CAPCA

ADVISER

JUNE 2021 | VOL. XXIV, NO. 3

California Association of Pest Control Advisers

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[1]Source: BRANDT Field Trials 2016-2018

CAPCA
AT THE CENTER OF PLANT HEALTH

On The Move

After 10 years at the California Farm Bureau Federation offices, the CAPCA office relocated to East Sacramento this month. In light of COVID and with the changes and challenges faced in this new hybrid remote environment, CAPCA has had a large office that sat virtually empty for the last year. Last fall, as the board developed a more streamlined budget for 2021, I started to re-evaluate where the CAPCA staff and business operations stood that provided the most benefit to you, our members.

Facing this reality of changing business and staff that has thrived collaborating virtually, I consulted with CAPCA leadership to consider a downsize from the over 3000 sq ft office that was serving us pre-pandemic to a more reasonable 1200 sq ft office that would serve as a streamlined base of operations for the future. As CEO, I wrestled with whether rent was, and would continue to be, a place CAPCA needed to invest heavily, given the current staff makeup and typical foot traffic in the office. Ultimately, this downsize was significant enough for us to invest in a move.

The CAPCA offices are now downsized to less than half of our old footprint and we are settling into the space as we set up to serve the future of CAPCA. We are grateful to the California Farm Bureau Federation for being great landlords and collaborators over the last 10 years and we look forward to continuing a great relationship with them in the future as visitors to the building.

Our updated address is noted below:

CAPCA
555 University Ave Ste. 260
Sacramento, CA 95825

We look forward to continuing to serve you, our members, and hope to find even more benefits to deliver as a result of this shift in costs to match our staffing and programming goals.

Thank you for your membership!

Ruthann Anderson, Editor
ruthann@capca.com

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CAPCA EDITORIAL STAFF
Ruthann Anderson - Editor
Joyce Basan - Deputy Editor
Crystelle Turlo - Chief Operations Director
Rachel Taft - Executive Assistant
Kent Hinson - Dir. of Engineering & Tech.
Ashley Hinson - Content Curator
Carrie Kihlthau - Technical Support Specialist

Graphic Design - Rosemary N. Southward
southwardr@comcast.net

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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PRINTING:
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Tucson, Arizona




CAPCA Conference is ON in Reno!

See you October 17th-19th, 2021

Patrick Dosier, CAPCA Chair; patrick.dosier@gmail.com

We have come a long way since the last CAPCA Board meeting in February. Back then, we were not very optimistic about the prospects for an in-person conference in 2021, and we communicated that to your Director.

Since then, we monitored COVID, negotiated with Grand Sierra Resort (GSR), spoke with CAPCA members and sponsors, and analyzed our options; it became evident that an in-person conference *is* feasible and safe!

This time last year, CAPCA staff was scrambling to figure out how to plan a virtual event. Now, they are laser-focused on creating a great in-person conference, and a virtual CE option for those who cannot join us in Reno. (See page 16 for more details.)

CAPCA Conference 2021 will look different. At this time, we believe that masks will be required for Conference's indoor activities. We have to re-think how food will be served at our big events, like Monday Night Football. There may even be a cap on the number of attendees. Frankly, it is impossible to know today what will be safe, and what the local health ordinances will be, in October. We expect that Conference will be great though, even with some lingering reminders of the pandemic.

THINGS TO EXPECT (AND SUBJECT TO CHANGE):

We will have a Convention Hall, but:

- Masks will likely be required.
- Traffic may be directed in a one-way fashion.
- Handouts (food and trinkets) may be restricted.
- Booth staff may be limited.
- There will be significantly fewer booths.

We will have exclusively on-site CE, but:

- The traffic flow in/out of the CE halls presents the biggest compliance challenge.
- There will be many, smaller break-out sessions.
- Most of the CE will be pre-recorded. All pre-recorded CE will be available, on demand, to virtual attendees. Some pre-recorded CE will be available in person along with live speaker presentations.
- The Label Update will be all-virtual, and available on September 1st, so that renewals can be timely.
- The rest of the virtual CE will be available for the entire month of October.

Meals are still restricted, so:

- The Monday Night Football buffet lines may look different.
- The Member Breakfasts and Luncheons will require RSVP.

We **WILL NOT** be asking for proof of vaccination, unless it becomes mandated by a health authority, as a condition for the event to occur. There is currently no such requirement.

Overall, we expect this to be a fun, engaging, and valuable event. We have missed that personal connection! I ask everyone to recognize that we will move forward safely and in compliance with local ordinances. Your patient acceptance of the little inconveniences will go a long way toward making CAPCA Conference 2021 the best in memory!

ARTICLE FEEDBACK: "ANTI-VAXX IS ANTI-PESTICIDE."

I received lots of feedback about my previous article. The feedback was split about 50/50 between supportive and critical. Here is what members had to say:

- A member asked for clarification about the environmental activist group Regenerate Ojai, and my assertion that they were falsely registering apiaries. To clarify: they were reported to be registering false apiaries within the old system at the County Ag Commissioner's Office, not the new digital BeeWhere system.
- Another member appreciated the science-based pep talk, with references.
- Another member felt that my message was biased against liberal anti-vaxx communities, and that I failed to call out the growing anti-vaxx rhetoric within the right-wing of the political spectrum. They felt that this was obvious and that it may discourage diverse people from entering, and remaining in, our profession.
- Another member communicated, albeit indirectly, that my message was clearly anti-Trump and that the Adviser is no place for an opinion piece.
- Another Member felt that I was advocating for silencing, or "canceling", anti-vaxx and vaxx-hesitant people. This weakened my argument. They then argued that science is subject to bias because the funding sources are biased. However, they felt that the vaccine results were promising, overall.
- A CAPCA Director reported that they received about 15 critical comments to this effect: "CAPCA/Dosier needs to stay in their lane. Leave the medical advice to the physicians."
- Another Member communicated that they had been feeling isolated within an anti-vaxx work environment, and they appreciated that someone from the industry spoke out.

My intention in publishing the article was to convince vaccine-hesitant members to get vaccinated, in the interest of the greater common good. It was also a warning that the use of anti-science rhetoric is not in agriculture's interest.

Do you have thoughts you want to share? I am eager to continue the conversation. You can reach me at patrick.dosier@gmail.com or (714) 504-5424. ■

The inevitables of life

George Soares, Kahn, Soares & Conway

Government intrusion in our lives has become as inevitable as death and taxes. There it is, government in one form or another ever present in our being—surrounding us, consuming us—even when seemingly totally preoccupied with unexpected intervening events like COVID. While this current threatening example will eventually lessen in severity and something more or less challenging will fill the void, the legislative and executive branches of government have their own schedules to keep, rain or shine, and 2021 is no exception.

As if below radar, while the rest of us were trying this past year to cope and normalize our lives, forty senators and 80 assembly members who comprise the California State Legislature collectively introduced over 2,500 pieces of legislation since early January 2021. Also, about the same time, the Governor presented his proposed state budget of about $220 billion. So many new laws and so many tax dollars being spent, but to what end?

Legislative Branch

Some legislation is innocuous, merely correcting drafting errors in laws adopted in previous years while many others are seriously impactful on various segments of society. Whatever their purpose, CAPCA reviews them all, line by line, separating good from bad and shaping strategy to deal with each. Easier said than done, of course, but its an essential first step.

In farming terms, the crop is planted when legislation is introduced and then CAPCA does in the State Capitol from January to September what pest control advisers do in the field throughout the year: eliminate the pests and weeds when possible and nurture the crop to its greatest potential.

At this point in 2021, it's too soon to evaluate the crop. No doubt there will be plenty of weeds but there is potentially long overdue good news as well for CAPCA members and the people they represent. For instance:

*** There is serious focus on the drought which could pour $2 billion of federal and state resources into water investments: groundwater management; drinking water availability; direct grants to install drought resistant landscapes; and more, under the banner that "Water is the life blood of California and its economy".

***A well-reasoned proposal in the making would repair the California Aqueduct, Friant-Kern Canal and a few other water conveyance facilities seriously damaged by ground subsidence. Countless farms, rural communities and millions of urban consumers are affected as is the economy in all regions of California.

***A potential bright light is a proposal that would rein in abuse of Proposition 65, which was approved in a voter initiative in 1986. The measure was allegedly intended to inform the public of toxic substances in what we eat and drink which may cause cancer or birth defects. Instead, the Proposition has led to a cottage industry for those who often leverage unfounded allegations and threats of prolonged litigation into financial gain.

***Wildfire legislation has created interesting crossover opportunity in the crop protection arena. In summary, the proposal identifies overpopulation of trees in our vast forests rather than climate change as the primary contributor to wildfires. What makes this thought provoking is that an environmental oriented legislator recently stepped up and admitted that mismanagement of forests is at least a contributing factor to wildfires. Imagine if the same occurred with legislators accepting the safeguards associated with pesticide registration and use in California. CAPCA along with industry groups are working to make it happen and there is some evidence of progress.

***Closer to home is a measure that declares April of each year as BeeWhere month to recognize and honor the efforts of CAPCA and County Agricultural Commissioners (CAC) to protect working bees during pollination. A regulatory program was established in the 1980's but communications between stakeholders remained erratic. Led by CAPCA and CAC, this problem was corrected in 2016 with legislation requiring a statutory mechanism for beekeepers to register their hives and provide notice of hive locations. By closing this loophole, working bee pollinators are protected year-

round when pesticides are being applied and the leadership of these two groups is being appropriately acknowledged.

Executive Branch

This separate branch of government which is the Governor's domain presents its own list of obstacles (and occasional benefits) requiring CAPCA's attention year round. The Governor's action of signing legislation into law is often not the end of the process. Instead, it usually triggers an administrative process concluding in regulations which implement provisions not fully spelled out in statute.

***Pest control adviser (PCA) licenses and continuing education requirements are regulated by the Department of Pesticide Regulation (DPR) through this administrative process. To be expected, CAPCA closely monitors these functions by DPR, and more. The list of other critical issues include timely registration and availability of effective crop protection tools; notice requirements; primacy of DPR authority; and appropriate use of mill tax dollars received from the sales of pesticides.

***The California Department of Food and Agriculture (CDFA) plays an important role with PCA's regarding integrated pest management standards and its Healthy Soils program, among others. Also, CDFA's little known but essential Office of Pesticide Analysis Consultation (OPCA) is intended to evaluate proposed pesticide regulations developed by DPR.

As the story goes, when the California Environmental Protection Agency (Cal EPA) was created nearly three decades ago, the new body of law transferred authority over pesticides from CDFA to DPR. However, as a safeguard for agriculture, the law established OPCA for the specific purpose of analyzing DPR proposals to ensure that the true financial impact on the industry would be known at the front end. OPCA worked as intended for decades but has deteriorated into a theoretical exercise with little similarity to its original intent. CAPCA is working with other groups to return credibility to this essential program.

A longer list of CAPCA's involvement in state government would certainly include the Water Resources Control Board, the Air Resources Board and the Office of Environmental Health Hazard Assessment. More on them in future reports. ■




Renewing your PCA license in 2021

Crystelle Turlo, Chief Operations Director

Will you be renewing your license this year? As we move into the busy summer months, renewing your PCA license may be the last item on your mind. However, we suggest you take some time to start planning now. Last year, due to the shift to only online continuing education and other uncertainties, many PCA's found themselves scrambling to obtain their CE hours and submitting their DPR renewal packets at the very end of the year in 2020. This resulted in long wait times in processing and receiving licenses. Because the licenses were delayed in the mail, many PCA's tried contacting DPR to find out where their license was causing even longer wait times to speak to someone on the phone.

To avoid the stress, we recommend you begin to plan by checking your hours and knowing what you need to do. Remember, all CAPCA members can check their CE hours by logging into their account at CAPCA.com. If you are missing hours, you can start by ensuring that those hours were reported by the sponsor. If you took hours that will not be reported, make sure you keep your Verification of Attendance (VOA) to include in your Renewal Packet.

If you believe you may need additional continuing education, CAPCA offers a variety of online CE that is on demand, meaning you can take it any time that is convenient for you. An added benefit to taking CAPCA courses is that those hours will appear withing 10 days on your Official CE printout so you can know exactly where you stand quickly.

Ready to renew, but you have not received a packet? Remember that to receive your Renewal Packet from DPR, they must have the correct address on file for you. Now is a good time to update your information if you have moved recently. In the event you still do not end up receiving a packet, forms can be found on the DPR website: https://www.cdpr.ca.gov/docs/license/lcforms.htm

Currently, on DPR's website, they do suggest sending in your Renewal Packet by October 1st to receive your license by the end of the year. Keep in mind that when contacting DPR, they continue to experience increased times for email responses, and it may take up to 10 days to hear back from your email.

By taking a few moments to plan now, you can save yourself time and stress at the end of the year. If you need assistance managing your CAPCA.com account so that you can obtain your official CE cert, please reach out to support@capca.com ■

Photo: J. McNutt

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY • DEPARTMENT OF PESTICIDE REGULATION

Early Renewal REMINDER

The Department of Pesticide Regulation (DPR) will mail out renewal packets in August to license and certificate holders with surnames or business names starting with the letters M-Z.

AVOID PROCESSING DELAYS

Submitting earlier allows DPR staff additional time to deal with issues or problems that could delay processing your license.

SUBMIT BY OCTOBER

Please mail your application before November so that your license or certificate can be issued before it expires. Submit before October, and be renewed by early December to register with the County before the New Year.

HAVE QP RENEW EARLY

For pest control businesses, the qualified person must be renewed before the business license can be processed. Submit renewals at the same time **before** November.

California Environmental Protection Agency
dpr Department of Pesticide Regulation

If you do not receive your application in the mail, download a blank application at: www.cdpr.ca.gov/docs/license/lcforms.htm. If you need to contact Licensing at LicenseMail@cdpr.ca.gov, don't forget to include your full name (First MI. Last) and license number(s) so staff can assist you faster.

PCA Profile: NorCal CAPCA's Anna Page

By CAPCA Staff

NorCal CAPCA's Anna Page is a second-generation PCA. She graduated from California State University, Chico with a Bachelor's degree in Agricultural Business and obtained her PCA license in 2014. She consults primarily in tree nuts, grapes and row crops, specializing in scale pests in tree nuts and Gill's mealybug in pistachios.

Anna has worked for Nichino America for four years and is currently their Northern CA Technical Sales Representative, but her experience in agriculture began at an early age. "I have always been interested in agriculture because I grew up around it. My dad has been a PCA for over 40 years and is also a rice farmer. I grew up going to work and checking fields with him. My passion for ag grew when I joined FFA in high school and that's when I knew I wanted to choose this career path."

Right out of college she interned with Grower's Ag, Dixon as a field checker, and from 2015-2017 worked for Syngenta Seeds as a sunflower field rep. "I worked with some great farmers while I was a sunflower field rep and they taught me so much about farming, from planting to harvest and everything in between. I am also thankful to work with an awesome group of coworkers at Nichino who have helped me learn and grow over the last four years." In her current position with Nichino she has the opportunity to work with growers and distributors in northern California providing technical advice and helping them best use their products. She is particularly proud to be part of a team that is bringing a new rice product to market. Talking about her job Anna says, "I love helping farmers and PCAs solve problems, grow food, and support their families. I also feel very fortunate to get to work outside."

Asked about her involvement with CAPCA, she says that also began at an early age. "I've been familiar with CAPCA since I was a kid. I've been going to conference at Disneyland with my family for as long as I can remember. I've always known it was a great organization that helps and advocates for the PCA. Not only does CAPCA make tracking your continued education hours extremely easy they do so much for the PCA that most don't see. They advocate and fight for the ability for us to do our job, including fighting to keep active ingredients available to us." Anna has been involved in the NorCal CAPCA Chapter for the last four years, where she served as Secretary before deciding to get more involved at the state level and becoming their Director on the State Board. When she considers what CAPCA has to offer PCAs, Anna says "CAPCA is such an important advocate for the PCA. There is so much done behind the scenes. I'm thankful to be a part of an association that is fighting for the job that I love to

do. Being involved in CAPCA is also a great way to meet people and build relationships. Our chapter is fortunate to have the county ag commissioners join our meetings and give us an update each month. I would encourage PCAs to get involved with their local chapter and learn more about what CAPCA has to offer."

Outside of work and involvement with CAPCA, Anna and her husband, Will, enjoy hunting, fishing, and spending time with their three dogs. ■

CAPCA

Annual Financial Report

for period ending December 31, 2020

Organization:
CAPCA is a California non-profit 501(c)(6) mutual benefit corporation.

Base of Reporting:
2020 financial statements were prepared using an accrual basis of accounting. Property and equipment purchased were capitalized and depreciated over their useful lives.

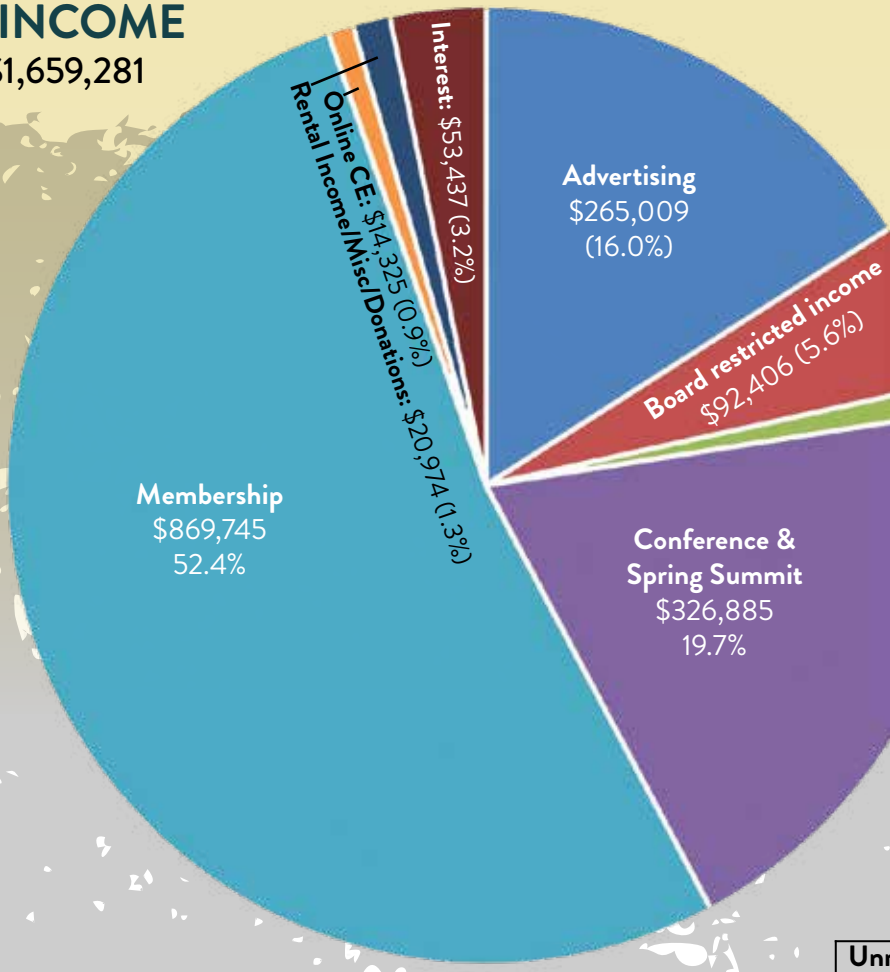
Income Tax Status:
CAPCA and Regional Chapters, Stanley W. Strew Educational Fund, and the CAPCA Political Action Committee are exempt from income taxes under IRS code sections 501(c)(6), 501(c)(3) and 527 respectively.

Functional Expense Allocation:
86.6% of expenses are directly related to CAPCA's purpose and mission. Only 13.4% is spent on general administration.

The CPA firm of Boden Klein & Sneesby performed a financial audit of CAPCA, Stanley W. Strew, Regional Chapters and the CAPCA PAC accounts. They found all financials to be in order. ■

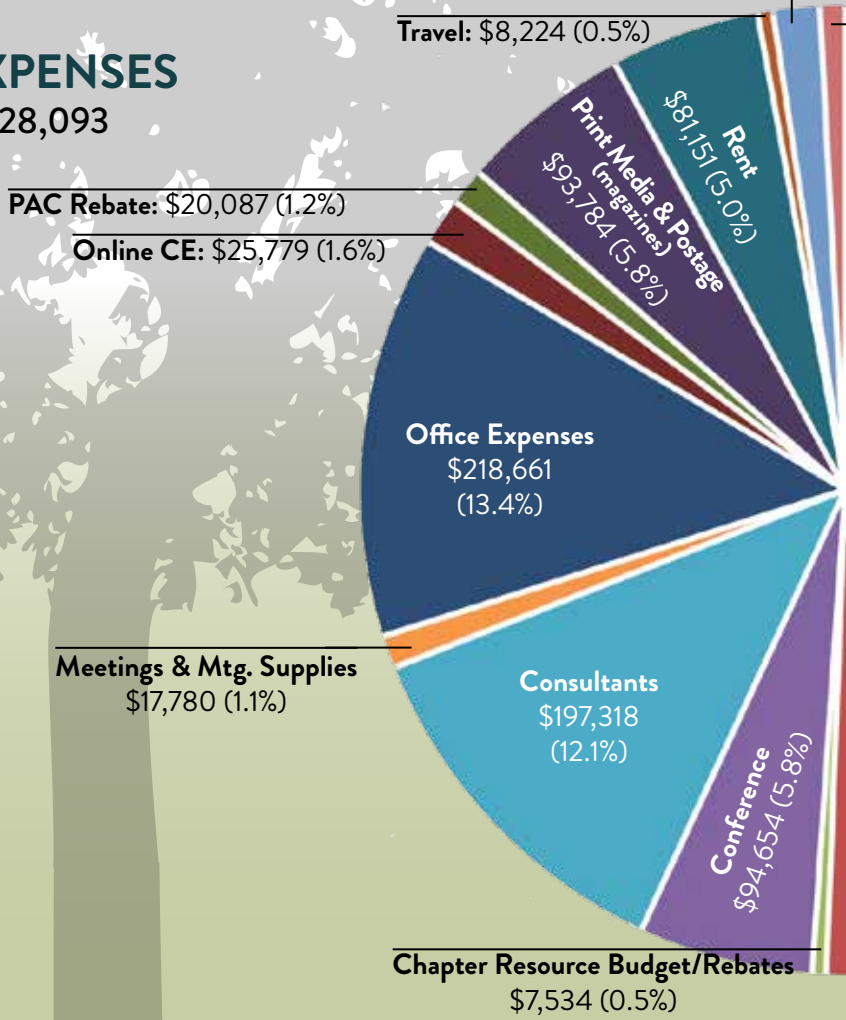
2020 INCOME

Total = $1,659,281



2020 EXPENSES

Total = $1,628,093



Meeting Revenue
$16,500 (1.0%)

realized loss on investments
,371 (1.5%)

Website: $13,580 (0.8%)

Personnel
$788,221
(48.4%)

CECPM Tracking
$35,949 (2.2%)

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CAPCA 47th ANNUAL CONFERENCE & AGRI-EXPO

CAPCA is pleased to announce our plans for a hybrid event in 2021!

Continuing to address the needs of our members and community concerns, CAPCA is developing both virtual and in-person opportunities to participate in our annual conference.

ATTENDEE REGISTRATION

Registration for the 2021 CAPCA Conference will open in May 2021 with options for both online CE and the networking-focused event in Reno https://capca.com/conference/#registration

SPONSOR AND EXHIBITOR OPPORTUNITIES

Sponsorship and Exhibitor sign-ups have begun for CAPCA's 2021 Virtual & Reno Conference.

Sponsorships are available now:
https://capca.com/sponsor-information/

Exhibitor options are open to 2020 Exhibitors now, and open for all other interested parties beginning May 17th
https://capca.com/exhibitor-information/

LABEL UPDATE

The Label Update session of CAPCA's 47th Annual Conference with CE will be a virtual program only - online, on-demand. This will be made available to attendees beginning September 1, 2021 through the end of October.

AGRI-EXPO AND NETWORKING PROGRAM OCTOBER 17-19, 2021 | RENO, NV

Agri-Expo and Networking event in Reno will include limited, additional CE programming. Watch our website for amended program at *https://capca.com/conference/*

Attendance will be limited based on CDC, State, and restrictions observed by the facility. Pre-registration will be required. **No on-site registration will be accepted.** ■

Photo: © Fred Rehrman, Elysian Fields

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2021 CAPCA CONFERENCE

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Agriculture leans into Newsom's conservation agenda

Brad Hooker, Agri-Pulse

Gov. Gavin Newsom has made conserving California's land, water and biodiversity a priority of his administration. Now the agriculture industry is stepping up to meet those standards through a new public-private partnership called the California Pollinator Coalition.

Last year Newsom directed state agencies to find ways to conserve 30% of California's land and coastal waters by 2030. The administration has also taken aggressive steps to reduce the use of agricultural pesticides with the aim of protecting the environment and communities. This includes banning the insecticide chlorpyrifos, proposing an overhaul of the mill assessment for pesticide sales and developing new mitigation measures for the use of four controversial neonicotinoids, to be unveiled later this year.

The industry has recognized the value of having a seat at the table when it comes to advancing bold environmental initiatives. The Pollinator Coalition will play a role in outlining the steps to meeting those goals—before policymakers make those decisions.

"It seems obvious to many on the outside, but it's really not that obvious that we should all be working together," said Karen Ross, secretary of the California Department of Food and Agriculture, during a press conference announcing the partnership.

The coalition builds on existing collaborations with CDFA and industry for protecting native bee species through the BeeWhere registration of hives and CDFA's BeeSafe program. Laurie Davies Adams, director of programs at the Pollinator Partnership, a coalition partner, said her organization's Bee Friendly Farming program certified 55,000 acres of California farmland over the past year through yet another collaboration with the Almond Board of California (ABC), tackling what she described as a critical issue of protecting all pollinators, including native and managed species.

"Here in California, we are held to very high standards on how we manage (pest) issues," said Josette Lewis, chief scientific officer for ABC. "Integrated pest management (IPM) is the largest area of our investment in the almond industry."

Lewis pointed to other partnerships with Resource Conservation Districts, University of California Agriculture and Natural Resources and the Environmental Defense Fund (EDF). The momentum has carried over to the Legislature as well.

CAPCA has joined the coalition and is working on behalf of PCAs to be part of this conversation.

Coalition Membership (as of 3/31/21):

- Agricultural Council of Caliornia
- Almond Alliance
- Almond Board of California
- California Alfalfa and Forage Association
- California Association of Pest Control Advisers
- California Association of Resource Conservation Districts
- California Cattlemen's Association
- California Citrus Mutual
- California Department of Food and Agriculture
- California Farm Bureau Federation
- California State Beekeepers Association
- California Sustainable Winegrowing Alliance
- Environmental Defense Fund
- Monarch Joint Venture
- Monarch Watch
- Pollinator Partnership
- Project *Apis m.*
- University of California Agriculture and Natural Resources
- USDA Natural Resources Conservation Service of California
- Western Growers
- Dr. Neal Williams, University of California, Davis

For additional information visit:

https://www.prnewswire.com/news-releases/diverse-group-of-agriculture-conservation-and-natural-resource-organizations-comes-together-to-protect-californias-pollinators-301263638.html

STAY INFORMED

Increase your knowledge of the news, actions and proposed regulatory changes from the Department of Pesticide Regulation (DPR) that may affect your PCA license and the pest management industry.

DPR Electronic Subscription Lists

DPR's web site includes a subscription page for their electronic mailing lists.

You can sign up to receive free, automatic delivery of:

DPR News Releases.
Licensing, Certification and Continuing Education Information.
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http://www.cdpr.ca.gov/docs/dept/listserv/listdesc.htm

California Department of Pesticide Regulation

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- OMRI Listed®

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EDF is sponsoring a bill that would provide $5 million in incentives grants for expanding on-farm pollinator forage and habitat, which gained unanimous support in the first committee hearing but now faces a critical hurdle with the Assembly Appropriations Committee.

Ross said this sort of funding and collaborative investment is essential for overcoming a key barrier for protecting pollinators: the availability of technical assistance for farmers due to a decades-long decline in investment for cooperative extension in the state. The administration is eager to scale up funding for CDFA's Healthy Soils Program as well, according to Ross. Two of the more popular practices among applicants are planting cover crops and hedgerows. The administration has also added more dollars for IPM grants in its initial state budget proposal.

Lewis cited a recent UC Davis study showing that each acre of pollinator habitat costs growers about $1,700. Other research found that less than 10% of Yolo County farmers saw financial gain from that habitat.

Lewis, Ross and Adams stressed that the approach of the Pollinator Coalition is to promote voluntary and incentive-based practices in order to create more permanent and meaningful changes.

"The outcome will not be a tidy report that sits on a shelf, but rather a metric of acres, projects and species added to the landscape, while agriculture continues to profitably feed the nation," said Adams. "Agriculture and conservation must work together to achieve this goal." ■

(above) metallic green sweat bee, (below) long-horned bee, photos by Anthony Colangelo, Pollinator Partnership

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CAPCA's 2021 Spring Summit: A Virtual Success

CAPCA is pleased to report that the virtual Spring Summit event for 2021 provided over 400 attendees with timely, beneficial, continuing education (CE) hours during April, and interaction via two Live events.

As the face of educational opportunities continues to change, CAPCA continues to pursue a variety of engagement options to bring benefit to our membership and the Industry.

Valuable educational content was provided by our presenters. Their contributions to our event are much appreciated.

James A. Bethke, *Floriculture & Nursery Advisor Emeritus, UCCE*
Steve Petrie, Ph.D., *Yara Dir. of Agronomic Services*
Robert Masson, *University of AZ, Yuma County Cooperative Extension*
Sonia Rios, *Area Subtropical Hort. Advisor, UCCE Riverside & San Diego Counties*
Ruben Arroyo, *Riverside County Ag Commissioner*
Niamh Quinn, *South Coast Research & Extension Center*
Abe Isaak, *AgroLiquid Field Agronomist*

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CAPCA STAFF CONTACTS

RUTHANN ANDERSON
CAPCA President/CEO
Adviser Editor
ruthann@capca.com
(916) 928-1625 x7

JOYCE A. BASAN
Programs/Communications Dir.
Adviser Deputy Editor
joyce@capca.com
(916) 928-1625 x2

ASHLEY HINSON
Content Curator
ashley@capca.com
(916) 928-1625 x4

RACHEL TAFT
Executive Assistant
rachel@capca.com
(916) 928-1625 x5

CRYSTELLE TURLO
Chief Operations Director
crystelle@capca.com
(916) 928-1625 x3

KENT HINSON
Director of Engineering
& Technology
kent@capca.com
(916) 928-1625 x8

CARRIE KIHLTHAU
Technical Support
Specialist
carrie@capca.com
(916) 928-1625 x1

Watergrass (*Echinochloa* spp.) in Rice:

Overview and Current Research

Whitney Brim-DeForest[1], Taiyu Guan[2]
[1]Rice Advisor, [2]Agricultural Technician, University of California Cooperative Extension, Sutter-Yuba Counties

Introduction

The genus *Echinochloa* includes numerous problematic weeds that cause significant yield losses to many summer crops and vegetables in more than 60 countries (Holm et al. 1977). High seed production, short seed dormancy, quick emergence pattern, rapid vegetative, and reproductive growth under wide-ranging agro-climatic conditions and various types of soil moisture content ensure its successful population survival (Maun & Barrett 1986; Wu et al. 2004).

Echinochloa species are reported as the most common and important weed species in transplanted and direct-seeded rice (Fischer et al. 1997). Its morphological features resemble rice and as a result, plants are difficult to eradicate at very early vegetative stages from rice fields (Galon & Agostinetto 2009; Catinding et al. 2011). Because most of the species in this genus are taller than rice, they can reduce canopy light transmission during the rice grain filling stage, causing negative effects on leaf photosynthetic rate, root oxidative activity, and accumulation of dry matter at maturity. Consequently, this can cause rice grain yield reduction and grain quality deterioration (Zhang et al. 2017). Interspecific hybridization in *Echinochloa* species has increased the genetic diversity of the species complex in this genus and sped up the evolution of resistance to herbicides, which are the main weed management practices in various cropping systems (Owen & Zelaya 2005; Sood et al. 2014).

Furthermore, *Echinochloa* species haves shown varying degrees of herbicide resistance (Valverde 2007; Widderick et al. 2013). In California rice, resistance to one or more herbicide modes of action has been found in barnyardgrass (*E. crus-galli*), early watergrass (*E. oryzicola*), and late watergrass (*E. phyllopogon*) as early as 2000 (Fischer et al. 2000; Osuna et al. 2002; Heap 2015; Iwakami et al. 2015).

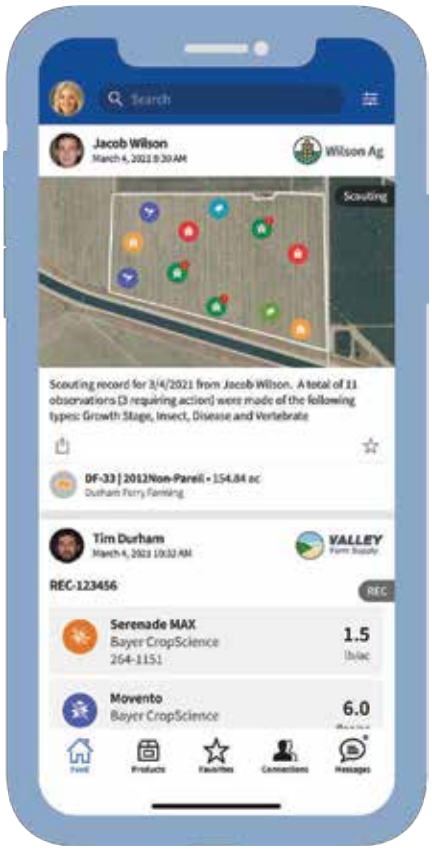
The morphology of *Echinochloa* species is significantly affected by environmental and soil-environmental factors, including temperature, precipitation, soil texture, soil carbon dioxide concentration, and others (Yoshioka et al. 1998; Lopez-Martinez et al. 1999). It is agronomically and economically important to identify *Echinochloa* species properly because of potential differences in response to crop and weed management practices (Tahir 2016). However, due to their phenotypic plasticity and their ability to cross and create interspecific hybrids, they are notoriously difficult to identify.

In 2017, two rice fields were identified with an unknown watergrass biotype, phenotypically dissimilar to the three main known species that infest California rice fields: late watergrass, early watergrass, and barnyardgrass. Both fields had extensive infestations, which were uncontrolled by repeated herbicide applications. The lack of control was coupled with phenotypic characteristics that were not immediately identifiable to one of the known species. After extensive attempts at identification at both the University of California (UC) Davis Herbarium, and even with the assistance of two *Echinochloa* experts at two other universities, we were unable to conclusively identify the species. In 2018, 10 more fields were identified, and samples were collected. The UC Cooperative Extension (UCCE) Rice Team is currently working on a large project to phenotypically characterize the *Echinochloa* species in California rice fields. In the meantime, however, we have started to work on control methods, including conducting preliminary herbicide screenings.

Methods

In 2018, 10 samples were collected in grower fields: 4 samples from Butte County, 2 from Glenn County, 3 from Sutter County, and 1 from Yolo County. They were multiplied (on a population level, not as single-seed lines) in the greenhouse in 2019, to produce enough seed to conduct the screening. Two susceptible samples (from the California Cooperative Rice Experiment Station, in Biggs, CA) were used as controls. The herbicides used for screening were: clomazone, thiobencarb, cyhalofop, benzobicyclon+imazosulfuron, penoxsulam, bispyribac-sodium, and propanil. Rates used were the recommended label rate (Table 1) with three replications per herbicide-sample combination.

Screenings took place at the Rice Experiment Station greenhouse in Biggs, CA, in the spring of 2020. All formulations were tested at the 1.5 leaf stage of the watergrass. Dormancy was broken by wet-chilling in the fridge for approximately two weeks before planting. Pots



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($4in^3$) were seeded and then thinned down to 4 plants per pot. All liquid formulations (cyhalofop, propanil, and bispyribac-sodium) were applied with the label-recommended surfactant (crop oil, crop oil, and modified vegetable oil, respectively). Applications for the water herbicides were made onto the water surface of bins that were flooded to 4 inches above the soil surface of the pots (where the watergrass was planted). All foliar herbicide treatments were applied with a cabinet track sprayer with an 8001-EVS nozzle delivering 40 gallons of spray solution per acre (at a pressure of approximately 20 psi). At 14 days after treatment, the number of living plants per pot was counted, and fresh biomass was measured (per pot) by cutting plants at the soil surface and taking the weight (per pot).

Table 1. Herbicides and rates utilized for 2020 watergrass screening. Rates are in grams of active ingredient (a.i.) per hectare.

Active Ingredient	Rate (a.i.)
Clomazone	673 g ha^{-1}
Thiobencarb	3918 g ha^{-1}
Benzobicyclon + Imazosulfuron	306 g ha^{-1}
Penoxsulam	40 g ha^{-1}
Cyhalofop	263 g ha^{-1}
Bispyribac-sodium	32 g ha^{-1}
Propanil	6726 g ha^{-1}

Results

Ten of the ten unknown watergrass samples were not controlled at 14 days after treatment (DAT) (less than 50% by biomass, in comparison to the untreated controls) by penoxsulam or benzobicyclon+imazosulfuron (Table 2). Nine of the ten samples were not controlled by thiobencarb, and 6 of the 10 were not controlled by clomazone. Propanil, bispyribac-sodium, and cyhalofop controlled 10 of 10 samples (at least 50% control).

Table 2. Percent control compared to untreated control by biomass at 14 days after treatment of 2 known susceptible late watergrass (*Echinochloa phyllopogon*) populations (Susceptible 1 and Susceptible 2), and 10 unknown watergrass populations (identified by county and sample number).

Control (%) Compared to Untreated Control							
	Penoxsulam	Clomazone	Thiobencarb	Benzobicyclon +Imazosulfuron	Propanil	Bispyribac-sodium	Cyhalofop
Susceptible 1	68	65	92	49	100	48	92
Susceptible 2	55	63	84	22	98	81	93
Glenn 1	45	80	71	45	100	85	87
Glenn 2	37	74	7	0	98	63	83
Butte 1	45	29	16	41	100	68	86
Butte 2	47	30	17	25	100	87	84
Butte 3	36	93	0	12	100	80	87
Butte 4	19	59	47	47	100	71	78
Sutter 1	47	33	0	0	100	78	89
Sutter 2	32	44	46	0	99	68	92
Sutter 3	26	0	0	7	98	80	81
Yolo	41	68	27	22	100	81	76

For the number of living plants remaining at 14 DAT, 10 of the 10 unknown watergrass samples were not controlled by penoxsulam, benzobicyclon+imazosulfuron, thiobencarb, or clomazone (50% or more of the plants remained) (Table 3). Ten of the ten samples were not controlled by bispyribac-sodium, and 9 of 10 were not controlled by cyhalofop. Propanil controlled 10 of 10 samples (at least 50% control).

Table 3. Percent control compared to untreated control by number of living plants at 14 days after treatment of 2 known susceptible late watergrass (*Echinochloa phyllopogon*) populations (Susceptible 1 and Susceptible 2), and 10 unknown watergrass populations (identified by county and sample number).

Control (%) Compared to Untreated Control							
	Penoxsulam	Clomazone	Thiobencarb	Benzobicyclon +Imazosulfuron	Propanil	Bispyribac-sodium	Cyhalofop
Susceptible 1	8	0	42	0	92	8	58
Susceptible 2	8	0	58	0	100	0	33
Glenn 1	0	8	0	0	100	0	8
Glenn 2	0	19	0	8	92	8	42
Butte 1	0	0	0	0	100	0	8
Butte 2	0	0	0	8	100	8	25
Butte 3	0	25	0	0	100	0	33
Butte 4	0	0	0	0	100	0	42
Sutter 1	0	0	0	0	100	0	33
Sutter 2	0	0	33	0	92	0	75
Sutter 3	0	0	0	0	92	0	0
Yolo	0	0	0	0	100	0	25

Conclusion

The results of this screening closely align with what growers are seeing in the field: the unidentified watergrass is escaping early-season granular control and is then difficult or impossible to control with later-season herbicide applications. Foliar applications in the greenhouse were highly effective (by percent biomass reduction), but since the greenhouse application was conducted at an early timing (1.5 leaf stage of grass), it is possible that later applications in the field may be less effective. Furthermore, some of the herbicides, in particular, bispyribac-sodium and cyhalofop, although showing biomass reduction at this early-stage application (at least 60% in most cases), did not

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show 100% control of individual plants, which could recover later in the season. Further testing in the field or greenhouse is necessary to determine if that is the case. Again, this matches closely with grower anecdotal evidence in the field, where the unidentified watergrass appears to recover from applications of both bispyribac-sodium and cyhalofop.

For growers, this preliminary screening implies that control of this new biotype/species will need to be prioritized early in the season, with an aim at overwhelming the plants' ability to metabolize the herbicides, as well as utilizing alternative modes of action. Some possible treatments (note: these have not been field-tested and could cause phytotoxicity) could be: a stale seedbed using a nonselective herbicide; preplant pendimethalin followed by postemergence herbicide applications; preplant thiobencarb followed by clomazone or benzobicyclon+imazosulfuron or penoxsulam; clomazone followed by benzobicyclon+imazosulfuron or thiobencarb or penoxsulam; or benzobicyclon+imazosulfuron followed by penoxsulam or thiobencarb. There is still a strong likelihood that a follow-up application may still be required later in the season, even with these early-season applications.

Research with this unidentified species or biotype is ongoing, and another larger set of samples was collected in 2020. This larger set will also be subjected to a screening in the greenhouse, and results will be reported in 2021. ■

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Integrated weed control in lettuce

Richard Smith, Elizabeth Mosqueda and Steve Fennimore, Vegetable Crop and Weed Science Farm Advisor, Assistant Professor California State University, Monterey Bay and Extension Weed Scientist, UC Davis.

Lettuce on the Central Coast is grown in an intensive production system with two or more crops grown sequentially on the same field. Weed pressure is affected by prior crop rotations and the effectiveness of weed control strategies. Planting configurations for full-term lettuce vary from 40-inch wide beds with two seedlines to 80-inch wide beds with 5-6 seedlines, and for high-density plantings (e.g. baby lettuce), 8 to 36 seedlines. In conventional production a preemergent herbicide is typically applied to a 4-inch wide band around the seedline. Lettuce is predominantly direct seeded by planting 3-4 times the amount of seed needed which is thinned to the desired stand. Thinning is accomplished by hand crews physically removing lettuce seedings or by automated thinners (autothinners) that chemically remove seedlings. A significant amount of weed control is provided during thinning. Typically, one follow-up hand weeding is carried out 10-14 days following thinning to remove remaining weeds and any double lettuce plants that remain following thinning.

Costs of Weeding

Total costs for weeding lettuce have been estimated to range from $454 to $623/A for 80-inch wide beds with 5 or 6 seedlines (https://coststudies.ucdavis.edu/en/current/commodity/lettuce/). However, weeding costs can vary significantly depending on weed pressure. If pressure is light, weeding costs can be less, but if weed pressure is high, weeding costs can be higher. The sequence of crops in the rotation can reduce or increase the weed pressure. For example, rotations with baby vegetables (spinach, baby lettuce and spring mix) that mature in 25-35 days are mechanically harvested, therefore fields are thoroughly weeded prior to harvest to reduce contamination of the harvested product with weeds. Any escaped weeds in this production system do not set seed because the production cycle is too quick for them to mature seeds which reduces the soil seedbank. On the other end of the spectrum, rotations with long-season crops such as peppers and annual artichokes allow multiple waves of weeds to germinate which are nearly impossible to totally and economically remove, thereby allowing significant numbers of weed seeds to set and increasing weed pressure in subsequent lettuce crops.

Cultural Practices

Pregermination is a key practice used during the fallow period to prepare the beds for planting, but also reduces weed pressure in the subsequent crop. Studies have shown that preirrigation followed by tillage lowers weed pressure to subsequent crops by as much as 50%. In organic production, pregermination is one of the most powerful practices for reducing weed pressure especially in high density plantings that cannot be mechanically cultivated. If time allows, pregermination can be repeated to further reduce weed pressure.

Cultivation of full-term lettuce is a common practice in the Salinas Valley. A four-inch wide uncultivated strip is left around the seedline, and depending on the planting configuration, anywhere from 70-90% of the beds is cultivated providing significant weed control. Automated guidance systems are commonly used to guide the cultivators and the knives to adjust to any irregularities in the seedline which helps increase the number of acres that a cultivator driver can cover in a day.

Preemergent Herbicides and Effect of Irrigation Systems

The three pre-emergence herbicides used in lettuce production are benefin, bensulide and pronamide. Benefin and bensulide control warm season weeds such as lambsquarters, pigweed and purslane, and many grass weeds. In addition, bensulide also controls burning nettle. Benefin is mostly mechanically incorporated into the soil while bensulide and pronamide are commonly applied at planting and incorporated into the soil with germination water. In addition to purslane, lambsquarter and pigweed, pronamide also controls shepherd's purse and nightshades.

In the Salinas Valley, lettuce is irrigated with sprinkler, drip or a combination of both. Where both irrigation systems are used, sprinkler irrigation is used up to thinning then drip irrigation is installed and used for the remainder of the crop cycle. Where sprinkler irrigation is used, 1.5 to 2.0 inches of water is typically applied with the first germination irrigation. Excessive water can push pronamide below the weed seed germination zone in the top half inch of soil. Movement of pronamide below the germination zone is particularly

Act Quickly to Control Downy Mildew

Downy mildew is a difficult disease to control in leafy vegetables, and resistance issues have made control of the disease even more difficult in recent years.

Preventive action is the most efficient path to economical control. Foliar applications should be made prior to disease development.

Enhance Plant Protection

According to Chris Clemens, Syngenta agronomy service manager for the western United States, “Higher moisture, particularly in the wintertime, typically leads to a higher incidence of pressure with downy mildew.”

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- Resistance management. Oxathiapiprolin is the only member of FRAC group 49, so it has no cross resistance to other fungicides. This makes it a good foundation product or rotation partner in a downy mildew control program.
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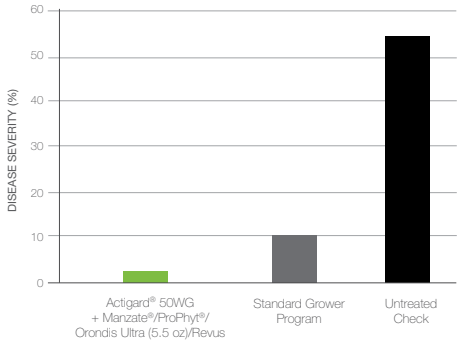

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Product performance assumes disease presence. Performance assessments are based upon results or analysis of public information, field observations and/or internal Syngenta evaluations. Trials reflect treatment rates and mixing partners commonly recommended in the marketplace.

MW 1ORO03237-Orondis-AG144 04/21

a problem on sandy soils during the summer when more irrigation water may be used. As a result, growers may see poor control of weeds like purslane if pronamide alone is used in these conditions. To improve the efficacy of pronamide with sprinkler irrigation, it can be applied in the 2nd or 3rd germination water, approximately 3-5 days following the first water, just prior to the emergence of the lettuce seedlings. Typically, only 0.25 – 0.5 inch of water is used in the 2nd and 3rd germination irrigations which does not push the pronamide as deep in the soil thereby keeping it in the zone where weed seeds are germinating and improving its efficacy. Bensulide is less mobile in the soil than pronamide and provides good control of purslane even in the summer when applied prior to the first sprinkler germination irrigation.

Single-use drip tape is being used to a greater extent in the Salinas Valley. The advantage of this practice is that each crop uses new tape with good uniformity which allows growers to consider using drip irrigation to germinate lettuce on appropriate soil types. The drip tape is typically placed 2-3 inches deep in the soil and the water moves up and laterally to the seedlines, which is different than the downward movement of water applied with sprinkler irrigation. This difference in the movement of the germination water affects the efficacy of bensulide and pronamide applied to the soil surface. For instance, in one 2020 trial we observed that bensulide controlled 12 and 87% of weeds with drip and sprinkler irrigation, respectively. Pronamide controlled 60 and 98% of weeds with drip and sprinkler irrigation, respectively. Bensulide is less mobile in the soil than pronamide and, in this trial, was not activated as effectively by drip irrigation compared to pronamide.

Photo 1. France's autonomous platform equipped with finger weeders

Automated Weed Removal Technologies

The use of autothinners that use a spray mechanism to kill the unwanted lettuce plants during the thinning process is now commonplace in the Salinas Valley. Autothinners use a camera to detect images of the lettuce stand which is sent to a computer which analyzes the image and makes

Photo 2. USA's autonomous weeder.

decisions on which plants to keep and which to remove. The computer activates the sprayer solenoid which then applies an herbicide (carfentrazone) or concentrated liquid fertilizer to remove unwanted lettuce plants and weeds.

Most lettuce is direct seeded, but there is interest in transplanting lettuce, and other crops. Mechanical transplanters are still used, but automated transplanters are also available. Some are relatively new and one is notable for its speed and labor savings. While the acreage of lettuce transplanted is still limited, forces affecting the industry may spur greater use of transplanted lettuce in the future: savings and efficiencies in the need for labor, efficiencies in the use of water and fertilizer, and potential for producing more crops per acre. Transplanting lettuce has great potential to improve weeding efficiencies, to reduce weeding costs and to effectively interface with automated weeders (autoweeders).

The weeding operation following thinning requires the crew to remove any escaped weeds and double lettuce plants left in the field. This operation varies in cost depending on weed pressure and the amount of double lettuce plants left from the thinning operation. Autoweeders are being used in lettuce production in the Salinas Valley to handle this operation. Current designs of autoweeders use technology similar to the autothinners: camera, computer processor and kill mechanism. Autoweeders being used and/or tested in the lettuce industry include devices developed in Denmark, Netherlands, Italy, England, France (Photo 1), and the USA (Photo 2). The machines are particularly effective for use with transplanted vegetables because recognizing the difference between the crop and the weeds is easier given the initial size difference between the transplants and germinating weeds. The France and USA machines are autonomous weeders and are capable traveling through the fields without a driver, although they are not currently used in that mode.

In 2020, we evaluated the France and USA autonomous weeders. Overall, auto weeders removed about twice the number of weeds than standard cultivation from the 6-inch band around the seedline and reduced subsequent hand weeding/double removal by 4 hours/acre while not reducing the stand of lettuce or mean head weight (Table 1). Currently, autoweeders cannot remove double lettuce plants from production fields and a hand crew is still needed to accomplish this task. This creates a critical economic decision for the grower: when is it economically advantageous to

Table 1. Overall weed and harvest evaluations

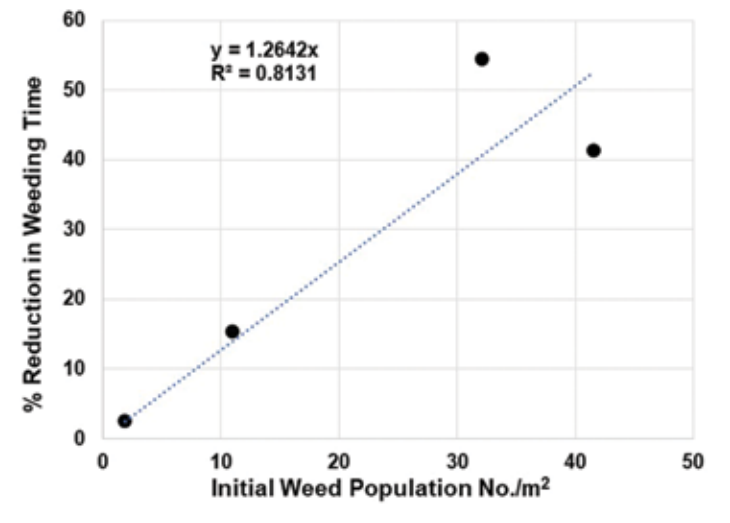
Response Variable	Autoweeder	Standard Cultivation	P-value
Weeds Removed (%)	59.2	31.5	< 0.001
Subsequent weeding time (Hrs/A)	7.3	11.0	0.195
Lettuce Stand Post Cultivation (%)	98.7	99.9	0.160
Mean heat wt. (lbs.)	1.8	1.8	0.913

utilize an autoweeder? At this point autoweeders do not eliminate the need for hand weeding but reduce the time for subsequent hand weeding to remove weeds and double lettuce plants. Figure 1 shows that in fields with greater weed pressure the autoweeders reduced subsequent hand weeding times to a greater extent and gives an indication of the advantage that they provided.

Summary

Weed control in lettuce production has many facets. The impact of prior rotations and cultural practices such as preirrigation affects weed pressure absent any other weed control measures. New developments in irrigation technology such as single-use drip tape affects the efficacy of the available preemergent herbicides used on lettuce. Automated thinners, transplanters and weeders provide new options for growers to better deal with weed control challenges in vegetable crops. ■

Figure 1. Relationship between initial weed population and the reduction in subsequent hand weeding time of lettuce by auto weeder.



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Peach root-knot nematode:

What we know and what we need to learn.

Andreas Westphal[1], J. Ole Becker[1], Antoon Ploeg[1], Mohammad Yaghmour[2], Sergei Subbotin[3], John Chitambar[3]

[1] Department of Nematology, University of California Riverside
[2] University of California Cooperative Extension Kern County, Bakersfield
[3] California Department of Food and Agriculture

How was the peach root-knot nematode found?

The peach root-knot nematode (PRKN), *Meloidogyne floridensis*, was first detected in Merced County, California in May 2018. This initial find was in a 3-year-old almond orchard in sandy soil. David Doll (UCCE Farm Advisor) observed poorly growing almond trees that had been grafted on 'Nemaguard' and 'Hansen 536' rootstock varieties. Both varieties are known to be resistant to southern root-knot nematodes (*Meloidogyne* species) which are typically the most abundant in California. Nemaguard in particular has a high level of durable resistance to *M. incognita, M. javanica*, and *M. arenaria*. Consequently, the presence of galls on roots of almond trees were of major concern, and the County Agricultural Commissioner's Office, University of California (UC), and the California Department of Food and Agriculture (CDFA) were involved in identifying the cause of the problem. Morphological and molecular analyses confirmed the identification of *M. floridensis*. In the US, this nematode had been first detected and identified in Florida on peach rootstocks. Its significance is based on its ability to overcome root-knot nematode (RKN) resistance in Prunus, and in certain vegetable crops. In Merced County, PRKN-induced galling was found on trees of varying ages. Not only was it detected on young trees but also on 10- to 12-year-old trees in an adjacent field. This age variance and the scattered distribution pattern throughout the orchard suggested that the nematode species probably had been present at this location for many years.

A second PRKN find was reported from Kern County from an almond orchard also expressing poor growth. Damage observed in this orchard with slightly more fine-textured soil was less severe than that at the initial site, but trees lacked vigor thereby warranting a closer examination of the roots. PRKN was also confirmed on these roots. In addition, galling caused by PRKN was also found at the border of an adjacent vineyard. Subsequently, this same nematode was found in a second unrelated orchard in Kern County. The fact that these three orchards with positive identification of PRKN have no known common history suggests that *M. floridensis* may be more wide-spread than currently known.

What happens if it is found and confirmed in a specific field?

By California State regulation, all three orchards were placed under quarantine as soon as the presence of PRKN was confirmed. Restrictions were put in place to reduce the risk of spreading a State quarantine-actionable pest beyond its determined area of infestation. State and County regulatory requirements prohibit the movement of soil and plant material from the orchards, restrict tillage depth during cultivation of crops and specify conditions for orchard renewal, e.g., prevention of soil movement from the orchard, cleaning of implements, and other safeguards. These requirements only minimally impact harvest and typical orchard management operations while preventing spread of the nematode outside the quarantine areas.

It is extremely challenging to eradicate a nematode pest once established in a field. After reviewing treatment options, the grower of the Merced County site decided to fumigate the orchard soil with methyl bromide after tree removal and destruction. He then replanted with almond trees. CDFA and Merced County monitored and surveyed the treated site two years following fumigation. No PRKN was detected in this field. While this was a costly up-front investment, it allows the grower to bring his orchard to full productivity pending the official removal of regulatory restrictions.

Why is PRKN of concern?

The peach root-knot nematode can overcome host plant resistance against other root-knot nematode species. For example, it reproduces on 'Nemaguard', and peach-almond hybrid rootstocks known to be resistant to southern root-knot nematode species. Especially Nemaguard has protected stone fruit and nut crops for more than 50 years thereby illustrating the importance and longevity of this resistance that is put in jeopardy by PRKN. In general, California growth environments are very conducive for RKN. This group of plant-parasitic nematodes typically has a wide host range and can sustain itself on many different plant genera. Many species within this group infect and damage

various crop plants, and also aggressively reproduce on weed species. The ability of the California population of PRKN to reproduce on *Prunus* plants has been demonstrated. More recently, experiments under quarantine greenhouse conditions at the UC Riverside main campus have shown that these nematodes can also overcome RKN resistance in several vegetable crops. This raises additional concerns for high value vegetable production industries in the State. However, to date, this nematode has NOT been confirmed in California vegetable production fields.

How wide-spread is PRKN in California?

Currently, the nematode has only been found in three unrelated almond orchards and one vineyard in California. Therefore, its actual distribution remains unknown. However, determining the statewide distribution of PRKN would require a survey which is not an easy endeavor considering the large acreage that would need checking. Testing 1.5 million acres of almond orchards plus stone fruit acreage for infestation with PRKN is not feasible. A simple random sampling could possibly be done but it is an unrealistic proposition during pandemic times. There are anecdotal reports of unexpected finds of root-knot nematodes on RKN-resistant *Prunus* rootstocks, but those have been difficult to confirm. Before more efforts can be spent on mitigating the potential problem, a more extensive assessment of its gravity needs to be made. Researchers depend on the collaboration of growers and their advisors who may recognize a perceived problem in their crops (e.g., galled roots on RKN-resistant rootstocks or cultivars).

What is done to mitigate the issue?

Despite the uncertainty of the distribution of PRKN, several preliminary projects are ongoing with the support of potentially impacted commodity boards, the nursery industry, and CDFA. At CDFA, serious efforts have improved the detection and molecular identification of *M. floridensis*. Such quick and reliable methods are available to examine large numbers of survey samples. Other efforts look into the genetics of *Prunus* rootstocks for resistance to this potential new threat. For example, in preliminary screens of *Prunus* germplasm for resistance to PRKN, some California

Galls induced on tomato roots caused by *Meloidogyne floridensis* four months after inoculation in greenhouse pots

experimental lines limit the reproduction of the nematode. Even if findings were confirmed, multiple years would be needed to develop these rootstocks to be commercially available. Since *M. floridensis* was reported previously to also thrive on vegetable crops, experiments are conducted under the respective safeguards to examine whether this nematode is able to infect vegetable crops with root-knot nematode resistance to the species that are common in California. These risk assessment data lay the foundation for potentially more detailed studies should more infestation sites of the nematode be found. It is doubtful that the sensitivity of this species to nematicides differs from other root-knot nematode species. Thus, such investigations appear less urgent. There is limited information on whether nematode antagonistic soil microbes distinguish between different root-knot nematode species, with the exception of the bacterial hyperparasite *Pasteuria* that is highly species specific. But the key for more research efforts afforded on this pest depends on an improved understanding of the nematode distribution.

What is done in other areas where PRKN has been found?

PRKN has now been confirmed in Florida, California, Georgia and South Carolina. The longest exposure has been in the name-giving state of Florida where the nematode causes damage in peach plantings. In Florida, an advanced rootstock breeding program is in place. When the species was first recognized, there appeared some utility of 'Flordaguard' to withstand infection by PRKN. However, this perceived resistance was not confirmed and subsequently the breeding program focused on different germplasms. In this work, *Prunus kansuensis* was identified as a source of resistance to *M. floridensis*. Introgression of this resistance into a broader *Prunus* rootstock germplasm is ongoing. Because of differences in climate and soil types, the adoption of such material would require implementation research under California conditions. The findings in South Carolina and Georgia are relatively recent, and mitigating research has probably just started.

What is the take home message?

PRKN has been confirmed in three unrelated almond orchards, and one vineyard. The almond orchards do not seem to have any similar or shared management history, and it is therefore unlikely that the nematodes were introduced at the same time or from the same source. This nematode is causing noticeable damage in Florida. Quarantine measures implemented in California are somewhat inconvenient but are necessary for protecting the crop in suspect fields and entire industries. CDFA and UC researchers, UCCE personnel, County Agricultural Commissioners, and commodity board members are on stand-by should suspect cases of infestations with PRKN be noticed. So far, the extent of the risk of PRKN in California is not clearly defined. Clarifying its distribution will benefit California agriculture by averting production risks. ■

Preventing Damage from Sodium

By Abe Isaak, AgroLiquid Agronomy Manager, West Region

Every year, from the beginning of almond harvest through post-harvest applications, the signs of damage from sodium is evident in many orchards; leaf edges showing burn, leaf drop and even serious defoliation. This damage has a direct effect on yield for the following crop year. The tree will show indications of damage earlier in the spring in the subsequent year, but you need to begin mediating the symptoms of sodium damage before you see these signs. Once the damage becomes visible, you are on the defensive and there are less options at your disposal.

Risk and Mitigation

With little rainfall last winter, the soil has had little opportunity to leach out sodium with clean rain water and we haven't gotten the deep moisture in the soil that the plant needs. This means the top foot of soil has a higher concentration of sodium. The risk of sodium burn begins when the weather turns hot, and worsens throughout the summer months as the central valley sees 100+° temperatures. Plants will go into stress starting at 85 degrees.

Calcium is often applied to the soil in either the form of gypsum or lime in an effort to improve soil structure and improve water and air movement. This effort to improve water movement in the soil can, in part, help reduce the sodium concentration in the top layer of soil, as this nutrient is easily leached from the root zone. Many growers stop here and hope this is enough to stop sodium damage to the plant. This can be a good start, but many times it isn't enough. Calcium is a tool in the toolbox but it isn't the total answer by itself. There is more than can be done.

Potassium (K) is vital for many processes in the plant. It can also be described as the Gatorade® for the plant, as it regulates the stomata opening and closing, and plant respiration. These processes help regulate temperature. As the weather gets warmer, the plant will pull potassium from the soil. The problem is that sodium and potassium have similar chemical properties. Because it is generally more available for the plant to use, sodium will be taken into the plant before the needed potassium. Chloride presents a similar problem, and it will also be grabbed from the soil, as well.

The result of this nutrient competition is that within a few days of sodium and/ or chloride uptake, the plant will start to lose its vigor, the leaves will start to droop and show signs of wilt. If left unchecked, the edge of the leaves will show signs of burn. Severe cases will experience defoliation.

How Does K Win?

Obviously, we want the plant to take up potassium instead. Using a soluble form of potassium is very important to ensuring uptake, as is soil application of the potassium fertilizer. However, a high pH soil limits the availability of potassium to the plant.

Another way to improve potassium levels in the plant is with foliar applications. Ideally, this begins in the fall with a good post-harvest application, followed by several more during the spring. Early season applications should begin at bloom and can be added to passes you make through the field for other applications such as fungicides and pesticides (always follow label instructions and perform a jar test when applying any agricultural input product).

Know Your Needs

How do you know if you need to add potassium to your crop nutrition program and how much should you apply? This is where tissue testing is very important. Review your previous years' tissue samples to help recognize any trends. This spring, when the leaves are fully developed, take a tissue test and check your numbers. Ideally 2.8% to 3.1% is where that number should be to help deal with sodium in the plant and to provide for crop needs. A good rule of thumb is to have potassium at 80% of nitrogen. As an example, if nitrogen is at 3.5%, you want potassium at 2.8%. A hungry plant will not care what it drinks to meet its need; a plant that is not starving will be much more selective in what it takes in.

One key point to remember: tissue tests tell us where we have been with our nutrition programs, not necessarily where we are going. If your results come back and things look good and the numbers are where you want them to be, don't let up. Stay on top of this potential problem. ■

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Top 3 things to consider before hull split

Drew Wolter, Almond Board of California Senior Specialist, Pest Management

Perhaps one of the most important times of year for almond growers is at the onset of hull split as the hull begins to open at the suture. Why is this such an important time during the almond production season? Once the hulls reach the b2 stage (deep v split, see Figure 1) susceptibility increases to both navel orangeworm (NOW) and to pathogens such as *Rhizopus* and *Aspergillus*. During this early stage of hull split, nut volatiles are released allowing NOW female to find the nut. This same opening gives *Rhizopus* and *Aspergillus* an opening to infect the hull.

There are many things for growers to consider as we approach hull split. Various orchard management practices such as proper irrigation, nutrient management, pest control and orchard monitoring can maximize almond quality and yield while minimizing the effect of NOW and hull rot. Below is a list of three key management practices that can assist growers in this process:

1. Proper Detection of hull split

Proper detection of hull split is the first step in effectively managing the potential for myriad pest and rot issues that may occur following hull split.

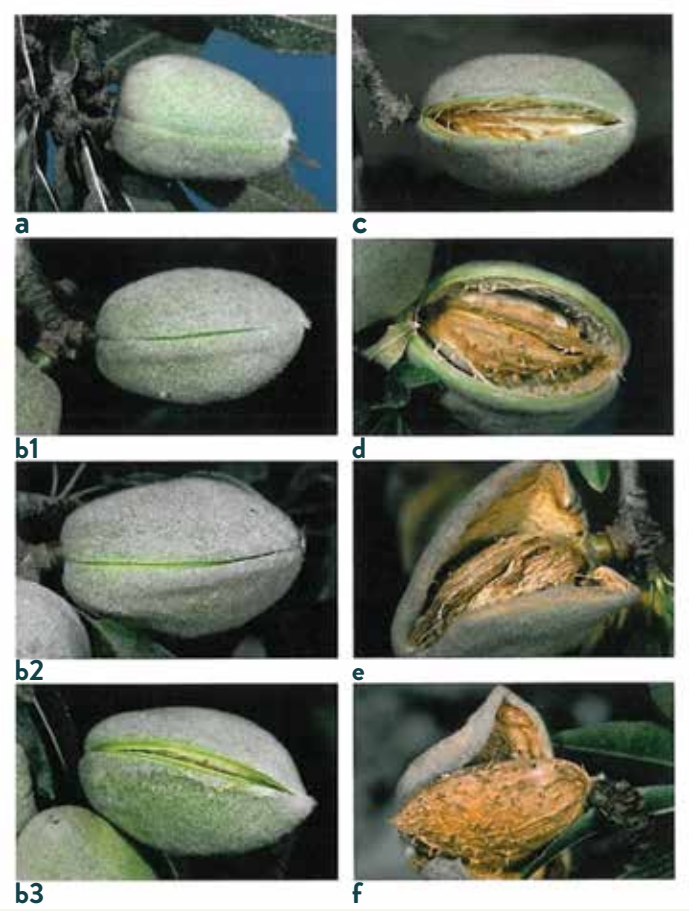
Hull split typically begins – and this year is projected to begin – in early July, starting in the early growing regions and spreading to later growing regions accordingly. The splitting of blank nuts (as much as 3–5% of the almonds) will occur about a week ahead of hull split and serve as a "heads up" that split will soon occur.

Tip: A key to identifying hull split is to look for an initial split in the upper and outer portions of the canopy, particularly the southwest quadrant. Once the fruit splits, hull split has begun.

2. Spray to Target Navel Orangeworm

The most effective time to spray for NOW is during its second flight, which often coincides with the initiation of hull split. As a confirmation that flight activity is coincident with

Figure 1: Stages of Hull Split



- **a.** unsplit hull
- **b1.** initial separation
- **b2.** deep V split
- **b3.** deep V split, but nut pops when squeezed
- **c.** split, but less than 1 cm
- **d.** split, more than 1 cm
- **e.** initial drying stages
- **f.** completely dry

Source: Orchard_Facts47981.pdf (ucanr.edu)

the beginning of hull split, check to see that eggs are being laid on egg or pheromone traps (note: mating disruption may affect trapping). Then, when spraying, make your application no later than at 1% hull split.

If your orchard experiences high NOW populations, a second insecticide application may be needed two-to-three weeks after the initiation of hull split, and a rotating of chemistries is advised to reduce resistance development pressure. As noted in the University of California (UC) Integrated Pest Management (IPM) guidelines, be sure to consider the following before conducting a second application:

- Varieties in the orchard (e.g., hard-shells tend to be less susceptible)
- Anticipated harvest dates
- Pest pressure noted from egg and pheromone traps
- Proximity to an external NOW source, such as neighboring pistachio or almond orchards managed by a different entity

As indicated in the UC IPM guidelines, methoxyfenozide and chlorantraniliprole, both of which are more recently registered cyantraniloprole-containing products, are preferred materials for hull split sprays. Pyrethroids have been used in the past, but their use should be considered with caution as NOW resistance to these materials has emerged, and pyrethroids are toxic to beneficials. If pyrethroids are used, they should be applied only once per season. It is imperative that you also make sure your sprayer(s) are well calibrated to improve spray efficacy and minimize drift.

3. Manage Hull Rot (*Rhizopus* & *Aspergillus*) from Day 1

Almond hulls are susceptible to hull rot fungi from the beginning of hull split until the hulls dry, typically a month-long period of time. This period may vary, however, depending on fertilization and irrigation. Successful hull rot control is based upon effective strategic deficit irrigation and nitrogen management.

Strategic Deficit Irrigation (SDI)

SDI, also known as regulated deficit irrigation or RDI, is the practice of mildly drought-stressing almond trees at hull split. By managing SDI, growers can reduce hull rot by 60–90% and experience a more uniform hull split and earlier harvest. These factors may contribute to less crop damage from weather and late-season NOW flights,

leading to less aflatoxin contamination, as well. What is more, SDI reduces water use for 2-3 weeks without impacting crop productivity.

The target period of when growers should stress trees is from the start of hull split through 90% hull split, a period of about three weeks. The most accurate way to practice SDI is to use a pressure chamber to track and maintain slight tree water stress levels, between -14 bars and -18 bars, depending on the weather. Information about the pressure chamber is available on the UC Davis Fruit and Nut Research and Information webpage.

Growers who do not rely on pressure chambers, particularly those with a history of hull rot and a visual baseline from which plant stress can be observed, may achieve similar results by irrigating at 50% of normal tree demand, using crop evapotranspiration (ETc) calculations during hull split.

The onset of hull split will vary according to orchard conditions; stress levels vary with soil type and other factors. Visit Natural Resources Publication 8515 to determine when to initiate water stress.

Nitrogen Management

Almond Board-funded research has found that excessive nitrogen increases incidences of hull rot. It is critical that a proper nitrogen budgeting plan, which is a function of crop load, is in place for the growing season to ensure that only the necessary amount of nitrogen is applied. Growers should also follow their nitrogen budgeting plans throughout the whole season and update their plans as actual yields become more evident. Regular updating will also allow growers to focus their nitrogen applications to the key times of nitrogen demand in almonds: For instance, application(s) during kernel fill should typically occur during the end of May through early June.

You can find more information on nitrogen budgeting and management at Almonds.com/NutrientManagement. ■

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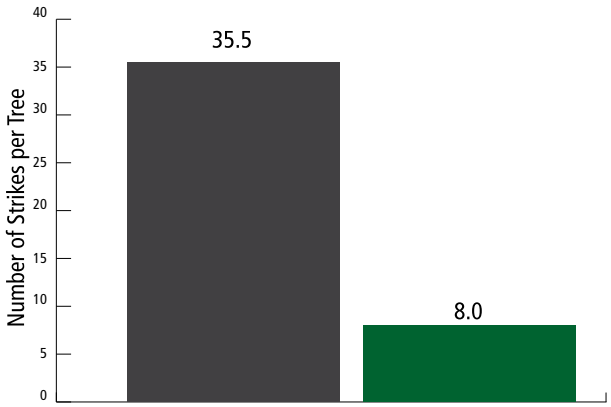

Cooperator: Jim Adaskaveg Location: Colusa Co. CA
Variety: Non-Pareil Volume: 100 gpa
Treatment dates: Utilize PK on 7/3 & 7/30

Over the years, the University of California Cooperative Extension (UCCE) has studied the benefits of incorporating different cultural practices to mitigate the damaging effect of almond hull rot, including deficit irrigation, minimizing nitrogen application near hull split, and applying bioscience products.

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CAPCA 2021 Sustaining Membership Levels

BENEFITS	BRONZE	SILVER	GOLD	CHROME	DIAMOND	PLATINUM
	$600	$2,000	$3,000	$5,000	$10,000	$25,000
Sustaining Member Acknowledgement on the CAPCA website and in each issue of the *Adviser*	✔	✔	✔	✔	✔	✔
Subscription(s) to *Adviser* Magazine	1	1	1	1	2	2
Job Opportunities Posting in *Adviser*	1	2	Unlimited	Unlimited	Unlimited	Unlimited
½ Page *Adviser* Ad (October issue excluded)		✔				
One-Page Ad in *Adviser*					1	3
Adviser Advertorial*			1	1**	1**	1**
Complimentary Mailing Labels		1	2	2	3	5
Comp Conference Registration(s)***			1	2	2	3
Priority Reservation for Conference Exhibit Booth***				✔	✔	✔
CAPCA Online CE Host or Collaboration Discount			$250	$500	$500	$750

* October issue fills quickly, first come, first served

** October issue guaranteed if booked by April 2021

*** Pending the availability of hosting In-Person events in 2021. Due to still unknown/potential space limitations or gathering restrictions, CAPCA reserves the right to limit one booth per sustaining member. In the event of a virtual CAPCA Conference in 2021, CAPCA will prioritize sustaining members in placement. Comp Conference Registrations will apply to virtual pricing.

To submit your Sustaining Membership form for 2021
visit www.capca.com/sustaining-membership

CAPCA

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CAPCA
FRESNO MADERA

The Fresno-Madera CAPCA Chapter gives scholarships annually to California State University, Fresno, West Hills College-Coalinga, and Reedley College students. In 2020 we were able to increase our scholarship giving to six academic scholarships of $1,000 each and plan to increase our giving again in 2021. Beyond academic scholarships, the Chapter also supports local FFA and 4-H groups, and various special projects with community organizations tied to agriculture. Our Chapter works closely with Dr. Jake Wenger, a professor of entomology in the Plant Sciences Department at CSUF. In non-COVID years, Dr. Wenger organizes students to attend the annual CAPCA Conference, many of whom are sponsored to attend by our Chapter. The Fresno-Madera CAPCA chapter is able to generously cultivate future industry leaders through the support of our members who attend our CE meetings and other events throughout the year.

Introducing CAPCA's New Member Highlights Social Media Feature

CAPCA is working hard to build out a robust social media platform to connect with our members, and to bring you more Industry-focused content. As part of our efforts, we are launching a social media feature called "**Member Highlights**" on Instagram and Facebook. In each short casual piece, we will be featuring a CAPCA member with a photo and a quote. Featured PCAs will be nominated by their local chapter. If you know someone you think should be featured, please send their information to Ashley Hinson at ashley@capca.com

Facebook:
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Instagram:
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Photo: "Little Shasta Road," by CAPCA member, E. Kersh

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