Project WERA-1017: Coordination of IPM Research and Extension/Educational Programs in the Western States and Pacific Basin Territories

ANNUAL STATE IPM REPORT FOR CALIFORNIA

Submitted by: James Farrar, Director
Submitted: 16 September 2019

Summary

In 2018, California continued its mission to provide science-based, practical solutions to manage pests. David Haviland won the UC Agriculture and Natural Resources (ANR) Award for Outstanding Extension and the Pacific Branch Entomological Society Excellence in Extension Award. Cheryl Wilen won the UC ANR Award for Outstanding Leadership. Jim Stapleton and the Soil Fumigant Alternatives/Bio Solarization Team won the California Department of Pesticide Regulation IPM Achievement Award. In the area of change, California's pest management web resources are moving to a mobile-friendly format while migrating the content to a database system. This will help better provide pest management information where and when people want it, while becoming nimbler in developing new decision-support tools. Over the last 20 years state and federal resources have continuously dwindled, and we now have to face the fact that they will not return. New funding models must be developed. California is exploring new funding streams including fee-for-service, a partnership program, and individual donations. This is a big change in mind-set from the era of free university cooperative extension.

Accomplishments and Impacts (2018)

Area addressed: Urban and Community IPM

Activity: Schools Outdoor Baiting Program to Manage Cockroaches

Output: Inside buildings, insecticide bait has been the standard management practice for decades. It is very effective. Area IPM Advisor Andrew Sutherland wants outdoor bait programs to become more common. Many were skeptical outdoor baits could work since gel baits can dry out quickly and dust can coat the surface making it less attractive. Funding from the California Department of Pesticide Regulation and the National Pest Management Association enabled Sutherland to show that baits could be effective outdoors in hot and arid environments. In addition to baiting, both schools invested in door sweeps and hardscape sealants to prevent cockroaches from getting inside. Insecticidal foam targeted the areas where cockroaches breed and hide. Training to use baits was provided to school personnel and pest control technicians. In just one month, numbers of cockroaches crashed. The project was continued for a full year. Roach numbers stayed low to nonexistent for the full year at both schools. Both school districts have maintained their baiting programs to continue to keep cockroaches out of school buildings.

Short-term outcomes:

Sutherland designed an effective cockroach management program that reduces outdoor numbers and prevents cockroaches from entering structures. This program can be used in schools and child-care environments without the posting and notification requirements, saving

school personnel and pest management professionals time and effort. This demonstration of the efficacy of outdoor baiting for Turkestan cockroaches benefits California, other states, and countries worldwide that may rely on applications of liquid pesticides to manage outdoor pests.

Impacts:

- Increased ecological sustainability of landscapes
- Reduced human health and environmental risks associated with pests and pesticides

●●●

Area addressed: Urban and Community IPM

Activity: Los Angeles State Historic Park Gets Savvy About IPM

Output: The restoration of the Los Angeles Historic Park provided an incredible opportunity to develop and implement an IPM program for the 32-acre park, which is located close to downtown Los Angeles. Working with input from a steering committee for this three-year project, Area IPM Advisor Cheryl Wilen, consultant Phil Boise (Urban Ag Ecology), and others developed an IPM Policy that the park can follow to make pest management decisions, prioritize management resources, and refer to when the public requires rationale about how the park is managed as related to pest management. Wilen and Boise held workshops for the park's landscaping and science interpretation staff to train them about plant health, soil improvement, and implementation of IPM, often using the resources from the UC IPM Program. “We found that the landscaping staff became much more aware of the ways they could modify their practices to reduce pest problems after Cheryl and I trained them at the workshops," says Boise. In addition to the workshops, Wilen and research assistant Monica Dimson used the landscape architectural plan provided by the Park to create a guidebook, *Plant and Pest Guide: Los Angeles State Historic Park*, which includes common pest issues related to plants. The park’s educational staff distributed informational brochures about IPM in English, Spanish, and Mandarin to the public that visits the park.

Short-term outcomes:

The park staff and others, including visitors, are now using the guidebook to identify pests and report to the IPM Coordinator. The landscaping staff became much more aware of the ways they could modify their practices to reduce pest problems after the workshops. Further, a volunteer, inspired by the guidebook, developed a citizen science project in the iNaturalist app. There have been over 600 observations recorded in the iNaturalist project, and 212 species have been identified, including some beneficials and pests. This collaborative project successfully developed comprehensive resources to reduce exposure to pesticides, while raising awareness and increasing enjoyment in a valued urban green space.

Impacts:

- Improved management and use of land
- Increased ecological sustainability of landscapes
- Decrease in environmental problems caused by pests or pest management, such as improved air quality
- Human health risks from pests and managing pests are reduced, leading to improved community health and wellness
- Improved access to positive built and natural environments
- Reduced human health and environmental risks associated with pests and pesticides

●●●

Area addressed: Agricultural Production IPM

Activity: Researching the benefits of mating disruption for vine mealybug management in table grape

Output: Mating disruption has recently become available for vine mealybug. University of California Cooperative Extension Advisor and UC IPM Affiliated Advisor David Haviland evaluated the use of microencapsulated pheromone as part of an IPM program for vine mealybug in table grapes. The microencapsulated pheromone is carried in a liquid that can be applied using a standard sprayer. Once applied, the pheromone is slowly released into the vineyard. Haviland evaluated two application timings of the pheromone, a 30-day interval and a 45-day interval over the season. Haviland found that pheromone applications at 30-day intervals continuously reduced the capture of male mealybugs in traps compared to the number of male mealybugs found in traps in the experimental vineyards without mating disruption. In the 45-day interval timing experimental vineyards, fewer male mealybugs were caught in traps for 30 days, but after 30 days, Haviland observed a resurgence of male mealybug numbers. In experimental vineyards where pheromone was applied every 45 days, the number of male mealybugs captured in traps was approximately 4 to 7 times higher than the number of mealybugs captured in vineyards where the pheromone was applied every 30 days. Harvested grape clusters in the 30-day interval mating disruption vineyards had fewer mealybugs compared to the experimental vineyards where no pheromone was applied. Similar numbers of mealybugs were found in the grape clusters in vineyards where the pheromone was applied at 45-day intervals and no pheromone was applied. Haviland concludes that adding mating disruption enhances the management of vine mealybug and that more research is needed.

Short-term outcomes:

Based on the reduction of infested grape clusters by mating disruption, Haviland calculated a savings of approximately $32 and $136 per acre for two experimental vineyards. The cost of pheromone application is approximately $60 per acre. He also points out a savings on the costs of labor by reducing the number of infested clusters. Infested grape clusters slow picking, processing, and packing clusters. His research is improving the integrated pest management program for vine mealybugs. Other potential outcomes: reduced insecticide applications, reduced numbers of mealybugs without increased insecticide use, improved crop quality, improved sustainability of grape production, and improved profitability of grape production.

Impacts:

- Increased agriculture efficiency and profitability
- Increased ecological sustainability of agriculture
- Reduced human health and environmental risks associated with pests and pesticides

●●●

Area addressed: Agricultural Production IPM

Activity: New look for the Agricultural Pest Management Guidelines:

Output: While UC IPM's website is well known for its high-quality content, the current website design is static and difficult to customize as our program needs and user needs change.

Improvements should benefit the user and also increase internal efficiencies. Check out the newly designed agricultural *Pest Management Guidelines*, the first step towards our overall goal of having a database-driven website to improve efficiencies and enhance collaboration with others. The graphic redesign focused on accessibility and improved access on mobile devices. The *Pest Management Guidelines* text was also added into a database (manually copied and pasted, then extensively reviewed to ensure nothing was changed). Databasing all 47 crop *Pest Management Guidelines* content will make it easier for UC IPM to present our content online and make global changes to content—remove a withdrawn pesticide in one place and all instances where it's online are removed. The working goals for the website are to engage users by using new technology for mobile devices and adapt existing knowledge into easy-to-use decision-making tools. The database should facilitate these goals as well as the long-term goal to develop a customizable user portal and the ability to search for information in many different ways (by pest, crop or plant host, management technique, or audience).

Short-term outcomes:

Improved user experience and ability to find IPM information on multiple devices (desktop and mobile). Increased number of instances where UC IPM content is shared in partnership, increasing the reach of IPM information.

Impacts:

- Increased ecological sustainability of landscapes and agriculture
- Increased agriculture efficiency and profitability
- Reduced human health and environmental risks associated with pests and pesticides

●●●

Area addressed: Agricultural Production IPM, Urban and Community IPM

Activity: Updated *Invasive & Exotic Pests* Webpage: The UC IPM *Invasive & Exotic Pests* webpage has been updated with a new look and new content. The webpage still highlights key exotic and invasive pests in California, leading viewers to the most current and important resources. New to the webpage are alerts for potential invasive pests that may not be in California yet. This addition assists Californians with keeping an eye out for pests that have a high likelihood of being detected since a rapid response when exotic pests invade is so important to preventing their establishment. The goal is to add new invasive pest information as quickly as possible. Criteria was developed for what pests to include: 1) pests in California causing harm or have the potential to cause harm (e.g., causes harm in other similar areas); 2) pests that are not endemic: not listed in a *Pest Notes* or *Pest Management Guidelines* or are rated A, B, or Q by California Department of Food and Agriculture; and 3) pests that are likely to come to California and cause harm, or become a problem in California again after an eradication effort. Pests to look out for are listed with an eye icon. Changes included removing pests such as diaprepres root weevil, light brown apple moth, glassy-winged sharpshooter, spotted wing drosophila, vine mealybug, tomato yellow leaf curl; changing the status of European grapevine moth to eradicated and something to watch for; and adding Italian white snail and nutria.

Short-term outcomes:

Improved awareness and knowledge about California invasive species.

Impacts:

- Increased ecological sustainability of landscapes and agriculture
- Increased agriculture efficiency and profitability
- Reduced human health and environmental risks associated with pests and pesticides

Publications

2018 Peer-Reviewed Publications

2018. *UC IPM Pest Management Guidelines: Avocado*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 3436. http://ipm.ucanr.edu/PMG/selectnewpest.avocado.html (updated)

2018. *UC IPM Pest Management Guidelines: Cole Crops*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 3442. http://ipm.ucanr.edu/PMG/selectnewpest.cole-crops.html (revised)

2018. *UC IPM Pest Management Guidelines: Dry Beans*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 3446. http://ipm.ucanr.edu/agriculture/dry-beans.html (revised)

2018. *UC IPM Pest Management Guidelines: Onion and Garlic*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 3453. http://ipm.ucanr.edu/agriculture/onion-and-garlic.html (revised)

2018. *UC IPM Pest Management Guidelines: Pecan*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 3456. http://ipm.ucanr.edu/agriculture/pecan.html (updated)

2018. *UC IPM Pest Management Guidelines: Strawberry*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 3468. http://ipm.ucanr.edu/agriculture/strawberry.html (revised)

2018. *UC IPM Pest Notes: Dandelion*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 7469. http://ipm.ucanr.edu/PMG/PESTNOTES/pn7469.html (revised)

2018. *UC IPM Pest Notes: Snails and Slugs*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 7427. http://ipm.ucanr.edu/PMG/PESTNOTES/pn7427.html (revised)

2018. *UC IPM Pest Notes: Weed Management in Landscapes*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 7441. http://ipm.ucanr.edu/PMG/PESTNOTES/pn7441.html (revised)

2018. *UC IPM Pest Notes: Asian Citrus Psyllid and Huanglongbing Disease*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 74155. http://ipm.ucanr.edu/PMG/PESTNOTES/pn74155.html (revised)

2018. *UC IPM Pest Notes: Brown Recluse and Other Recluse Spiders*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 7468. http://ipm.ucanr.edu/PMG/PESTNOTES/pn7468.html (revised)

2018. *UC IPM Pest Notes: Ground Squirrel*. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 7438. http://ipm.ucanr.edu/PMG/PESTNOTES/pn7438.html (revised)

Achmon Y, Sade N, Wilhelmi MD, Fernández-Bayo JD, Harrold DR, Stapleton JJ, VanderGheynst JS, Blumwald E, Simmons CW. 2018. The effects of short-term biosolarization using mature

compost and industrial tomato waste amendments on the generation and persistence of biocidal soil conditions and subsequent tomato growth. *Journal of Agricultural and Food Chemistry* 66(22):5451–5461.

Baspinar H, Doll D, Rijal JP. 2018. Pest management in organic almonds. *In:* The Handbook of pest Management in organic farming (Eds. Vincenzo Vacante and Serge Kreiter). pp. 328-347.

Byrne FJ, Grafton-Cardwell EE, Morse JG, Olguin AE, Zeilinger AR, Wilen C**,** Bethke J, Daugherty MP. 2018. Assessing the risk of containerized citrus contributing to Asian citrus psyllid (*Diaphorina citri*) spread in California: Residence times and insecticide residues at retail nursery outlets. *Crop Protection* 109 33–41.

Crump A, Farrar J, Fournier AJ, Ellsworth PC. 2018. Employing California Pesticide Use Data for Evaluating Integrated Pest Management Programs and Informing Pesticide Policy and Regulation. IN: Managing and Analyzing Pesticide Use Data for Pest Management, Environmental Monitoring, Public Health and Public Policies. American Chemical Society Symposium Series #1283. Pages 225–237.

Del Pozo-Valdivia AI, Reisig DD, Arellano C, Heiniger R. 2018. A Case for Comprehensive Analytical Analyses Demonstrated by Evaluating the Yield Benefits of Neonicotinoid Seed Treatment in Corn (*Zea mays* L.). *Crop Protection* 110: 171–182.

Farrar JJ, Ellsworth PC, Sisco R, Baur ME, Crump A, Fournier AJ, Murray MK, Jepson PC, Tarutani CM, Dorschner KW. 2018. Assessing Compatibility of a Pesticide in an IPM Program. *Journal of Integrated Pest Management* 9(1):3; 1–6. doi: 10.1093/jipm/pmx032

Fernandez-Bayo JD, Randall TE, Achmon Y, Hestmark KV, Harrold DR, Su J, Dahlquist-Willard, RM, Gordon TR, Stapleton JJ, VanderGheynst JS, Simmons CW. 2018. Effect of waste management practices on organic wastes to inactivate *Brassica nigra* and *Fusarium oxysporum* f.sp. *lactucae* using soil biosolarization. *Pest Management Science* 74(8): 1892–1902.

Flint ML. 2018. Pests of the Garden and Small Farm, Third Edition. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 3332.

Flint ML, Sutherland A, Windbiel-Rojas K. 2018. Vegetable Pest Identification for Gardens and Small Farms. University of California Statewide Integrated Pest Management Program. Oakland: UC ANR Publication 3553.

Rijal JP, Godfrey LD. 2018. Efficacy of selected bio-and reduced risk insecticides on mint root borer. *Arthropod Management Tests* (Editor-reviewed). 43(1), 1 January 2018, tsx134.

Rijal JP, Gyawaly S. 2018. Characterizing brown marmorated stink bug injury in almond, a new host crop in California. *Insects* 9(4), 126. https://doi.org/10.3390/insects9040126.

Rijal JP, Regmi R, Ghimire R, Puri KD, Gyawaly S, Poudel S. 2018. Farmers' knowledge on pesticide safety and pest management practices: a case study of vegetable growers in Chitwan, Nepal. *Agriculture* 8, 16.

Taravati S. 2018. Evaluation of Low-Energy Microwaves Technology (Termatrac) for Detecting Western Drywood Termite in a Simulated Drywall System. *Journal of Economic Entomology* 111:1323–1329.

Taravati S, Mannion C, McKenzie C, Osborne L. 2018. Lethal and Sublethal Effects of Selected Systemic and Contact Insecticides on *Nephaspis oculata* (Coleoptera: Coccinellidae), in a Tri-Trophic System. *Journal of Economic Entomology* 112(2):453–548.

Taravati S, Mannion C, McKenzie C, Osborne L. 2018. Oviposition Preference of Rugose Spiraling Whitefly (Hemiptera: Aleyrodidae) on Five Host Plant Species. *Florida Entomologist* 101:611–617.

2018 Extension Bulletins/Newsletter Articles/Technical Reports/Blog Posts

2018. Retail Nursery and Garden Center IPM News. Volume 8: 3 Fall. University of California Statewide IPM Program. http://ipm.ucanr.edu/PDF/PUBS/Fall_2018_Retail_Newsletter.pdf

- Wilen C. 2018. Managing Weeds in Landscapes. *Retail Nursery and Garden Center News*. 8: 3, 1,4.

2018. Retail Nursery and Garden Center IPM News. Volume 8: 2 Summer. University of California Statewide IPM Program. http://ipm.ucanr.edu/PDF/PUBS/Summer_2018_Retail_Newsletter.pdf

- Messenger-Sikes B, Windbiel-Rojas K. 2018. When Familiar Pesticides Change. *Retail Nursery and Garden Center IPM News*. Vol. 8: 2.
- Windbiel-Rojas K. 2018. What is a Pesticide?. *Retail Nursery and Garden Center IPM News*. Vol. 8: 2.
- Windbiel-Rojas K. 2018. Mosquito Problem in Garden Centers. *Retail Nursery and Garden Center IPM News*. Vol. 8: 2.

2018. Retail Nursery and Garden Center IPM News. Volume 8: 1 Spring. University of California Statewide IPM Program. http://ipm.ucanr.edu/PDF/PUBS/Spring_2018_Retail_Newsletter.pdf

2018. Green Bulletin. Volume 8: 2 Fall. University of California Statewide IPM Program. http://ipm.ucanr.edu/PDF/PUBS/greenbulletin.2018.fall.pdf

- Taravati S. 2018. Dark Rover Ant: Current Status in California. *UC IPM Green Bulletin* 8.

2018. Green Bulletin. Volume 8: 1 Spring. University of California Statewide IPM Program. http://ipm.ucanr.edu/PDF/PUBS/greenbulletin.2018.spring.pdf

- Messenger-Sikes B, Windbiel-Rojas K. 2018. New Fipronil Label Protects Water. *Green Bulletin*. Vol 8: 1.
- Quinn N. 2018. Investigating the pathways of rodenticide in urban wildlife. *UC IPM Green Bulletin*.

2018. Quick Tips. University of California Statewide IPM Program.

- Carpet Beetles (new)
- Mealybugs (new)
- Pantry Pests (new)
- Ants
- Asian Citrus Psyllid and Huanglongbing Disease
- Bark Beetles
- Bed Bugs
- Beneficial Predators
- Cockroaches
- Common Garden Spiders
- Garden Chemicals: Safe Use & Disposal
- House Mouse
- Lady Beetles
- Landscape Design & Water Quality
- Mosquitoes
- Parasites of Insect Pests
- Peach Leaf Curl
- Powdery Mildew
- Rats
- Snails and Slugs
- Spider Mites
- Tree Borers
- What is IPM?
- Whiteflies

Baur M, Crump A, Farrar J, Elliott S. 2018. Integrated Pest Management Improvements in California Melons from 2003 to 2016. 8 pages. Western IPM Center. http://westernipm.org/index.cfm/about-the-center/publications/special-reports/melon-ipm-report-pdf/

Berger LA, Farrar JJ, Goodell PB. 2018. Pests, Pesticides, and the IPM Project | Creating a Roadmap for the Next Generation of IPM in California. *CAPCA Adviser* XXI, 5: 34–36.

Berger LA, Farrar JJ, Goodell PB, McIntyre J. 2018. Roadmap for Integrated Pest Management: Systems Thinking to Build Better IPM for All Californians. 19 pages. https://www2.ipm.ucanr.edu/pests-pesticides-and-ipm-project/

Blecker L. Proper Selection and Use of Personal Protective Equipment (PPE) in California. *CAPCA Adviser* XXI, 1: 26–31.

Burks CS, Symmes, Rijal J. March/April 2018. Monitoring and Treatments of NOW in Walnuts: Research Update. *Progressive Crop Consultant*, 18–21.

Burks CS, Symmes EJ, Rijal JP. January 2018. Source, Monitoring, and Management of Lepidoptera Pests of Walnuts. Walnut Research Reports 2017.

Burks CS, Symmes EJ, Rijal JP. 2018. Movement of Navel Orangeworm Males and Females Between Adjacent Walnut and Almond Orchards. 92nd Annual Orchard Pest and Disease Management Conference. January 2018, Portland Oregon (abstract).

Del Pozo-Valdivia AI. 2018 April. Red Aphids in Organic Lettuce. Salinas Valley Agriculture Blog. https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=27055

Del Pozo-Valdivia AI. 2018 May. Scouting for Bagrada Bug and an Update on Biological Control Project on this Pest. Salinas Valley Agriculture Blog. https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=27147

Del Pozo-Valdivia AI. 2018 June. Bagrada Bug Update. Salinas Valley Agriculture Blog. https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=27561

Del Pozo-Valdivia AI. 2018 August. Got "Red" Aphids? Salinas Valley Agriculture Blog. https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=27890

Del Pozo-Valdivia AI. 2018 August. Dealing with Diamondback Moth. Salinas Valley Agriculture Blog. https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=28052

Del Pozo-Valdivia AI, Merchan HA, Smith R. 2018. Management of Aphids in Lettuce Grown in California Central Coast. *CAPCA Adviser Magazine*, Vol XXI, No. 4, 40–43

Fernández-Bayo JD, Stapleton JJ, Achmon Y, VanderGheynst JS, Simmons CW. 2018. The role of organic amendment stability on soil biosolarization efficacy. Page 31 in: *Book of Abstracts, IX International Symposium on Soil and Substrate Disinfestation*. https://www.sd2018crete.com/img/IX_Soil_Abstract_Book.pdf

Hasey JK, Lightle DM, Jarvis-Shean KS, Milliron LK, Symmes EJ, Hanson B, Fulton A, Murdock J, Sumner DA. December 2018. Sample Costs to Produce English Walnuts: Sacramento Valley. University of California Cooperative Extension Agricultural and Natural Resources Agricultural Issues Center.

Hasey J, Symmes EJ. August 2018. Walnut Orchard Tasks. *Pacific Nut Producer*.

Haviland D, Rijal J, Symmes EJ. October 2018. Evaluation of Mating Disruption as Part of an IPM Program for Navel Orangeworm in Almonds. *CAPCA Adviser*, 38–42.

Haviland D, Rill S, Rijal JP, Symmes E. 2018. Demonstration and implementation of IPM in Almonds. Almond Board of California Annual Conference, 5–7 December, Sacramento, CA.

Jarvis-Shean KS, Niederholzer FJA, Symmes EJ. March 2018. Prune Bloom Orchard Management Considerations. UCCE Sacramento Valley Prune News.

Lightle DM, Symmes EJ. March 2018. Orchard Management Considerations. UCCE Sacramento Valley Walnut News.

Lightle DM, Symmes EJ, Niederholzer FJA. October 2018. Fall and Winter Prune Orchard Management Considerations. UCCE Sacramento Valley Prune News.

Martin T, Rijal JP. 2018. Brown marmorated stink bug moving into agriculture. The IPM Corner Blog (June).

Michailides T, Morgan DP, Felts DG, Luo Y, Brisach C, Moral J, Puckett R, Brown P, Gonzalez D, Hasey J, Lampinen B, Symmes EJ, Buchner R, Lightle D, Fichtner E. January 2018. Epidemiology and Management of Botryosphaeria/Phomopsis Canker and Blight and Anthracnose Blight in Walnut. Walnut Research Reports 2017.

Milliron LK, Hasey J, Lightle DM, Symmes EJ, Michailides T. September 2018. Fall Orchard Management Considerations. UCCE Sacramento Valley Walnut News.

Niederholzer FJA, Symmes EJ. February 2018. Navel Orangeworm Considerations 2018. UCCE Sacramento Valley Almond News; Sacramento Valley Orchard Source Website (Blog and Content, March 2018).

Niederholzer FJA, Symmes EJ. February 2018. Tips for Nut Growers Living with Navel Orangeworm. *Western Fruit Grower*.

Quinn N. 2018. Researching Rodenticide Pathways and Impacts in California. *CAPCA Applicator Alert: Vertebrate Pest Issue*. III:3.

Rijal JP. 2018. Understanding the Overwintering Biology of the Husk Fly—A Research Update. Field Notes Newsletter (August).

Rijal JP. 2018. California almonds: what to expect from third now flight in upper SJV. Ag Fax Update (August 13), https://agfax.com/2018/08/13/california-almonds-what-to-expect-from-third-now-flight-in-upper-sjv/

Rijal JP. 2018. New Pest of Almond: The knowns and unknowns of brown marmorated stink bug in California. *Progressive Crop Consultant* (July/August).

Rijal J. 2018. Mating disruption and navel orangeworm. UCCE Stanislaus Walnut News (Spring).

Rijal JP. 2018. Insect pest monitoring for tree crops (Bloom-Spring). UCCE Field Notes Newsletter (February).

Rijal JP. 2018. Invasion of brown marmorated stink bug in California agriculture. Poster. ANR Statewide Conference, 9–12 April, Lancaster, CA.

Rijal JP. 2018. Developing sampling methods for pre-season mite detection in almonds. Poster. Almond Board of California Annual Conference, 5–7 December, Sacramento, CA.

Rijal JP. 2018. An update on brown marmorated stink bug spread to the agricultural crops in the northern San Joaquin Valley, California. Abstract. 92nd Orchard Pest and Disease Conference 10–12 January, Portland, OR. page 30.

Rijal JP, Haviland D. 2018. Integration of mating disruption into management programs for navel orangeworm. *West Coast Nut* (June).

Rijal JP, Tollerup K, Zalom F. 2018. Development of sampling methods for pre-season mite detection in almonds. Abstract. 92nd Orchard Pest and Disease Conference, 10–12 January, Portland, OR. page 17.

Rios S, Quinn N. 2018. Wild Pig Management. *CAPCA Applicator Alert: Vertebrate Pest Issue*. III:3.

Roncoroni J. 2018. A New Type of Resistance to Glyphosate. *CAPCA Adviser* XXI, 6: 56–57.

Shea, E, Lopez E, Bayo JF, Parr A, Milkereit J, Achmon Y, Hodson A, Stapleton J, VanderGheynst J, Simmons C. 2018. Using biosolarization with almond byproduct amendments to disinfest almond orchard soil during pre-plant processing and improve soil quality. Paper # Agro279 in: Abstracts of Papers of the American Chemical Society (Vol. 256). Washington, D.C. (Abstr.)

Symmes EJ. December 2018. Alternative Devices to Control Navel Orangeworm. Annual Research Update and Report (2018.2019), Almond Board of California.

Symmes EJ. December 2018. Demonstration of IPM Principles and Increasing Adoption in the Sacramento Valley. Annual Research Update and Report (2018.2019), Almond Board of California.

Symmes EJ. December 2018. Sacramento Valley Pest Monitoring and IPM Updates. Annual Research Update and Report (2018.2019), Almond Board of California.

Symmes EJ. December 2018. Scale Pests, Navel Orangeworm, and Flatheaded Borers (Walnut). Sacramento Valley Orchard Source Website (Blog and Content).

Symmes EJ. August 2018. Harvest Damage Evaluation for Almonds. Sacramento Valley Orchard Source Website (Blog and Updated Content).

Symmes EJ. July 2018. Almonds and Walnuts: Are You a Friend to Natural Enemies? *West Coast Nut*, 46–50.

Symmes EJ. April 2018. Approaches to Spider Mite Management in Almonds. *West Coast Nut*, 56–62.

Symmes EJ. March 2018. Walnut Orchard Tasks. *Pacific Nut Producer*.

Symmes EJ. February 2018. Honey Bees and Bloom Sprays. UCCE Sacramento Valley Almond News; Sacramento Valley Orchard Source Website (Blog and Content).

Symmes EJ. January/February 2018. Managing Navel Orangeworm on Two Million Acres. *Progressive Crop Consultant*, 4–6.

Symmes EJ. January 2018.Walnut and Almond Pest Management: Preparing for a Successful New Year. *West Coast Nut*, 12–18.

Symmes EJ. January 2018. Sacramento Valley Pest Monitoring and IPM Updates. Walnut Research Reports 2017.

Symmes EJ, Van Steenwyk RA, Cabuslay C. 2018. Control of Frosted Scale on Walnut. 92nd Annual Orchard Pest and Disease Management Conference. January 2018, Portland Oregon (abstract).

Tollerup K. 2018. Red Imported Fire Ants in San Joaquin Valley Almond Orchards. CAPCA Adviser XXI, 4: 36–39.

Wilen C. 2018. Los Angeles State Historic Park Gets Savvy About IPM. December 19, 2018. https://ucanr.edu/delivers/?impact=1095&a=0

Wilen C. 2018. Crop Safety Fiesta (Fe HEDTA) Herbicide applied over the top at 2 rates and 2 spray intervals. Also, with and without a preemergence herbicide. IR-4 Biopesticide PR. NO.: B00102. December 27, 2018.

Wilen C. 2018. Revisiting Your Integrated Pest Management Policy. *Parks and Recreation Business*. 8/9/2018. https://www.parksandrecbusiness.com/articles/2018/8/revisiting-an-integrated-pest-management-policy

2018 Extension Online Trainings/Videos/Website Tools & Pages

Online Course: Proper Selection, Use, and Removal of Personal Protective Equipment. http://ipm.ucanr.edu/training/

Video: Respirators UC Ag Experts Talk webinar series. https://www.youtube.com/watch?v=by9taoqm4vU&feature=youtu.be Video: Avocado Root Rot Disease UC Ag Experts Talk webinar series. https://www.youtube.com/watch?v=L-2x0I6KsZk&feature=youtu.be Video: Citrus Thrips UC Ag Experts Talk webinar series. https://www.youtube.com/watch?v=l2GnmTjQLp0&feature=youtu.be

Web Tool: Bee Precaution Pesticide Ratings. https://www2.ipm.ucanr.edu/beeprecaution (updated with new pesticides and ratings)

Webpage: Best Management Practices to Protect Bees from Pesticides. ipm.ucanr.edu/mitigation/protect_bees.html (revised to address adjuvants, chemigation, dust from granule application, pesticide-treated seed, and tank mixes)

Webpage: Invasive & Exotic Pests. https://www2.ipm.ucanr.edu/Invasive-and-Exotic-Pests/ (added new pest alert peach root-knot nematode)