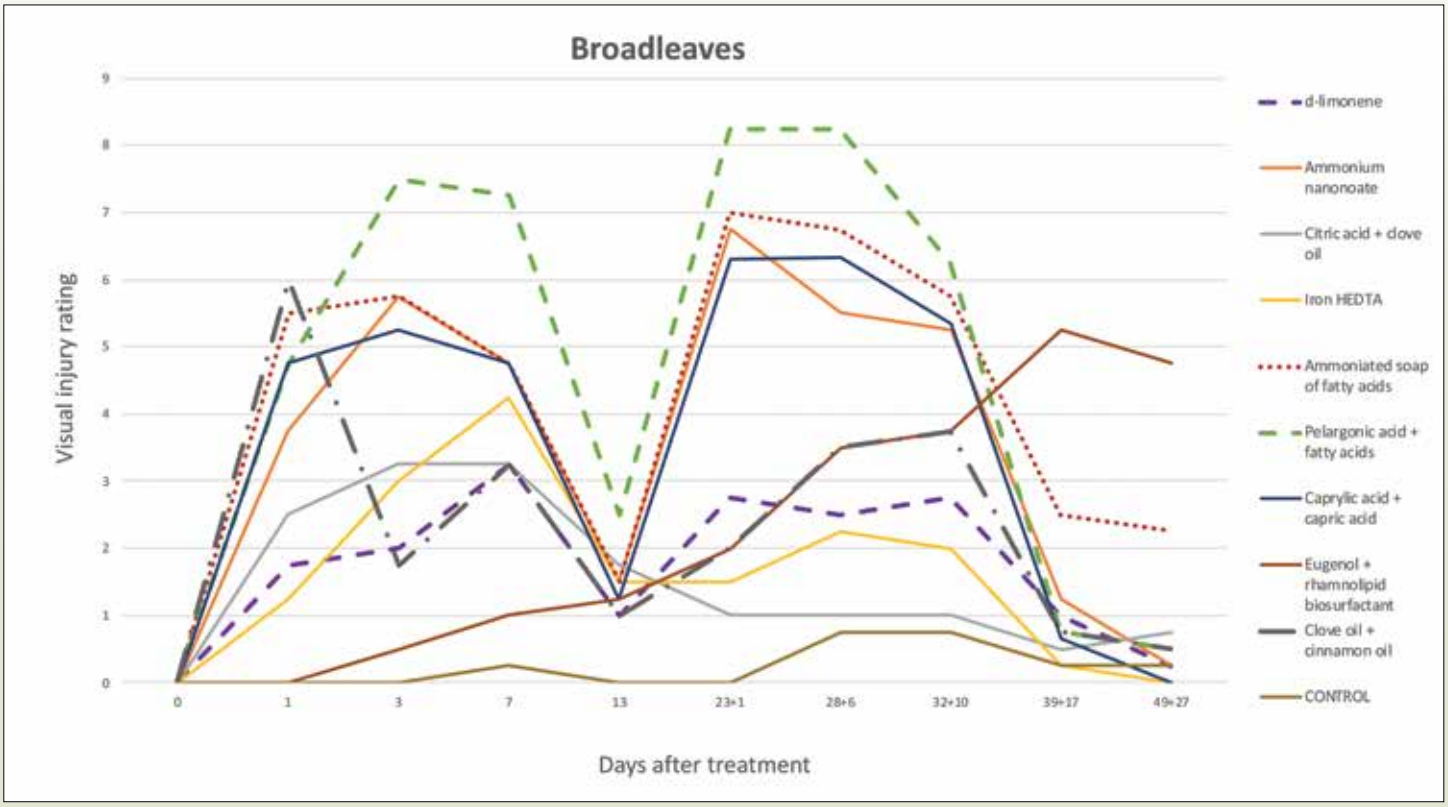

**FIG. 3.** Examples of herbicide efficacy for each herbicide treatment in Dinuba (experiment 1).
*Photo: Maggie Reiter, UCCE*

After a couple of weeks (observed at 13 DAT), most weeds in plots treated with non-glyphosate products began to regrow or recover. Although not illustrated in the charts, plots that received the glyphosate treatment maintained significant plant injury starting about two weeks after the initial treatment until the end of the trial.

For plots receiving a second treatment, Figure 4 also illustrates that by 17 days after the second treatment, efficacy of most products had declined and weeds once again regrew or recovered. The only product that did not exhibit this same trend was eugenol + Bacillus megaterium, which showed a gradual increase in control for both

**FIG. 4.** Visual rating of phytotoxicity to grasses and broadleaves in the Sacramento trial (experiment 2). Arrow indicates second herbicide application at 22 days after first treatment.



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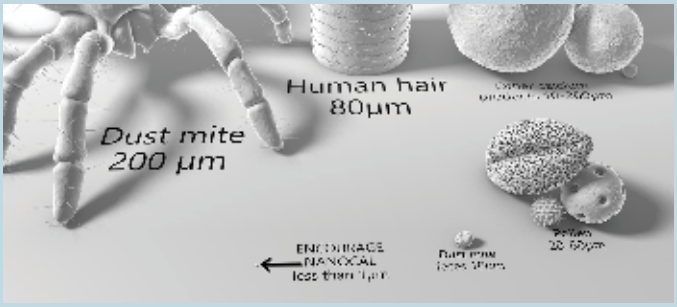


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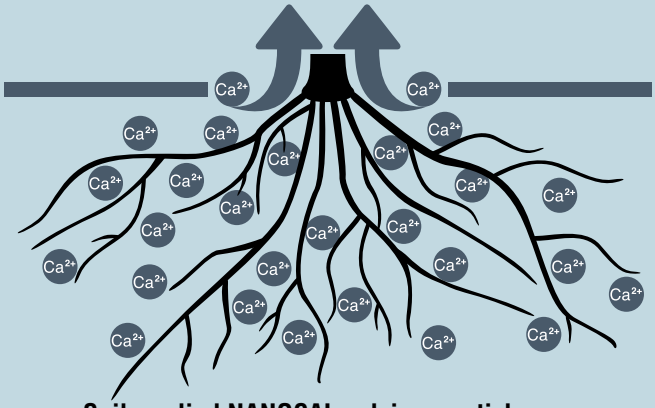


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grasses and broadleaves. (Eugenol + Bacillus megaterium is not currently registered for use in noncrop areas of California.)

**Discussion**

Organic herbicides were characterized by an immediate burndown and ultimately complete recovery after one application (Fig. 3). On the other hand, conventional products containing glyphosate or glufosinate provide significantly better control over time. This response is documented in previous research on landscapes and roadsides (Chinery 2002, Young 2002).

Citric acid + clove oil did not perform well in either Experiment 1 or 2. A similar product containing the active ingredient clove oil previously showed no difference from untreated control for roadside vegetation management in Massachusetts (Barker and Prostak 2009). In Experiment 1, d-limonene and acetic acid performed similarly and bermudagrass control lasted longer than caprylic acid + capric acid and ammoniated soap of fatty acids treatments. Preliminary data from Wilen (2016) found d-limonene did not work as well as caprylic acid + capric acid, ammoniated soap of fatty acids, and acetic acid in trials conducted on broadleaf weeds under 5 inches tall.

Urban land managers need to understand tradeoffs associated with different weed control strategies (Table 2). Switching from glyphosate-containing products to organic herbicides will require a reallocation of resources for more frequent applications at higher product volumes. Resources will include costs for labor involved in more frequent applications, possible increased costs in purchasing additional personal protective equipment (PPE), training for handling more acutely toxic products, and higher product costs.

**Future directions**

We know from recent school and child care center pesticide use reports from the California Department of Pesticide Regulation, that herbicides are applied year-round in various temperatures and conditions (E. Denemark personal communication May 3, 2019). Therefore, practitioners need information about how well these products work in different conditions such as a range of temperatures, varying weed species, cloud or canopy cover, and other factors. UC Cooperative Extension will continue to investigate these variables and will share findings via articles, workshops, seminars, and other extension avenues.

**Acknowledgements**

The authors would like to thank the Ridge Creek Golf Club in Dinuba, California, and the California State University, Sacramento for the use of their properties for these trials. ■

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Young SL. 2002. Exploring alternative methods for vegetation control and maintenance along roadsides. Cal EPPC News 10: 5–7.

**TABLE 2.** Tradeoffs associated with weed control approaches using conventional glyphosate products or a nonselective organic alternative.

| | Conventional glyphosate product[1] | Organic nonselective herbicide |
|---|---|---|
| **Mode of action** | Systemic | Contact |
| **Signal word** | Caution | Variable depending on product: Caution, Warning, or Danger |
| **Personal Protective Equipment (PPE)** | California minimum PPE (long-sleeved shirt, long pants, shoes plus socks, protective eyewear, and chemical-resistant gloves) | Variable depending on product, may include: California minimum PPE, chemical-resistant footwear, coveralls, or respirator |
| **Rate of observable weed injury** | Visible injury in 4 to 20 days[2] | Visible injury in hours to days |
| **Reapplication frequency for broadcast spray** | Lower reapplication frequency | Higher reapplication frequency |
| **Active ingredient volume** | Lower volume of active ingredient | Higher volume of active ingredient |
| **Cost per application area** | Lower cost per application area | Higher cost per application area |

[1]Information for a standard glyphosate-containing product
[2]Henderson et al. 2010

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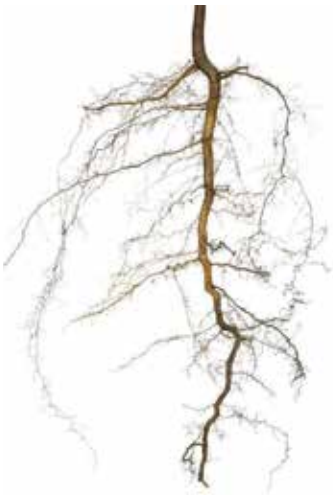

**A TREE'S ROOTS ARE THE FOUNDATION TO SUCCESSFUL PRODUCTION.** They provide stabilization, nutrients, water, and oxygen. Without these attributes plant systems simply could not function. So why as a crop protection industry do we focus so much so much on the crop destructors within the branches of a tree rather than the crop constructors at the foundation. As agronomist we need to focus on crop production before we start to worry about crop protection.

A tree's root system faces various obstacles to maintaining an effective gateway for production inputs. A crop advisor once made the statement "Why does an almond grower have to wait for his trees to blow over to realize he has *Phytopthora*, when in fact every tree in the orchard is probably infected in some degree", and to build upon that a noted pathologist offered "And what root hair isn't in a constant battle with *Pythium*". To what degree are your orchards infected ?

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**Mark Brady, Western Marketing Manager, Plant Food Systems, Inc.**

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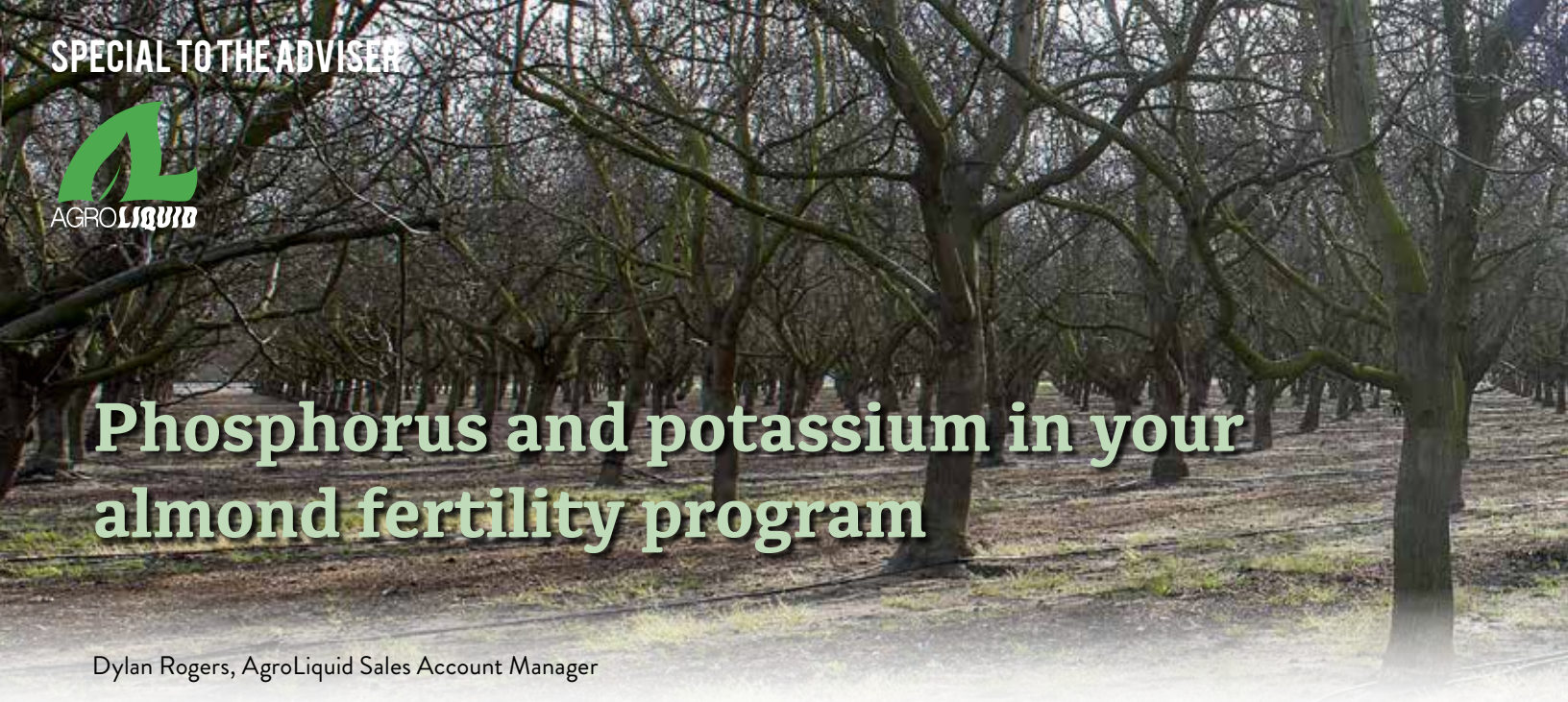


# Phosphorus and potassium in your almond fertility program

Dylan Rogers, AgroLiquid Sales Account Manager

In agriculture, we are always dealing with factors out of our control – Mother Nature and market fluctuations are two that immediately come to mind. This growing season will be no exception. Our opportunity lies in focusing on the factors we can control to ensure we make the best possible crop, regardless of what is thrown our way. Understanding how phosphorus and potassium fertilizers interact with other inputs and elements in the soil will help in decision making on which inputs and application timings will best suit any particular situation.

## Phosphorus (P)

Phosphorus is an essential plant nutrient and very important for numerous plant processes and crop production. It is a vital component of DNA and RNA, the building blocks of proteins and protein synthesis. The adenosine triphosphate (ATP) molecule is responsible for storing and transferring all of the energy produced and needed by the plant. At the core of this ATP molecule are phosphates, responsible for all of the activity of ATP. Phosphorus also plays a major role in the stimulation of new root growth.

Studies have shown that an almond crop will remove about 18-20 pounds of $P_2O_5$ with every 1,000 pounds of kernels removed. For a 4,000-pound crop, that's upwards of 80 pounds of $P_2O_5$ that the crop requires. Understanding how phosphorus fertilizers react in the soil and with other inputs is essential to ensure your crop will receive the required amount.

"Tie up" within the soil is the primary concern with phosphorus fertilizers. In acidic soil conditions, P will tend to get tied up by iron, aluminum, and manganese. In basic soil conditions, calcium will be the major component of phosphorus tie up. Phosphorus is most available to the plant in a soil pH range of 6.3-6.8. It is a common practice for growers to make gypsum ($CaSO_4$) applications in the fall to help flocculate soils for better water penetration and also to help mitigate salt buildup in the soil. It is also common for growers to apply dry fertilizers, such as SOP (0-0-50) and MAP (11-52-0), in the fall. If an application of gypsum and MAP are both made to an orchard in the fall, the chances of the phosphorus from the MAP being tied up by the calcium component of the gypsum are very high. Common liquid fertilizers, such as ammonium polyphosphate (10-34-0) and orthophosphate (9-18-9), applied in the early spring will also have a likely chance of being tied up if a gypsum application was made in the fall.

Choosing a phosphorus fertilizer that is protected from tie up will ensure that you get the most out of your fertilizer investment and that your crop will receive the required amount of phosphorus needed.

## Potassium (K)

Potassium is also an essential plant nutrient responsible for many vital processes within the plant. It plays a major role in plant water relations and photosynthesis. K regulates the opening and closing of the stomata. In turn it regulates the uptake of $CO_2$ from the atmosphere, an important aspect of photosynthesis. Potassium is also responsible for the translocation of sugars within the phloem and other nutrients and water within the xylem. Potassium must be in adequate supply for the plant to function properly and produce the best crop possible.

Studies have shown that an almond crop will remove about 90 pounds of $K_2O$ with every 1,000 pounds of kernels removed. For a 4,000-pound crop, that's upwards of 360 pounds of $K_2O$ that the crop requires. That is higher than the nitrogen requirement for an almond crop. Understanding potassium fertilizers' chemical makeup, solubility, and interactions within the soil will ensure you supply your crop with the adequate potassium required.

Potassium and sodium have a unique relationship that is many times overlooked. The use of poor-quality, well water throughout the years of drought in California has caused sodium levels to build up in our soils. In these situations, the soil solution will contain more sodium ions than potassium ions. These two ions are "look alike" ions and the plant will not discriminate against which one it takes up. An excess of sodium in the soil solution will tend to induce a potassium deficiency in the plant. This is an important aspect to address in your growing operation.

It is also important to understand the solubility of potassium fertilizers. As mentioned earlier, it is common for growers to apply SOP (0-0-50) in the fall. SOP is a great tool for building soil potassium levels, however it is important to understand how much is actually going to be available to the crop. Dry SOP has a solubility of around 6%. A 500-pound application of 0-0-50 will deliver 250 pounds of $K_2O$, so at 6% solubility, only about 15 pounds of $K_2O$ will be immediately available to the crop. Over time, with rain and irrigations, more of the $K_2O$ will become available. Supplementing this with an in-season, highly soluble, liquid potassium fertilizer is a great way to ensure your crop will get the large amount of potassium it requires. When choosing a liquid potassium source, it is important to understand that all liquid potassium sources are not created equal. Some potassium fertilizers are high in chlorides and other salts that can be toxic to plant health. It is important to choose a potassium source that has a low salt index and is free of chlorides.

Having a better understanding of how phosphorus and potassium fertilizers interact in the soil and with other inputs will help growers get more out of their fertilizer investment this season. As always, it is also important to use the 4R method when planning your recommendations: Right source, Right rate, Right time, and Right place. If you have questions or concerns about a crop nutrition plan, remember there are experts in this field available for consultation. Using all of these available resources will help guide sound recommendations, and a sustainable future for our industry.

# Bacterial blast of almond caused crop losses in 2019

Dr. J. E. Adaskaveg and Dr. H. Forster, University of California, Riverside, and Layne Wade, Technical Service, Grow West®, Woodland, CA

In the spring of 2019, cold and wet conditions during bloom of some almond varieties across the Sacramento and northern San Joaquin valleys from Butte Co. to Fresno Co. resulted in outbreaks of bacterial blast caused by *Pseudomonas syringae* pv. *syringae*. The disease was most severe on self-pollinating cultivars, as well as selected other cultivars that bloomed during frost conditions. Bacterial blast and bacterial canker are phases of a disease that affects most *Prunus* species and is found worldwide wherever these crops are grown.

**Symptoms.** Canker symptoms include elliptical lesions on trunks and scaffold branches, as well as dieback of shoot tips. Gum is often exuded profusely on the surface of the canker. Under the bark, pale, water-soaked, reddish-brown streaks or flecks extend into the phloem above and below the canker. As the tissue dies, a sour smell of the sap develops ("sour sap").

Blast infections of dormant buds result in bud death by spring. Dead buds are often covered with gum. Blossoms may wither suddenly and turn dark brown (Fig. 1). With multiple blasted flowers, the shoot tip may become necrotic and exude gum. Additionally, developing leaves and fruit may develop necrotic flecks 2-4 mm (1/8-1/4 in) in diameter (Fig. 1). On leaves, a chlorotic halo may form around the lesion, and the necrotic tissue may fall out to produce a shot hole appearance.

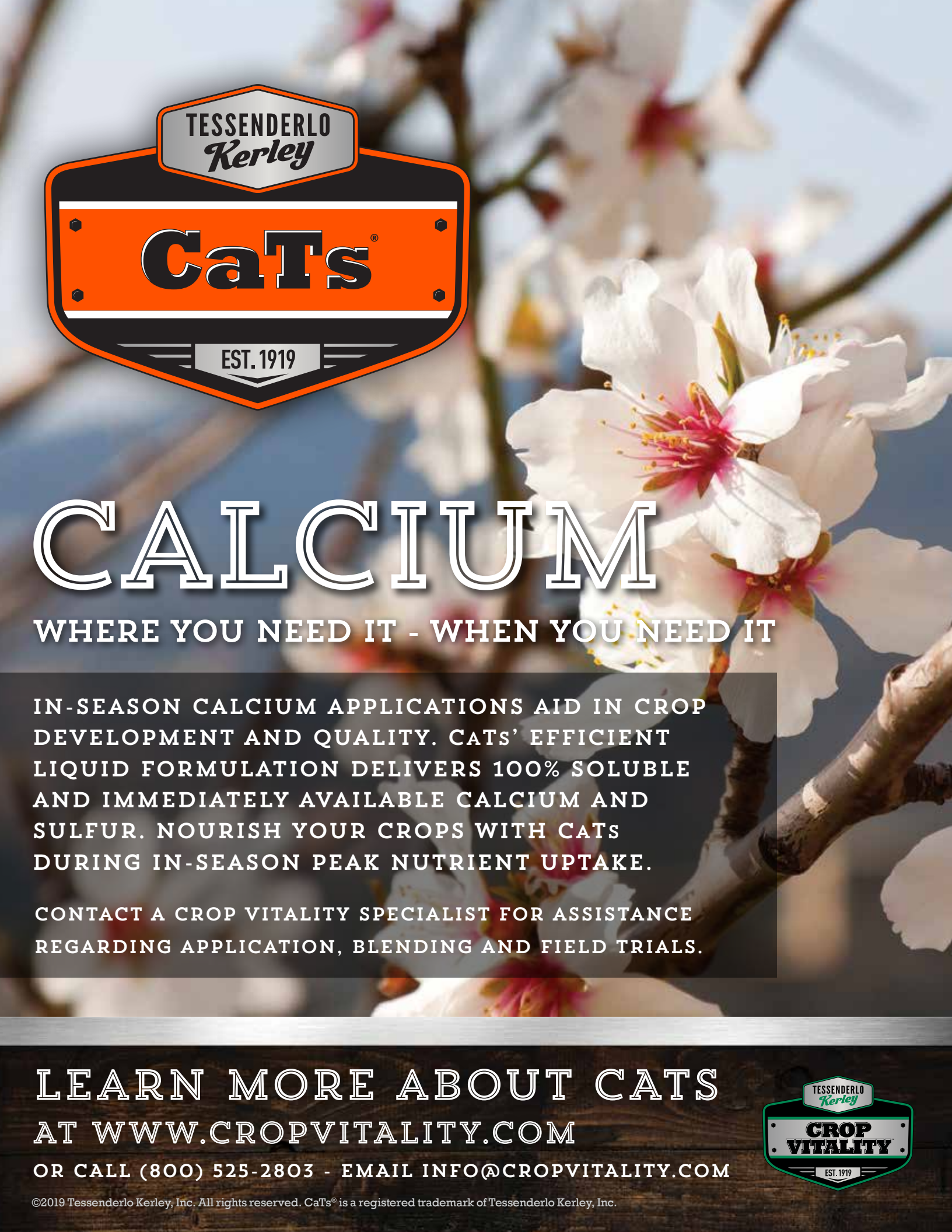
**Epidemiology.** *P. syringae* is an omnipresent, epiphytic bacterial species on aerial parts of *Prunus* and other species of plants. The pathogen has also been isolated from plant debris and from the surfaces of weeds in the orchard. Under favorable conditions, the pathogen multiplies on its hosts and is then disseminated by water splash to infection courts. Leaf scars and buds may be infected on almond, cherry, peach, and other plants. Pruning wounds and other injuries can also lead to infections.

During frost and wet conditions in the spring, blossoms and developing leaf buds may become infected and give rise to the blast phase of the disease. Blast infections are thought to occur through stomata or injuries resulting from frost damage. Bacterial cells ingress into plant tissues damaged by ice formation that results in broken cells and cell leakage.

Blast is most severe in the lower portion of the canopy and in the lowest parts of the orchard, generally areas where frost conditions are most severe. Almond is typically the most susceptible to blast because it blooms earlier than other *Prunus* spp. and therefore, is subject to colder, wet weather in the early spring. Detached almond shoots exposed to -4°C for two hours have been shown to be more susceptible to blast than shoots not exposed to cold temperatures. Ice-nucleating bacteria and freezing temperatures are important factors in the blast phase of the disease. Thus, protecting trees against frost damage by cultural practices can help to reduce blast. If temperatures drop too low, however no treatment will be effective.

Plant frost injury involves an interaction between certain epiphytic bacteria and low-temperature stress. Some bacteria such as *P. syringae* cause frost-sensitive plants to become more susceptible to

**FIG. 1.** Bacterial blast symptoms of almond. Symptoms develop typically in early spring. The disease can be very destructive to shoots and dormant buds (left), result in leaf spots and shot hole symptoms (center), or it can cause flower blast and shoot dieback (right). No fungal mycelium or sporulation is observed on diseased tissue in contrast to brown rot blossom blight caused by *Monilinia* species.

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freezing damage by initiating the formation of ice that is responsible for the injury. Many of the strains of *P. syringae* are among the most common ice nucleation-active bacteria on plants in the United States. Secondary infections by fungal pathogens such as *Botrytis cinerea* or *Monilinia* spp. may occur on ice-damaged flowers and buds. This further complicates the diagnosis of the cause of the disease.

Cankers typically develop in the fall and winter during tree dormancy after cold, wet conditions. Most cankers are annual rather than perennial, and the bacteria in many cankers die off during the summer, but some may survive as holdovers.

**Blast conditions in the spring of 2019.** In recent seasons (2013, 2017, 2018, and 2019), early-spring cold spells have resulted in a high incidence of bacterial blast of almond buds and blossoms in several almond production areas in California. In these four years, CIMIS stations in Denair (Station No. 206), Durham (12), Modesto (71), Manteca (70), and Williams (250), accumulated 3 to 11 (average 8), 5 to 12 (average 8.3), 1 to 12 (average 7.8), 3 to 11 (average 7), 4 to 18 (average of 9.3) days per year with minimum temperatures below 0°C, respectively, between Feb. 5 to March 26, a time when almonds are in bloom and in early fruit development. In comparison, an average of 1 or 0 days below 0°C occurred in 2015 and 2016, respectively, among the five CIMIS stations. Moreover, in 2013, 2018, and 2019, many of these freeze events occurred over multiple days (2 to 7 days in a row).

These frost events with concurrent wetness and minimal temperatures below 0°C in the last several years have caused direct crop losses in the form of blasted flowers, dropped fruit, and shoot dieback that affected future fruiting wood on the tree. Crop losses have been more than 20% for many growers in the last three consecutive years and in five of the last seven years. The disease can be quite severe in low areas (e.g., along rivers or drainage areas) where cold air settles and dew formation occurs.

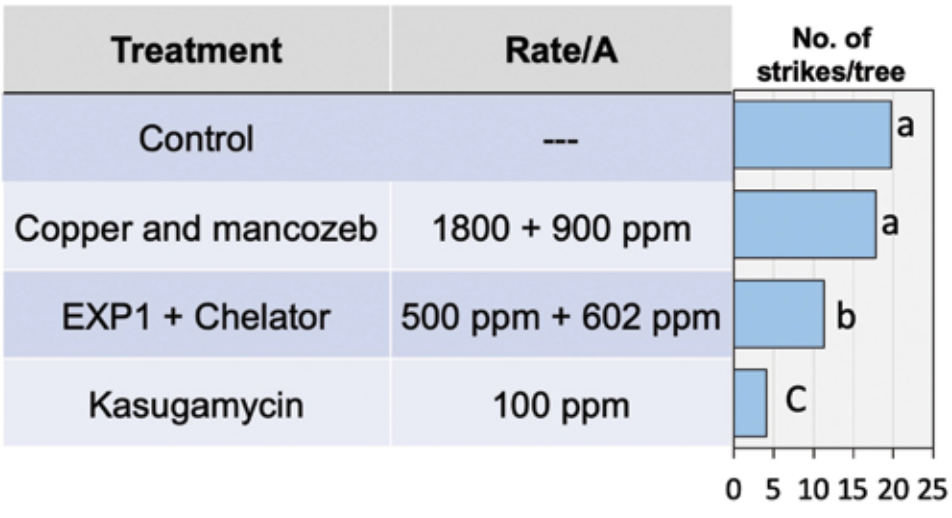
**Management of bacterial blast and canker.** No single practice will adequately reduce the **canker phase**, but a number of integrated measures can reduce the severity of the disease. These include site selection to avoid sandy and acidic soils, maintaining tree vigor with balanced fertilization, and rootstock selection to ensure root and scion vigor. Additionally, soil fumigation to reduce nematode damage to roots and avoiding pruning prior to cold, wet conditions reduces the incidence of the disease. In California, one to two applications of copper in the fall or early winter have been inconsistent in reducing the canker phase of the disease. Multiple applications of copper during the fall and winter have reduced canker infections on sweet cherry in Australia. Copper resistance often results with over-use of copper. Resistance is common in California, and any growth of the pathogen at ≥50 ppm copper indicates copper resistance in laboratory assays to evaluate the sensitivity of the bacteria.

The **blast phase** of the disease can be somewhat managed in orchards with frost protection practices including sprinkler irrigation and with the use of wind machines to create turbulent air to prevent dew/frost from forming. In the last several years, we demonstrated that the use of kasugamycin or other bactericides can reduce blast on almonds under cool, wet conditions (Fig. 2). Copper applications are generally phytotoxic to blossoms and young, succulent almond tissues. They can result in defoliation when applied at leaf emergence (bloom time) or later. Additionally, copper can increase blast severity on cherry and almond. No biological controls are registered on almond against bacterial blast.

An emergency registration (Section 18 of the Federal Insecticide, Fungicide, and Rodenticide Act, FIFRA) request for the use of kasugamycin for managing bacterial blast was submitted to the California Department of Food and Agriculture, Department of Pesticide Regulation (CDFA-DPR) by the California Almond Alliance in November 2019. The Section 18 request documents crop losses due to blast in the last few years with an emphasis on the spring of 2019. Kasugamycin is classified as an aminoglycoside (a bactericidal antibiotic) with a unique mode of action (Fungicide Resistance Action Committee or FRAC Code 24) that is different from all other registered pesticides. It is not used in human medicine or animal agriculture unlike other antibiotics registered for agricultural use. Furthermore, kasugamycin is fully registered on several agricultural crops in the state. The request is currently pending at the United States Environmental Protection Agency (US-EPA). ■

**FIG. 2.** Efficacy of bactericidal treatments for managing bacterial blast of almond in 2019

- Treatments were applied using an air-blast sprayer at a rate of 100 gal/A on 2-20-19 (pink bud to 30% bloom) prior to a forecasted frost event in the following week. EXP1 is an experimental bactericide.
- The number of blast strikes (spurs with dead flowers) was counted on each tree on 3-7-19.
- No phytotoxicity was observed in any of the treatments.



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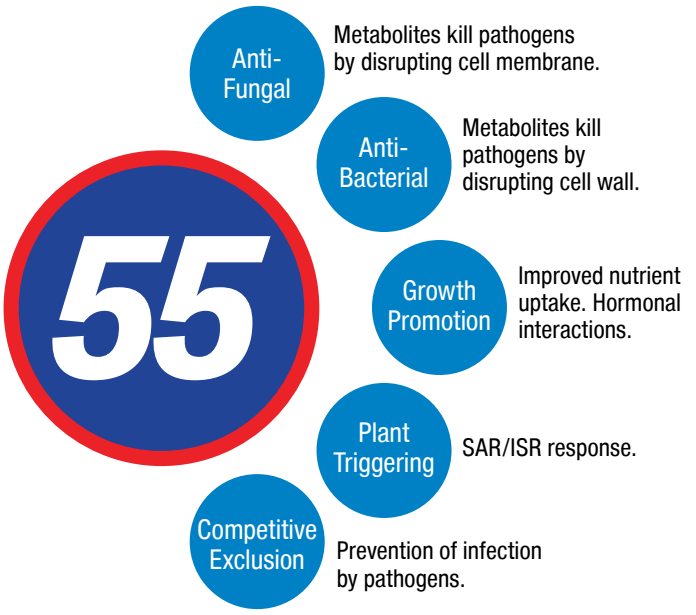


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- **Bacterial spot** *(Xanthomonas perforans)*
- **Botrytis bunch rot/fruit rot/gray mold** *(Botrytis cinerea)*
- **Cercospora leaf spot** *(Cercospora beticola)*
- **Downy mildews** *(cucurbit, grape, lettuce, spinach)*
- **Early blight** *(Alternaria solani)*
- **Fire blight** *(Erwinia amylovora)*
- **Flyspeck/sooty blotch/summer diseases** *(pome fruit)*
- **Lettuce drop** *(Sclerotinia minor)*
- **Phytophthora blight** *(Phytophthora capsici)*
- **Powdery mildews** *(cucurbit, grape, pepper, pome, strawberry, tomato)*
- **Rhizoctonia**
- **Southern blight** *(Sclerotium rolfsii)*
- **White mold** *(Sclerotinia sclerotiorum)*

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# Susceptibility of aphids to insecticides used in California Central Coast lettuce

Alejandro Del-Pozo, IPM & Entomology Advisor, University of California Cooperative Extension, Salinas, CA

**Introduction**

Aphids (Hemiptera: Aphididae) are major pests in lettuce due to the cosmetic damage they cause, their role as insect contaminants, and by vectoring viruses, all of which can reduce marketability and profitability. The green peach aphid (*Myzus persicae*), potato aphid (*Macrosiphum euphorbiae*), foxglove aphid (*Aulacorthum solani*), and lettuce aphid (*Nasonovia ribisnigri*) are the most problematic species infesting lettuce in the Central Coast. However, there has been an increase in lettuce aphid populations over the past two years, compared to the other aphid species. Biology and general life history of these aphids have been documented in multiple crop systems (van Endel & Harrington 2017), including lettuce (Del-Pozo et al. 2018).

Chemical tools are one of the most-used tactics for managing aphids in lettuce. The majority of foliar insecticides sprayed in lettuce are used to manage aphids. Commonly sprayed insecticides to control aphids are in chemical classes for which there are water regulatory concerns, such as pyrethroids and neonicotinoids. Consecutive and repetitive use of insecticides puts populations of insect pests under intense selection pressure. Many insects, including species of aphids, thus develop resistance to various active ingredients. For instance, the lettuce aphid has become resistant to carbamates and pyrethroids, in particular in Europe, where resistance was first detected in France and Spain back in 1997 (Kift et al. 2004). Therefore, monitoring for insecticide resistance is key for identifying the early development of this phenomenon in cropping systems, especially where pests are constantly exposed to insecticide applications, like in vegetable production.

Rotating modes of action is a key component of insecticide resistance management, and registration of novel insecticides and evaluation of efficacies of various active ingredients are key to this strategy. There are a number of currently registered insecticide groups that target aphids, and available in the market for vegetable production. In-field replicated trials have been conducted to document the performance of these insecticides for managing aphids in lettuce. Upcoming research will quantify the efficacy of these insecticides on different planting dates and at multiple locations, and to identify which tactics will be consistently effective to control aphids in lettuce.

The purpose of this project was to assay aphids for 'practical' insecticide resistance. Evaluating for practical insecticide resistance is based on exposing individual aphids from each field-collected population to insecticides under controlled conditions, using the maximum allowed label rate per acre diluted at the most common volume of water sprayed per acre. The immediate goal for this project was to assay two field-collected aphid populations from the Salinas Valley for practical insecticide resistance to selected insecticides using laboratory bioassays.

**Methodology**

Potato aphids and green peach aphids were collected from Romaine lettuce in Soledad and Castroville, CA respectively, during 2018. Colonies of these two aphid species were kept in separate cages and on Romaine lettuce under greenhouse conditions (~70°F and ~40% RH and 14:10 light:dark) at the UCCE Monterey County facility in Salinas, CA.

For potato aphids and green peach aphids, practical resistance was tested using modifications of the Insecticide Resistance Action Committee (IRAC) Susceptibility Test Method 019 (IRAC 2016). In brief, an experimental unit consisted of a closed feeding arena with 10 apterous aphid adults enclosed in a 1-oz plastic shot glass, containing agar and an insecticide-treated lettuce leaf disk. The leaf disks were made of Iceberg lettuce and were previously dipped into a stock solution containing each of our insecticide treatments using the maximum label rate per acre. The five experimental insecticides and rates per acre are presented in Table 1. We used 50 gallons of water per acre to make the stock solutions. Each experimental insecticide had four replications (r = 4) within one repetition. Three repetitions for each aphid species were used during different dates in January 2019. For each repetition, 250 aphids were randomly collected from the aphid colonies. Distilled water was used on leaf disks as an untreated control.

**TABLE 1.** Experimental treatments, including insecticide trade names, active ingredients, and rates. (*) Sulfoxaflor was tested using the maximum rate approved on the Federal label.

| Active ingredient | Chemical class | Trade name | IRAC group number | Rate (per acre) |
|---|---|---|---|---|
| Control / Untreated | N/A | Control | N/A | N/A |
| Imidacloprid | Neonicotinoid | Admire-Pro | 4A | 1.30 fl oz |
| Lambda-cyhalothrin | Pyrethroid | Silencer | 3A | 3.84 fl oz |
| Pymetrozine | Pyridine | Fulfill | 9B | 2.75 oz |
| Spirotetramat | Tetronic acid | Movento | 23 | 5.00 fl oz |
| Sulfoxaflor (*) | Sulfoximine | Sequoia | 4C | 5.75 fl oz |

Bioassay repetitions were housed in a Percival growth chamber under controlled conditions (80°F, 50% RH, 14:10 L:D). Aphid mortality was recorded at 24, 48, 72, 98 and 120 hours after each bioassay repetition was set-up. To account for natural mortality, mortality rates were corrected using the Abbott's formula.

**Discussion**

Mortality rates varied depending on the type of insecticide and the aphid species. However, all tested insecticides killed 100% of the aphids after five days (120 hours) of being exposed to insecticide-treated leaf disks under controlled conditions.

In the first 24 hours after exposure to treated leaf disks, the highest aphid mortality rates were recorded from sulfoxaflor (Sequoia, 86%, Fig. 1) for the green peach aphid, and from lambda-cyhalothrin (Silencer, 100%, Fig. 2) for the potato aphid. The lowest mortality rates, in the same 24-hour time span, were documented from spirotetramat (Movento, 16%, Fig. 1) and pymetrozine (Fulfill, 8%, Fig. 2) for the green peach aphid and potato aphid, respectively.

Mortality rates reached 100% when specimens were exposed to sulfoxaflor (Sequoia) and lambda-cyhalothrin (Silencer) at 96 hours after treatment for the green peach aphid (Fig. 1), and at 48 hours after treatment for the potato aphid (Fig. 2). On the contrary, total aphid mortality was documented at 120 hours for both species when specimens were exposed to leaf disks treated with imidacloprid (Admire Pro), pymetrozine (Fulfill) and spirotetramat (Movento).

Insecticide performance, expressed as aphid mortality, will be influenced by the chemical nature of the tested insecticide. Some selected insecticide materials for this project, such as sulfoxaflor and lambda-cyhalothrin, exhibited a short-term (contact) effect killing most aphids within 48 hours of exposure to treated leaf disks. Other materials, such imidacloprid, pymetrozine and spirotetramat, had their highest performance by the end of the assays at 120 hours after exposure. These compounds needed to be absorbed by the plant tissue, broken down into other metabolites and then ingested by the exposed aphids. Routes of exposure

**FIG. 1.** Corrected mortality, expressed as percentage (%), of the green peach aphid (Myzus persicae, Hemiptera: Aphididae) through time (X-axis) when exposed to insecticide-treated lettuce leaf disks under controlled conditions. Control disks were treated with distilled water.

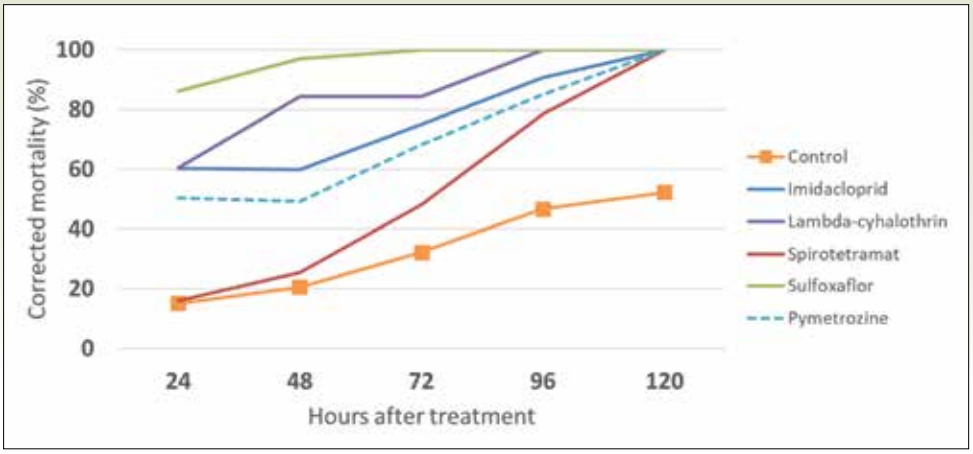
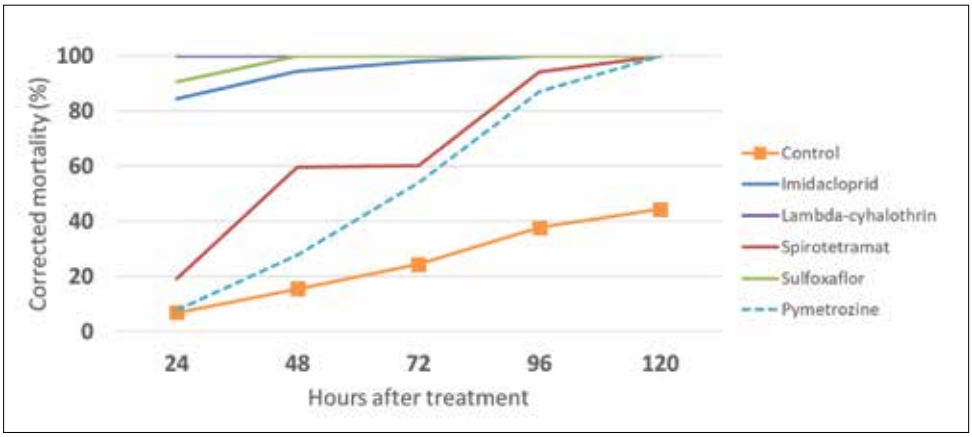



**FIG. 2.** Corrected mortality, expressed as percentage (%), of the potato aphid (Macrosiphum euphorbiae, Hemiptera: Aphididae) through time (X-axis) when exposed to insecticide-treated lettuce leaf disks under controlled conditions. Control disks were treated with distilled water.




(contact vs. systemic) and modes of action (nerve poison vs. growth disruptor) play fundamental roles on the performance of each insecticide, ultimately influencing mortality rates of a pest over time.

This preliminary data demonstrates that tested populations of aphids from Soledad and Castroville, CA are susceptible to our selected insecticides under controlled condition. This could be an indication that there is no insecticide resistance in aphids from those two locations to our tested insecticide materials. However, growers and pest control advisors might think there could be an insecticide resistance issue when the insecticide application performance was below the expected standards. Poor application coverage, lack of adjuvant, windy and other adverse conditions will negatively influence the efficacy of an insecticide application to control aphids in lettuce. Additional aphid populations across the Salinas Valley were assayed during the 2019 growing season, and results will be posted on the Salinas Valley Agriculture blog (https://ucanr.edu/blogs/SalinasValleyAgriculture/). Currently, we have established a monitoring program to regularly test different aphid populations from lettuce to detect any potential development of insecticide resistance at the early stages, by using the methodology described in this project. If you believe you had any sort of an 'application failure' to control aphids, please do not hesitate in contacting your UCCE Farm Advisor. It would be informative to assay that 'problematic' aphid population to determine any potential development of insecticide resistance.

**Acknowledgements**

Author would like to thank Richard Smith (UC Cooperative Extension) and Daniel Hasegawa (USDA - ARS) for revising a previous version of this manuscript. This research was funded by the California Leafy Greens Research Program. ■

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# STANDARD OF CONDUCT

Adopted 1989

CAPCA members will conduct themselves in a professional manner according to their code of ethics by observing all laws and all regulations, broadening their abilities through continuing education, and respecting the needs of their clients, the environment and public safety at all times.

# CODE OF ETHICS

Adopted 1992

## INTRODUCTION

The California Association of Pest Control Advisers (CAPCA) recognizes the unique ethical and professional responsibility of the licensed pest control adviser (PCA). PCAs have the responsibility to support and promote the highest standards of conduct in the performance of their duties to the public, the environment and their clients.

CAPCA members will observe and obey all laws and regulations pertaining to our industry, and will voluntarily assume the obligations of self-discipline, honor, and environmental respect set forth in the CAPCA 'Code of Ethics.'

## ARTICLE I: Obligation of the PCA to the Public and Environment

- Prescribe environmentally sound pest management methods which do not jeopardize the public health and welfare.
- Ensure that alternative measures for pest management situations have been reviewed, as provided by law.
- Maintain an awareness of public concerns and be willing to address those concerns in a sound, scientifically-based manner.
- Serve as a leading advocate of safe and effective pest management technologies.
- Participate in the advancement of pest management and professional knowledge.

## ARTICLE II: Obligation of the PCA to the Client

- PCAs have an affirmative ethical obligation not to conceal their source of compensation when asked.
- Help the client keep abreast of relevant regulatory and technological changes which could impact the client's business.
- Provide the client with pest management advice which meets the following criteria:

- environmentally, economically, and ethically sound
- legal uses that are objective and are research-based

## ARTICLE III: Obligation of PCA to the Profession

- Refrain from making false or misleading statements about the work of other PCAs.
- Recognize the duty to report illegal practices to the proper authorities.
- Maintain state-of-the-art knowledge of pest management through conscientious pursuit of continuing education.
- Participate in industry affiliated organizations and activities which encourage the betterment of the profession.
- Foster and support research and education for the advancement of pest management.

# CAPCA 2020 Sustaining Membership Levels

| BENEFITS | BRONZE | SILVER | GOLD | CHROME | DIAMOND | PLATINUM |
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| | $600 | $2,000 | $3,000 | $5,000 | $10,000 | $25,000 |
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| Subscription(s) to *Adviser* Magazine | 1 | 1 | 1 | 1 | 2 | 2 |
| Job Opportunities Posting in *Adviser* | 1 | 2 | Unlimited | Unlimited | Unlimited | Unlimited |
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| One-Page Ad in *Adviser* | | | | | 1 | 3 |

* October issue fills quickly, first come, first served

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For additional information, contact Dee Strowbridge: (916) 928-1625 x3

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**NOTE:** Some of the following job opportunities are abbreviated postings. To view the complete posting, please log into your membership access on our website at https://capca.com/my-account/

## Regional Grower Representative Manager – Salinas, CA

**Bolthouse Farms**

**Description:** Consult with growers on ground selection, fertility and nematode sampling and reviewing results with grower and Management, inspect ground work, pre-irrigation, and nematicide application prior to planting; Inspect crops, fields to determine conditions and need for cultivating, weeding, or harvesting; Advise growers on cultural practices, providing updates on industry production research, offering guidance on best practice farming techniques. (See CAPCA website for full list of duties.)

**Required Skills and Abilities:** Knowledge of techniques and equipment for planting, growing and harvesting products; ability to travel frequently throughout the Salinas Valley regions; Ability to monitor multiple farm locations to ensure proper farming techniques; 80% of the time will be spent in the field with the grower community.

**Minimum Qualifications:** Bachelor's degree in Business, Food Science, Agriculture, Nutritional Science, Management, Engineering and/or related field; Valid California Driver License with a clean driving record; Bilingual in English/Spanish

**Apply:** Send resume to arlet.miranda@bolthouse.com. Make sure to write "Regional Grower Rep Mngr Salinas" on the subject line.

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## Crop Adviser (Pest Control Adviser) – Woodlake/Corcoran/Firebaugh/Chowchilla

**Buttonwillow Warehouse Company, Inc.**

**Description:** Crop Advisers are knowledgeable about plants, soil and water. They maintain a close relationship with their client and scout their fields for problems that may arise during the growing season. They make recommendations ranging from seed to fertilizer and from pest management to disease treatment.

**Apply:** For more information or to submit resumes, please contact Tracy Chavez: tchavez@techag.com or (661) 695-6514.

---

## Research & Formulation Chemist

**Nutrient Technologies, Inc**

**Duties, Qualifications & Requirements:** BS Degree in Chemistry is required with a minimum of 3 years' experience in one of the following areas: agricultural chemistry, formulation chemistry, production plant and QC laboratory support. Extensive knowledge of laboratory equipment operations and analytical methods (AA, ICP, HPLC, etc.). Effective oral and written communication skills, bi-lingual (Spanish) preferred. Excellent inter-personal, customer service, and computer skills. Well organized, detail orientated and able to cope with multiple projects and deadlines. Self-driven with a positive outlook. A team-player with the ability to work across different science/laboratory functions.

**Apply:** Please send resumes to jobs@techflo.com

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## Product Development Specialist – Fresno, California

**Oro Agri Inc**

**Description:** Responsible for Product development; Support/Training to marketing and sales staff. Report writing, budgeting; and interpretation of trail data. Compile product data dossiers for regulatory team.

**Duties, Qualifications & Requirements:** MS degree in biological science specializing in plant pathology, entomology or soil science. Experience in similar research position. Knowledge of crop protection industry. Strong communication skills, attention to detail, disciplined and self-motivated.

**Apply:** Please send inquiries and resume to: jcoetzee@oroagri.com

## Assistant Maintenance Superintendent: Vegetation – Grass Valley, California

**Nevada Irrigation District**

**Description:** Join the Nevada Irrigation District team in its mission to supply water to families, farms and businesses in the foothills of the Northern California Sierra Nevada Mountains! The District is recruiting for an individual to lead its IVM Program in aquatic and terrestrial environments. $39/hour-$47/hour +benefits. Learn more at: https://nidwater.com/employment/job-openings

**Duties, Qualifications & Requirements:** Plan, organize and direct the activities and operations of the vegetation control section within the Maintenance Department, providing highly responsible and technical support. The position requires possession of a valid California driver's license, a valid PCA License, and a valid QAC or QAL with Aquatics and Right-or Way categories. For more information: https://nidwater.com/employment/job-openings2/

**Apply:** Go to https://nidwater.com/employment/job-openings2/ to apply. Applications are due Monday, February 3, 2020 by 5:00 pm.

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## Pest Control Adviser – Kern County, CA

**Sun Pacific Farming Cooperative, Inc.**

**Description:** The pest control adviser will oversee field scouts, sample fields for pest and beneficial insects and mites, manage the sampling of leaf and plant tissues, write recommendations, and communicate an overall pest management plan with farm managers. Competitive pay and benefits offered.

**Duties, Qualifications & Requirements:** BS in an agricultural field of study or equivalent preferred; Adhere to California Department of Pesticide Regulation; Knowledge of agricultural methods, pesticides, fertilizers, labels; Knowledge of proper pesticides to be used depending on crop destination; Possession of PCA license and CDL with acceptable driving, record. Computer literate in MS Office and ag-specific software such as Agrian; Self starter, who can be flexible in a farming environment and lead effectively.

**Apply:** Please submit resume to bcarmen@sunpacific.com.

# CAPCA Ed

Please visit www.capca.com/events for registration and event details.

| DATE | LOCATION | EVENT | SPONSOR |
|---|---|---|---|
| **1/28/2020** | Bakersfield | Kern CAPCA Label Update | **Kern County CAPCA** |
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| **3/10/2020** | Pleasant Hill | SF Bay CAPCA CE Meeting | **SF Bay CAPCA** |
| **3/12/2020** | Fresno | Fresno Madera CAPCA CE Meeting | **Fresno Madera CAPCA** |
| **3/26/2020** | Atascadero | Central Coast CAPCA CE Meeting | **Central Coast CAPCA** |
| **4/16/2020** | Brawley | Desert Valleys CAPCA CE Meeting/Golf Tournament | **Desert Valleys CAPCA** |
| **5/7/2020** | Pomona | SoCal CAPCA CE Meeting | **SoCal CAPCA** |
| **5/14/2020** | Imperial | Desert Valleys CAPCA CE Meeting | **Desert Valleys CAPCA** |
| **5/21/2020** | San Jose | CAPCA Ed CE Meeting | **CAPCA State Office** |
| **6/10/2020** | Santa Paula | Ventura CAPCA CE Meeting | **Ventura CAPCA** |
| **6/10/2020** | Blythe | Desert Valleys CAPCA CE Meeting | **Desert Valleys CAPCA** |
| **6/11/2020** | Palm Desert | CAPCA Ed/UCANR CE Meeting | **CAPCA State Office/UCANR** |
| **8/6/2020** | La Quinta | Desert Valleys CAPCA CE Meeting | **Desert Valleys CAPCA** |
| **8/13/2020** | Simi Valley | CAPCA Ed CE Meeting | **CAPCA State Office** |
| **8/20/2020** | Atascadero | Central Coast CAPCA CE Meeting | **Central Coast CAPCA** |
| **9/3/2020** | Sacramento | CAPCA Ed CE Meeting | **CAPCA State Office** |
| **9/9/2020** | Santa Paula | Ventura CAPCA CE Meeting | **Ventura CAPCA** |
| **9/10/2020** | Fresno | Fresno Madera CAPCA CE Meeting | **Fresno Madera CAPCA** |
| **9/15/2020** | Bakersfield | Kern CAPCA CE Meeting | **Kern CAPCA** |
| **9/17/2020** | Modesto | CAPCA ED CE Meeting | **CAPCA State Office** |
| **10/7/2020** | Arcadia | CAPCA ED/UCANR CE Meeting | **CAPCA State Office/UCANR** |
| **11/5/2020** | Imperial | Desert Valleys CAPCA CE Meeting | **Desert Valleys CAPCA** |
| **11/12/2020** | Fresno | Fresno Madera CAPCA CE Meeting | **Fresno Madera CAPCA** |

# CONTINUING EDUCATION

## 2020 DPR Accredited Course Report



| Date | Title | Location | Sponsor | Contact | Phone | Hrs |
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| 1/28/20 | Kern CAPCA Label Update | Bakersfield | CAPCA | Williams, Roger | (661)221-3840 | 6 |
| 1/29/20 | Pesticide Handler Training | Hanford | Kings Co Ag Dept | Martinez, Elvis | (559)852-2830 | 3 |
| 1/29/20 | NRCA Weed Control Session 2 | Indianapolis, IN | NRCA | Shoults, Mindy | (765)385-2101 | 7 |
| 1/30/20 | Pesticide Handler Training | Hanford | Kings Co Ag Dept | Martinez, Elvis | (559)852-2830 | 3 |
| 2/4/20 | MRL & You: Global Look at Strategy | Sacramento | Unified Symposium | Devine, Jenny | (916)379-8995 | 1 |
| 2/4/20 | Tulare Kings CAPCA Label Update | Tulare | CAPCA | Barsanti, Adam | (916)928-1625 | 6 |
| 2/6/20 | Sustainable New Tech Manage Vineyard Pests & Diseases | Sacramento | Unified Symposium | Devine, Jenny | (916)379-8995 | 2 |
| 2/6/20 | Innovations Pest Mgmt | Sacramento | Unified Symposium | Devine, Jenny | (916)379-8995 | 1 |
| 2/6/20 | Weed Control Vineyards: Sustain Consumer Perception | Sacramento | Unified Symposium | Devine, Jenny | (916)379-8995 | 1 |
| 2/12/20 | Worker Safety | Woodland | Yolo Ag Comm | King, Jenni | (530)666-8140 | 2 |
| 2/27/20 | Bionatural Healing-BNHC | Pomona | BioNatural Healing College | Sidiqi, Nadir | (909)568-4150 | 7 |
| 3/18/20 | Pesticide Handler Training | Hanford | Kings Co Ag Dept | Martinez, Elvis | (559)852-2830 | 3 |
| 3/19/20 | Pesticide Handler Training | Hanford | Kings Co Ag Dept | Martinez, Elvis | (559)852-2830 | 3 |
| 3/26/20 | Handler Safety | Durham | Specialty Safety Trn | Bruce, Richard | (530)385-1841 | 4 |
| 3/26/20 | Bionatural Healing-BNHC | Pomona | BioNatural Healing College | Sidiqi, Nadir | (909)568-4150 | 7 |

# 2020 Chapter Board Meetings

(Contact Chapter President for more information)

**Central Coast:**
2nd Tuesday of the month (some exceptions) - 7:00 a.m. to 8:00 a.m.
at F. McLintocks in Arroyo Grande
Contact Danilu Ramirez: (805) 345-5418

**Central Valley:**
2nd Friday of every month - 7 a.m. at My Garden Café in Ripon.
Contact Larry Fisk: (209) 814-4406

**Desert Valleys:**
Meetings held monthly, times and locations vary
Contact Bryan McCleery: (760) 525-4430

**Fresno-Madera:**
3rd Tues. of the month - 6:30 a.m. at Fresno Breakfast House, Fresno
Contact Patrick Murphy (559) 696-2298 to confirm location

**Kern County:**
2nd Tuesday of each month / 7:00 a.m. winter & 6:30 a.m. daylight savings,
at Milt's Coffee Shop, Bakersfield
Contact Daniel Palla: (661) 345-6613

**Monterey Bay:**
3rd Thursday of each month
Contact Drew Butler to confirm location: (831) 682-5722

**NorCal:**
Last Wednesday of the month - 7:00 a.m. at Cozy Diner, Chico
Contact Kristina Short: (530) 520-8377

**North Coast:**
Meetings held quarterly, times and locations vary
Contact Mike Boer: (707) 489-0656 for info

**San Diego:**
1st Monday of every other month unless adjusted for a holiday
January 6, March 2, May 4, July 6, September 7, and November 2
at Mi Guadalajara restaurant, Escondido
Contact Jan Hall: (760) 579-3097

**San Francisco:**
3rd Tuesday of each month
Contact Jeoff Dunster for information: (650) 814-2436

**SoCal:**
1st or 3rd Friday of every two or three months
at Mimi's Cafe, Anaheim
Contact Heather Palmer: (949) 429-9944

**Sutter Buttes:**
TBA. Contact Toby Leonard: (530) 701-7100

**Tri-County:**
1st Tuesday of each month (except April, May & June) - 12:00 p.m.
at Pappy Ganders, Merrill, OR
Contact Corey Thompson: (541) 205-1262

**Tulare-Kings:**
2nd Thursday of every month - 7:00 a.m. at Valhalla's Restaurant, Visalia
Contact info TBD

**Ventura:**
Cafe 126 in Ventura
Contact Ted Swartzbaugh: (805) 914-4185

**Woodland:**
Meet Quarterly. Contact Mark Allen for information: (530) 304-9091

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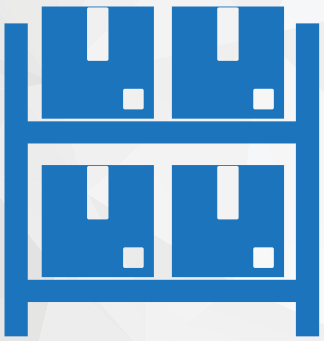

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