2565 Alluvial Ave. Suite #152, Clovis, California 93611 • P. 559 456-9096 • F. 559 456-9099

AGENDA

California Olive Committee
Research Subcommittee Meeting

San Joaquin County Ag. Commissioner Office
2101 E. Earhart Ave.
Stockton, CA 95206
Zoom/Conference Call

Tuesday, August 4, 2026
9:00 am

Join Zoom Meeting:
https://us02web.zoom.us/j/81880432234

Meeting ID: 818 8043 2234

Dial-in: +1 (669) 444-9171

I. Call to Order - Chairman Dennis Burreson

a. Roll Call
b. Research Subcommittee Chairman's comments
c. Approval of Previous Research Committee Minutes: November 20, 2025 (action item) (page 3)

II. Review of 2025 Research Final Reports (page 11)

III. Grant Application (page 53)

IV. Product Registration Update (page 54)

V. Discussion and Approval of 2027 Research Priorities (action item) (page 55)

VI. Other Business

VII. Adjournment

2025-2027 Research Subcommittee:

Producer Members:

Carolina Burreson
Michael Silveira
Kevin Neeley
Andy Weinrich
Michael Stokes
Vito DeLeonardis
Giulio Zavolta
Pat Ricchiuti
Galen Pfeiffer
Mark Heuer

Handler Members:

Dennis Burreson-Chairman
John Pieretti
Tomas Masanes Autard
Julia Tinsley
Phil Quigley
Vacant

California Olive Committee

RESEARCH SUBCOMMITTEE MEETING

NOVEMBER 20, 2025
9:00 a.m.

California Olive Copmmittee
2565 Alluvial Avenue, Suite 152
Clovis, CA 95206

Zoom/Conference Call
http://US02web.zoom.us/j/89701065641

MINUTES

I. CALL TO ORDER

Chairman Dennis Burreson called the meeting of the Research Subcommittee to order at 9:01 a.m. The following Research Committee members were present:

a. Roll Call

Members	**Affiliation:**
Michael Silveira	Producer
Kevin Neeley	Producer
Andy Weinrich	Producer
Michael Stokes	Producer
Giulio Zavolta	Producer
Pat Ricchiuti	Producer
Galen Pfeiffer	Producer
Mark Heuer	Producer
Dennis Burreson	Handler
John Pieretti	Handler
Tomas Masanes Autard	Handler
Phil Quigley	Handler

STAFF	
Todd Sanders	California Olive Committee
Mary McDonnell	California Olive Committee
Ethan Cranmer	California Olive Committee
Janette Ramos	California Olive Committee

Guests	
Abigail Maharaj	USDA
Jeffery Rymer	USDA

b. Establish Quorum

With the appropriate number of members from producers and handlers in, a quorum was established.

c. Approval of Previous Minutes – ACTION

The minutes of the August 7, 2025, meeting was presented to the Board for approval.

- **MOVED by RICCHIUTI, duly seconded by PIERETTI, and carried THAT the minutes for August 7, 2025, be approved as presented. (MOTION 11-20-25 #1)**

II. DISCUSSION AND REVIEW OF 2025 PROJECTS

Each year, the Subcommittee funds research projects, and requests progress reports from researchers. The research progress reports were provided in the packet.

2025 Research Projects

#	Researcher	Project
1	Dr. Jim Adaskaveg*	Epidemiology and Management of Olive Knot Caused by Pseudomonas Savastanoi pv. Savastanoi (Year 1)
2	Rodrigo Almeida and Franklin Lewis	Survey of Xylella Fastidiosa Genetic Diversity within California Olive Trees (Year 2)
3	Georgia Drakakaki, and Becky Wheeler-Dykes	Evaluation of Effects of Accede (ACC) at Two Different Application Rates on Enhancing Horticultural Maturity and Abscission Zone Development and Commercial Trunk Shaking Efficiency in Table Olives (Year 3)
4	Dr. Carol Lovatt and Elizabeth Fichtner	Integrating Alternate Bearing Mitigation Strategies in a Commercial Table Olive Orchard (Year 3)
5	Elizabeth Fichtner	Designing a Web App for Predicting Risk of Olive Fruit Fly – a Tool for California Olive Growers and Pest Control Advisors
6	Nicholas Manoukis**	New Prospects for the Control of Black Scale in California Olive Groves
7	Ernie Simpson	Sacramento Valley Olive Fruit Fly Monitoring Project
8	Jim Stewart	Southern San Joaquin Valley Olive Fruit Fly Monitoring Project

*Projects co-funded by the Olive Oil Commission of California.
**No progress report due to government delay.

III. PRESENTATION OF 2026 PROPOSALS

a. 2026 Priorities

Below are the Research priorities established during the August 7, 2025, meeting.

California Olive Committee Research Priorities for 2026

- Olive Fruit Fly Trapping
- OFF management techniques with an emphasis on examining new traps that attract flies. Also, OFF management techniques focused on needing a membrane and a new delivery system.

- Management of Olive Knot with an emphasis on developing new methods of control via soil applications. Management of Olive Knot focused on systemic rather than topical treatments.
- Management of Peacock Spot
- Evaluation of drone technology and satellite mapping pertaining to moisture evaluation and crop load estimates
- Mechanical harvesting on existing and new high-density orchards
- Development of Loosening Agents
- Olive DNA evaluation to distinguish between different varieties in the market place
- Chemical control of Glassy-winged sharpshooter/Leaf Hoppers
- Determine costs of preventative measures relating to the spread of Xylella-fastidiosa (Xf)
- Pollination assist techniques focused on Manzanillo/ Field measurement tool to determine optimal pollination timing
- Investigation of Urea as a thinning agent. What is the cost and optimal application rate? Where is it currently being used?
- Determine what research has already been conducted regarding sterilization of OFF
- Attract and Kill trap for Olive Fruit Fly
- Black Scale Control from a Natural Insect Pest
- GWSS research on mass trapping
- Biological Research on Black Scale
- Unexplained Crop Failures specifically in the South
- Health Claims backed with research for canned California Ripe Olives

b. 2026 Proposals

2026 Research Proposals

	Researcher	Project	Amount
1	Joel Kimmelshue-Land IQ	Olive Acreage Mapping	$30,700
2	Carol Lovatt and Elizabeth Fichtner*	Integrating Alternate Bearing Mitigation Strategies in a Commercial Table Olive Orchard (year 4/4)	$36,922
3	Elizabeth Fichtner*	Designing a Web App for Predicting Risk of Olive Fruit Fly- a Tool for California Olive Growers and Pest Control Advisors (Year 2/2)	$20,432
4	Dr. Eve Laroche-Pinel*	Moisture and Crop Load Monitoring in Ripe Olives Using Drone Hyperspectral and Satellite Imagery (Year 1/3)	$38,500
5	Georgia Drakakaki, and Becky Wheeler Dykes*	Evaluation of Effects of Accede (ACC) at Two Different Application Rates on Abscission Zone Development and Trunk Shaking Efficiency in Table Olives	$97,799
6	Georgia Drakakaki, and Minmin Wang*	DNA Evaluation to Authenticate manzanilla and Hojiblanca Table Olive Cultivars	$22,625
7	Olivier Ceberio*	Collaborative Nutrient Calibration with California Olive Growers Using Nutriscope	$48,840
8	Rodrigo Almeida*	Ecology of Olive Associated Xylella fastidiosa Strains in California	$46,618
9	Christopher Simpson	Sacramento Valley Olive Fruit Fly Monitoring Project	$13,500
10	Bert Quezada and Jim Stewart	Southern San Joaquin Valley Olive Fruit Fly Monitoring Project	$12,000
		Total	$367,936

c. Product Registration

Product	Active Ingredient	Registrant	Status
Assail 70 WP	Acetamiprid	UPL	Subcommittee instructed staff to look into registering this for OFF. UPL is looking into it.
Assail 30 SG	Acetamiprid	UPL	Subcommittee instructed staff to look into registering this for OFF. UPL is looking into it.
Kasugamycin	Kasumin	UPL	Pushing EPA to look at the products under the AMR (Antimicrobial Resistance) framework which is where Kasumin falls. In January, we will be meeting with EPA to push this through and take it to CDPR.
Syllit	Dodine	UPL	There was a mix-up due to staff turnover — Dodine was believed to have been submitted to CDPR, but it appears that was not the case. The EPA registration for Syllit is approved, so the next step will be submitting to CDPR. However, we're unsure at this point how long that process may take.
Ph-D	Poloyxin D Zinc Salt	UPL	Commercially available for use on olives.

IV. APPROVAL OF 2026 BUDGET – ACTION

The Subcommittee determined which proposed projects to recommend to the Full Committee for funding. An estimated budget of $504,634.87 (with no-cost extensions) is proposed based on the submitted projects.

	Researcher	Project	Amount
1	Joel Kimmelshue-Land IQ	Olive Acreage Mapping	$30,700
2	Dr. Carol Lovatt and Elizabeth Fichtner	Integrating Alternate Bearing Mitigation Strategies in a Commercial Table Olive Orchard (Year 4/4)	$36,922
3	Elizabeth Fichtner	Designing a Web App for Predicting Risk of Olive Fruit Fly—a Tool for California Olive Growers and Pest Control Advisors (Year 2/2)	$20,432
4	Dr. Eve Laroche-Pinel	Moisture and Crop Load Monitoring in Ripe Olives Using Drone Hyperspectral and Satellite Imagery (Year 1/3)	$38,500
5	Georgia Drakakaki and Becky Wheeler- Dykes	Evaluation of Effects of Accede® (ACC) at Two Different Application Rates on Abscission Zone Development and Trunk Shaking Efficiency in Table Olives	$97,799
6	Georgia Drakakaki, and Minmin Wang*	DNA Evaluation to Authenticate Manzanilla and Hojiblanca Table Olive Cultivars	$22,625
7	Olivier Ceberio	Collaborative Nutrient Calibration with California Olive Growers Using Nutriscope	$48,840
8	Rodrigo Almeida	Ecology of Olive Associated Xylella fastidiosa Strains in California	$46,618
9	Christopher Simpson	Sacramento Valley Olive Fruit Fly Monitoring Project	$13,500
10	Bert Quezada and Jim Stewart	Southern San Joaquin Valley Olive Fruit Fly Monitoring Project	$12,000
	2025 -NCE Carol Lovatt	Integrating Alternate Bearing Mitigation Strategies in a Commercial Table Olive Orchard	$13,993.60

	2025 -NCE Elizabeth Fichtner	Designing a Web App for Predicting Risk of Olive Fruit Fly- a Tool for California Olive Growers and Pest Control Advisors	$7,944
	2025 -NCE Georgia Drakakaki and Becky Wheeler- Dykes	Evaluation of Effects of Accede® (ACC) at Two Different Application Rates on Enhancing Horticultural Maturity and Abscission Zone Development and Commercial Trunk Shaking Efficiency in Table Olives	$41,761.27
	2025 NCE-Manoukis	New Prospects for the Control on Black Scale in California Olive Groves	$73,000
		Total without No-Cost Extensions	**$367,936**
		Total with No-Cost Extentions	**$504,634.87**

*Projects are co-funded by the Olive Oil Commission of California.

- **MOVED by PIERETTI, duly seconded by SILVEIRA, and carried THAT the Research Subcommittee fund Dr. Carol Lovatt and Elizabeth Fichtner's project for $36,922, for the 2026 Fiscal Year. (MOTION 11-20-25 #2)**

- **MOVED by SILVEIRA, duly seconded by RICCHIUTI, and carried THAT the Research Subcommittee fund Elizabeth Fichtner's project for $20,432, for the 2026 Fiscal Year. (MOTION 11-20-25 #3)**

- **MOVED by SILVEIRA, duly seconded by BURRESON, and carried THAT the Research Subcommittee fund Georgia Drakakaki and Becky Wheeler-Dykes project for $97,799, for the 2026 Fiscal Year. (MOTION 11-20-25 #4)**

- **MOVED by PIERETTI, duly seconded by MASANES AUTARD, and carried THAT the Research Subcommittee fund Georgia Drakakaki and Minmin Wang's project for $22,625, for the 2026 Fiscal Year. (MOTION 11-20-25 #5)**

- **MOVED by RICCHIUTI, duly seconded by ZAVOLTA, and carried THAT the Research Subcommittee fund Olivier Ceberio's project for $48,840, with the contingency on obtaining additional information, and further discussion on this project, at the next Full Board of Directors meeting. (MOTION 11-20-25 #6)**

- **MOVED by SILVEIRA, duly seconded by RICCHIUTI, and carried THAT the Research Subcommittee fund Rodrigo Almeida's project for $46,618, for the 2026 Fiscal Year. (MOTION 11-20-25 #7)**

- **MOVED by BURRESON, duly seconded by SILVEIRA, and carried THAT the Research Subcommittee fund Christopher Simpson's project for $13,500, for the 2026 Fiscal Year. (MOTION 11-20-25 #8)**

- **MOVED by PIERETTI, duly seconded by RICCHIUTI, and carried THAT the Research Subcommittee fund Bert Quezada and Jim Stewart's project for $12,000, for the 2026 Fiscal Year. (MOTION 11-20-25 #9)**

V. AUTHORITY TO THE EXECUTIVE DIRECTOR AND CHAIRMAN FOR INTER-ITEM TRANSFERS OF THE RESEARCH COMMITTEE BUDGET - ACTION

The Committee discussed granting authority to the Executive Director and Chairman for inter-item transfer of the Research Subcommittee Budget.

- **MOVED by RICCHIUTI, duly seconded by PIERETTI, and carried THAT the Research Committee grant authority to the Executive Director and Chairman for inter-item transfers of the Research Subcommittee Budget.**
  (MOTION 11-20-25 #10)

VI. OTHER BUSINESS

None

VII. ADJOURNMENT

Chairman Dennis Burreson adjourned the Research Subcommittee meeting at 10:17 a.m.



Todd W. Sanders
Executive Director
California Olive Committee

SUMMARY OF MOTIONS FOR NOVEMBER 20, 2025

Motion 11-20-25 #1 **APPROVED**

MOVED by RICCHIUTI, duly seconded by PIERETTI, and carried THAT the minutes for August 7, 2025, be approved as presented.

Motion 11-20-25 #2 **APPROVED**

MOVED by PIERETTI, duly seconded by SILVEIRA, and carried THAT the Research Subcommittee fund Dr. Carol Lovatt and Elizabeth Fichtner's project for $36,922, for the 2026 Fiscal Year.

Motion 11-20-25 #3 **APPROVED**

MOVED by SILVEIRA, duly seconded by RICCHIUTI, and carried THAT the Research Subcommittee fund Elizabeth Fichtner's project for $20,432, for the 2026 Fiscal Year.

Motion 11-20-25 #4 **APPROVED**

MOVED by SILVEIRA, duly seconded by BURRESON, and carried THAT the Research Subcommittee fund Georgia Drakakaki and Becky Wheeler-Dykes project for $97,799, for the 2026 Fiscal Year.

Motion 11-20-25 #5 **APPROVED**

MOVED by PIERETTI, duly seconded by MASANES AUTARD, and carried THAT the Research Subcommittee fund Georgia Drakakaki and Minmin Wang's project for $22,625, for the 2026 Fiscal Year.

Motion 11-20-25 #6 **APPROVED**

MOVED by RICCHIUTI, duly seconded by ZAVOLTA, and carried THAT the Research Subcommittee fund Olivier Ceberio's project for $48,840, with the contingency on obtaining additional information, and further discussion for this project, at the next Full Board of Directors meeting.

MOTION 11-20-25 #7 **APPROVED**

MOVED by SILVEIRA, duly seconded by RICCHIUTI, and carried THAT the Research Subcommittee fund Rodrigo Almeida's project for $46,618, for the 2026 Fiscal Year.

MOTION 11-20-25 #8 **APPROVED**

MOVED by BURRESON, duly seconded by SILVEIRA, and carried THAT the Research Subcommittee fund Christopher Simpson's project for $13,500, for the 2026 Fiscal Year.

MOTION 11-20-25 #9 **APPROVED**

MOVED by PIERETTI, duly seconded by RICCHIUTI, and carried THAT the Research Subcommittee fund Bert Quezada and Jim Stewart's project for $12,000, for the 2026 Fiscal Year.

MOTION 11-20-25 #10 **APPROVED**

MOVED by RICCHIUTI, duly seconded by PIERETTI, and carried THAT the Research Committee grant authority to the Executive Director and Chairman for inter-item transfers of the Research Subcommittee Budget.

****INFORMATION ONLY****

FROM: RESEARCH SUBCOMMITTEE

SUBJECT: 2025 RESEARCH FINAL REPORTS

BACKGROUND:

2025 RESEARCH PROJECTS FOR THE CALIFORNIA OLIVE COMMITTEE

- Projects in red had No Cost Extensions and are now complete. Final Reports can be found in the following pages of the packet.

	Researcher	Project	Amount	No Cost Extension
1	Dr. Jim Adaskaveg*	Epidemiology and Management of Olive Knot Caused by Pseudomonas Savastanoi pv. Savastanoi	$15,490	
2	Carol Lovatt and Elizabeth Fichtner	Integrating Alternate Bearing Mitigation Strategies in a Commercial Table Olive Orchard	$34,984	6/30/2026
3	Georgia Drakakaki, Becky Wheeler Dykes, and Leslie J Nickels Trust	Evaluation of Effects of Accede (ACC) at Two Different Application Rates on Enhancing Horticultural Maturity and Abscission Zone Development and Commercial Trunk Shaking Efficiency in Table Olives	$115,129	6/30/2026
4	Rodrigo Almeida and Franklin Lewis	Survey of Xylella fastidiosa diversity within California olive trees	$31,151	
5	Jim Stewart	Southern San Joaquin Valley Olive Fruit Fly Monitoring	$12,000	
6	Ernie Simpson	Sacramento Valley Olive Fruit Monitor Project	$12,500	
7	Elizabeth Fichtner	Designing a Web App for Predicting Risk of Olive Fruit Fly- a Tool for California Olive Growers and Pest Control Advisors	$19,860	6/30/2026
8	Nicholas Manoukis**	New Prospects for the Control of Black Scale in California Olive Groves	$73,000	12/1/26
		Total	**$314,114**	

*Projects co-funded by the Olive Oil Commission of California.
** No contract was executed, and no invoices were submitted or paid in connection with this project. Dr. Manoukis has stepped down as the Principal Investigator. As a result, the project will not proceed.

Contains confidential information for the COC. Please do not post online.

Department of Botany and Plant Sciences
Relevant AES/CE Project No.: 4556

University of California
Division of Agricultural Sciences

FINAL REPORT
(Year 3 2025 COC Final Report with NCE through June 30, 2026)

Project Year: 2025 Period of Performance: Year 3 of our 2023-2025 project; Year 1 of research in the Ivanhoe orchard to determine the best alternate bearing management strategy and test the efficacy of foliar-applied low-biuret urea and Accede™

Project Leaders:

Carol Lovatt, Ph.D.
Department of Botany and Plant Sciences-072
University of California
Riverside, CA 92521-0124
(O) 951-827-4663 FAX: 951-827-4437 (M) 951-660-6730
carol.lovatt@ucr.edu

Elizabeth Fichtner, Ph.D.
University of California Cooperative Extension
4437 S. Laspina St.
Tulare, CA 93274
(O) 559-684-3310 FAX: 559-685-3319 (M) 559-684-2057
ejfichtner@ucdavis.edu

Project Title: Integrating Alternate Bearing Mitigation Strategies in a Commercial Table Olive Orchard

Collaborator:
Kent Daane, Professor and Cooperative Extension Specialist, Department of Environmental Science, Policy, and Management, UC-Berkeley, CA, and Kearney Agricultural Research and Education Center, 9240 S. Riverbend Ave., Parlier, CA 93648: Phone: 559-646-6522; Fax: 559-646-6593; E-mail: kdaane@ucanr.edu

KD volunteered his time *gratis* to train the Co-PIs and their technical staff (1) to quantify black scale populations at important stages in their life cycle, honeydew produced by black scale, and sooty molds that grow on the honeydew and rate the impact on fruit quality, (2) to analyze the collected data, and (3) to assist the PIs in interpreting the results.

Cooperators:
Donald Cleek, Agricultural Supervisor, UC Lindcove Research & Extension Center, 22963 Carson Avenue, Exeter, CA 93221; Phone: 559-592-2408, Ext 1157; Email: dlcleek@ucanr.edu

DC coordinates the application of treatments, applies the foliar treatments and pruning treatments to the 'Manzanillo' olive trees at Ivanhoe. DC also carries out the harvest at Ivanhoe. Approval for DC to prune, spray and harvest off the Lindcove REC and on the cooperator's property has been secured.

Objectives for 2025 (Year 3): ***Background information.*** A reliable strategy for mitigating the economic problem of alternate bearing (AB), production of a light, low yield "off crop", followed by a heavy, high yield "on" crop, is critical to the sustainability of both the table and oil olive industries. In ON-crop years, trees produce numerous small size fruit with reduced commercial value. In OFF-crop years, trees produce large fruit, in some cases too large, but there are too few fruit of commercially valuable size to provide growers with a good income. In addition, our research also documented that fruit quality was reduced in some OFF-crop years, e.g., the large fruit of OFF-crop trees tended to turn black earlier in the season, which can further exacerbate the problem of too few commercially valuable size fruit. In the ON-crop year, fruit take longer to mature, attain size, and accumulate oil, which delays harvest and further reduces floral intensity the following spring. Alternate bearing often occurs beyond the tree or orchard level, synchronizing across geographic regions, particularly when initiated by environmental conditions that affect crop load (e.g., hot or cold wet weather at bloom in 'Manzanillo' orchards). An industry-wide shortage of fruit in the OFF-crop year has a negative economic impact on every step in the production chain from farm to consumer, including orchard management, harvesting, packinghouse and processor operations, manufacture of value-added products, marketing, and consumer prices, which individually and taken together threaten the stability and sustainability of the table and oil olive industries.

Climate is the major factor initiating alternate bearing. Adverse climate events, such as high or low temperatures, water-deficit stress or excessive winter rain causing soil hypoxia etc., which significantly reduce yield, result in an OFF crop that is followed by an ON crop. Conversely, optimal climate conditions during flowering and fruit set, such that natural fruit thinning fails to occur result in an ON crop that is followed by an OFF crop. Adverse climate events can also reduce bloom of the pollinizer trees in an orchard and impact pollinator activity, reducing out-crossing and causing an OFF-crop. Climate events repeat in a random manner, creating a reoccurring need for a strategy to mitigate alternate bearing and the negative economic impact of alternate bearing on table and oil olive growers and industries.

Objectives for 2025 (Year 3): ***Justification.*** Results of our prior COC-funded research demonstrated that the young developing fruit of the ON crop of 'Manzanillo' olive trees inhibited summer vegetative shoot growth and thereby reduced the number of nodes that can produce floral (inflorescence) buds the following spring (Fichtner and Lovatt, 2018; Sibbett, 2000). The developing ON crop also inhibits the transcription of key genes required for inflorescence development and flower formation. The maturing fruit of the ON crop significantly increased abscission of floral buds for next year's bloom starting in September, as well as inhibiting spring bud break (Chao, 2014; Fichtner and Lovatt, 2018; Fitchner et al., 2021). These later effects of the ON crop are consistent with reports that late-harvested ON crops further reduce return bloom (Lavee, 2007; Ravetti, 2014). Thus, for ON-crop olive trees, the negative effect of the total number of fruit (crop load) on the tree (whole tree effect) is stronger than the effect of fruit set on a shoot

(localized effect). As a result, bearing shoots on ON-crop trees, which are subjected to both localized and whole tree effects of the crop load produce virtually no flowers the following spring (0.8 inflorescences/shoot) (Fichtner and Lovatt, 2018). Thus, it is the nonbearing shoots on ON-crop trees, which are in the minority on an ON-crop tree, that produce the inflorescences at spring bloom following the ON-crop year (13.8 inflorescences/shoot) (Fichtner and Lovatt, 2018). Further, a cytokinin-based strategy was only effective in stimulating summer vegetative shoot growth and increasing return bloom on nonbearing shoots of ON-crop trees (Fichtner and Lovatt 2018; Fichtner et al., 2021). Thus, just thinning the number of fruit per shoot is insufficient. A crop reduction strategy that increases the number of nonbearing shoots is necessary to mitigate the negative effects of the ON-crop in an alternate bearing olive orchard.

Results of our COC-funded research identified two effective crop reduction strategies. Foliar-applied NAA (165 ppm) at full bloom (FB) and pruning (hedging and topping) 28 days after full bloom (DAFB) to one side of the tree and then the other side of the tree every other year, *biennially* not *annually,* evened out total annual yield, but more importantly increased the 3-year cumulative yield of medium + large size fruit with near equal yield distribution in 3 out of 4 years (Fichtner and Lovatt, 2023). However, it is important to note that these results were obtained in an experiment conducted at a single site. Additionally, the success of these two treatments was due in part to not carrying out the scheduled crop reduction treatments in year 5 (the final project year) due to too few inflorescences at bloom based on our calculated sum of the estimated floral intensity at bloom on the east and west sides of the trees in north-south running rows. Thus, knowing when to carry out crop reduction and when not to is important for maintaining high yields of medium + large size fruit. Before this information is recommended for implementation by table olive growers, the results need to be validated in a second experiment conducted in a new commercial table olive orchard. In 2025, our research was conducted in a new 'Manzanillo' table olive orchard in Ivanhoe, CA.

Crop reduction strategies reduce yield and are thus, economically viable in high yield ON-crop years because they increase the yield of commercially valuable size fruit. Foliar application of NAA or pruning to low or medium bloom trees can reduce total yield and yield of medium + large size fruit below the profit margin. Pruning is critical to tree crop production to open the canopy for light penetration (no light, no flowers, no fruit), to increase canopy complexity to create new fruiting shoots and to balance the proportion of bearing vs. nonbearing shoots to maintain yield and fruit size on an annual basis, in addition to keeping rows open for orchard management, e.g., canopy spraying, harvesting. Pruning both sides of the tree in winter has the disadvantage that nonbearing and bearing shoots from the previous year, which have a high and low potential to flower the following spring, respectively, are not as easy to distinguish. Given the random reoccurrence of climate conditions that result in OFF or ON blooms, decisions about when, how many sides of the tree, and how frequently to prune or apply NAA in an orchard are critical and are best made based on a visual inspection of bloom (or fruit set), with knowledge of the potential impact that each decision has on the yield of medium + large size fruit not just in the ON year, but in subsequent years also.

Additionally, it is important to know whether the strategy selected to mitigate alternate bearing will impact table olive orchard pest management. Choices for crop reduction starting in an ON-crop year include pruning both sides of the tree annually, just one side of the tree annually, one

side of the tree every other year, or eliminating pruning in favor of using foliar-applied NAA. Thus, the crop reduction strategy selected to mitigate alternate bearing regulates the degree to which the canopy is open or closed at different times of the year.

Black scale population densities and damage have long been associated with temperatures in the olive tree canopy. More open canopies and more frequent pruning result in higher temperatures and drier conditions – both of which result in greater black scale mortality. This relationship is also clearly associated with summer temperatures, but traditional pruning strategies are timed to post-harvest winter periods, when the scale population has already established and reached second to third instar stages. Our research compares a pruning strategy implemented closer to June, when the scale first instars have hatched and are most vulnerable to hot, dry conditions, with the grower standard practice of winter pruning. By increasing scale mortality at this critical period, damage resulting from the scale's associated honeydew production and growth of sooty mold may be lowered, resulting in reduced use of insecticide sprays targeting black scale.

Ivanhoe - Objectives for 2025 (Year 3): ***Plant material and experimental plan.*** There were three research objectives and goals:

(1) to test the results of our prior COC-funded research in a second commercial 'Manzanillo' table olive orchard (Ivanhoe, CA) to confirm that (*i*.) foliar-applied NAA (165 ppm) at full bloom (FB) or (*ii*.) pruning (hedging and topping) 28 days after full bloom (DAFB) to one side of the tree and then the other side of the tree every other year (*biennially*) are the best crop reduction strategies for reducing the severity of alternate bearing for total yield and yield of medium + large (M+L) size fruit (based on alternate bearing index, ABI) and increasing yields of M+L size fruit compared to each of the following treatments: (*iii*.) ON-/OFF alternate bearing (untreated) control trees; (i*v*., *v.*, *vi.*, and *vii*.) trees treated with urea (4%) at FB or 10 DAFB on one side of the tree and then the other side *annually* or *biennially;* (*viii*, *ix*, *and x*.) trees treated with 200 ppm, 400 ppm, or 800 ppm Accede™ (Valent BioSciences) at FB; or (*xii*) grower standard practice of winter pruning of the entire tree and topping *annually.* ***The goal is to determine the management strategy that best mitigates alternate bearing (AB) and maximizes yield of commercially valuable size fruit***;

(2) to use the sum of the bloom estimates on two sides of an olive tree to decide when to use a crop reduction strategy in a 'Manzanillo' olive orchard to maintain high yields of commercially valuable size M+L fruit and thereby, test how well the relationships among estimated bloom, total yield and yield of M+L size fruit from our previous COC-funded research hold up in a second orchard and to make needed adjustments. ***The goal is to develop a decision support tool that growers will find easy, rapid and valuable to use annually across multiple acres of table olive trees to determine whether a crop reduction strategy is required to maintain yields of M+L size fruit;***

(3) to quantify the effects of crop reduction strategies, which range from pruning both sides of the tree annually, pruning one side every other year, to no pruning (alternate bearing ON-crop control) on the potential lethality of canopy temperatures on first instar black scale populations, and associated effects on honeydew, sooty mold, and fruit quality in a table olive orchard. ***The goal is to determine whether implementation of a specific alternate bearing mitigation strategy in a commercial table olive orchard has the potential to positively or negatively affect black scale pest management, e.g., pesticide use, and table olive fruit quality.***

Lindcove REC, Exeter, CA -Objectives 1 and 2, we continued our second pruning trial on 'Manzanillo' olive trees at the Lindcove RECi n Exeter, CA, to compare pruning one side of the tree 28 DAFB and then the other side *biennially* with pruning both sides of the trees in every other row every other year as requested by growers. This orchard also serves as a control for testing our estimated bloom model. We know our bloom model works in the Lindcove REC orchard. If it does not work at Ivanhoe but continues to work at Lindcove, then we learn that modification is required to expand its use across orchards. If the model does not work at either site in 2025, then we learn that the model's efficacy is influenced by post-bloom climate affecting fruit set as we previously observed in 2024. This research contributes to goals 1 and 2 above.

Research Accomplished in 2025.

Procedures to Accomplish Objectives:

IVANHOE ORCHARD

To meet objective 1. We applied the following treatments to the west side of 'Manzanillo' olive trees in north-south running rows in a commercial orchard in Ivanhoe, CA, going into an ON bloom/ON-crop year. The experiment was designed as a randomized complete block with 14 individual tree replications per treatment and 12 treatments that specifically meet the three objectives of the proposed research. The treatments included:

1) Untreated ON-crop control (last pruned and topped in winter 2023), e.g., alternate bearing control
2) Pruning (hedging and topping) @ 28 DAFB to one side of the tree then the other side of the tree every other year – *biennially* – Treated in 2025
3) Foliar-applied NAA (165 ppm) @ FB to one side of the tree then the other side of the tree every other year – *biennially* – Treated in 2025
4) Foliar-applied urea (4%) @ FB to one side of the tree then the other side of the tree the following year - *annually* – Treated in 2025
5) Foliar-applied urea (4%) @ FB to one side of the tree then the other side of the tree every other year – *biennially* – Treated in 2025
6) Foliar-applied urea (4%) @ 10 DAFB to one side of the tree then the other side of the tree the following year - *annually* – Treated in 2025
7) Foliar-applied urea (4%) @ 10 DAFB to one side of the tree then the other side of the tree every other year - *biennially* – Treated in 2025
8) Foliar-applied Accede (200 ppm) @ FB to one side of the tree then the other side of the tree every other year – *biennially* – Treated in 2025
9) Foliar-applied Accede (400 ppm) @ FB to one side of the tree then the other side of the tree every other year – *biennially* – Treated in 2025
10) Foliar-applied Accede (800 ppm) @ FB to one side of the tree then the other side of the tree every other year – *biennially* – Treated in 2025
11) Pruning (hedging and topping) @ 28 days after full bloom to one side of the tree then the other side on a flexible schedule, using a decision support tool based on sum of the estimated bloom on the two opposing sides of the tree – *flexible schedule* – Treated in 2025; see the justification in the Results section.
12) Control – grower standard practice of pruning two sides of the tree and topping in winter – *annually* – Treated in 2025

Notes: To have a sufficient number of healthy trees of similar size and floral intensity to permit testing multiple concentrations of urea and Accede, the treatment testing foliar-applied NAA (165 ppm) @ FB to one side of the tree then the other side of the tree the following year (*annually*) was not included.

At full bloom (5 May 2025), floral intensity was estimated on the east and west sides of each tree; the orchard rows are oriented north-south. With the exception of the trees in Treatment 12 (which had an estimated sum of the bloom equal to 2.9, likely due to being pruned in the winter before the estimates were done), all trees had a sum of estimated floral intensity greater than 4.5 ± 0.25, which, based on our model, indicated that implementation of a crop reduction strategy was required (Table 1). In 2025, crop reduction treatments were applied to the side of the trees that had the lower bloom (west side of the trees) to ensure a good total yield and yield of CVS M+L fruit in the current year and a good return bloom and yield in 2026. Full bloom foliar applications of NAA (165 ppm), urea (4%), and Accede (at three concentrations: 200, 400 and 800 ppm) were completed just after full bloom on 7 May 2025. In addition, two subsets of trees were treated on 7 May with urea at two higher concentrations (6% and 8%, respectively) to test for phytotoxicity, so we would know if the higher concentrations of urea are safe to use if required in 2026 to increase crop reduction. No phytotoxicity was observed for either the 6% or 8% urea applications. Foliar-applied urea (4%) at 10 days after full bloom (DAFB) was applied on 16 May 2025. Trees in Treatment 2, pruning on one side of the tree and then the other side 28 DAFB, were pruned on the west side of the tree on 4 June 2025. For Treatment 11, trees pruned based on a flexible schedule, all trees were pruned 28 DAFB on the West side of the tree on 4 June 2025 (see justification in the Results section.)

The olive trees in Ivanhoe were harvested 25-29 September 2025. Total yield and fruit size distribution (kg/tree), including yield of M+L size fruit, were determined and used to calculate yield and fruit size distribution as number of fruit per tree and in the development of our decision support tool.

To meet objective 2. We estimated the floral intensity at full bloom 5 May 2025 at our research orchard in Ivanhoe on two opposing sides of the tree on a scale from 0 to 3 (0 = no bloom, 1 = low bloom intensity, 2 = medium intensity bloom and 3 = high intensity bloom) and calculated the sum of the estimated bloom. Bloom estimates were made on the east and west sides of the trees (north-south running rows). The goal was to test the utility of the sum of bloom estimates on two opposing sides of the tree to predict when and when not to implement a crop reduction strategy to better maintain yields of M+L size fruit from one year to the next across orchards of similar size trees pruned according to our prescribed strategy (Fichtner and Lovatt, 2023). Importantly, the model will indicate poor crop years when the yield of commercially valuable size fruit can only be maintained by eliminating the use of a crop reduction strategy. Estimated sum of the bloom data was used to analyze the relationships among bloom estimates, total yield and yield of M+L size fruit by calculating Pearson's product moment correlation coefficients to identify significant relationships ($r > 0.5$, $P \leq 0.05$) to determine how well the new data fit our earlier results to improve our model.

To meet objective 3. Since the new research orchard in Ivanhoe did not have a black scale problem, we placed temperature data loggers in the canopy of the trees in the treatments that

created a gradient from open to closed canopies to determine if, when and for how long branches experience temperatures that cause a high rate of black scale nymph mortality. Based on our review of the literature, we determined when and for how many days branches experience 30°C (86°F) or 33°C (91.4°F), which support egg laying and black scale reproductive population growth, respectively, and temperatures > 33°C (91.4°F), > 35°C (95°F), > 40°C (104°F), and > 45°C (113°F) that progressively reduce black scale fecundity and nymph survival.

Research Accomplished in 2025.

Procedures to Accomplish Objectives:

ORCHARD AT THE LINDCOVE REC, EXETER

To meet objective 1. We continued our pruning research on the 'Manzanillo' olive trees at the Lindcove REC, initiated in 2023, to determine whether pruning one side of the tree and then the other side every other year (*biennially*) *vs*. pruning both sides of the trees in every other row every other year have different effects on total yield and yield of M+L size fruit. This experiment required the use of two sets of trees for each treatment (Treatments 1 and 2 *vs*. 3 and 4, respectively) replicated on 16 individual trees in a randomized complete block design:

Treatments 1 and 2 - pruning one side of the tree 28 DAFB and then the other side *biennially* (for example, rows 1-6 are pruned on one side in year 1, not pruned at all in year 2, and pruned on the opposing side in year 3) and

Treatment 3 - pruning both sides of the trees in every other row every other year, e. g., both sides of trees in rows 7, 9 and 11 are pruned in years 1 and 3,

Treatment 4 - whereas both sides of trees in rows 8, 10 and 12 are pruned in years 2 and 4.

Objective 2. At full bloom (6 May 2025), floral intensity was estimated on the east and west sides of each tree (north-south rows). All trees had a sum of estimated floral intensity less than 4.5 ± 0.25. Based on our model, this indicated that implementation of a crop reduction strategy was not required (Table 3). However, to meet the objective of the research, trees in treatments pruned *biennially* were pruned on the east side of the tree as scheduled (which, coincidently, was the side with the lowest bloom estimate) on 4 June 2025. Trees scheduled to be pruned on both sides of the tree in 2025 were also pruned on 4 June. Trees were topped in 2024 and are scheduled to be topped again in 2026.

Results for 2025.

Ivanhoe: Treatment effects on yield, fruit size and fruit quality and the relationships among estimated bloom, pre-harvest on-tree fruit counts, total yield and yield of CVS fruit.

All trees had a sum of estimated floral intensity greater than 4.5 ± 0.25, except the trees in Treatment 12 (Table 1). Treatment 12 is the grower standard practice of winter pruning the entire tree with topping, which was completed before the bloom estimates were made. Thus, trees in Treatment 12 had a low sum of the bloom estimate of 2.9 (Table 1). In addition, all trees had a greater estimated bloom on the east side of the tree. Thus, crop reduction treatments were applied to the west side of the trees, which had the lower bloom (Table 1) to ensure a good total yield and yield of CVS M+L fruit in 2025 and a good return bloom and yield in 2026. Treatment 11 is pruning (hedging and topping) @ 28 days after full bloom to one side of the tree then the other side on a flexible schedule, using a decision support tool based on estimated sum of the bloom on the two opposing sides of the tree – *flexible schedule.* The trees in Treatment 11 were pruned in 2025. Justification: The average sum of the estimated bloom for the trees in Treatment 11 was 5.3

(Table 1) (9 of 14 trees had a sum of the estimated bloom on the east and west sides of the trees ≥ 4.5 +/- 0.25, the threshold value for implementation of a yield reduction strategy, and only 5 trees had a bloom estimate < 4.5 +/- 0.25).

The olive trees in Ivanhoe were harvested 25-29 September 2025. Just prior to harvest, we counted the number of fruit per 10 shoots on both the east and west side of the trees (north-south running rows) for half the replications (1,677 shoots at Ivanhoe) to determine which sides of the trees produced the majority of the fruit in response to the crop reduction treatments and the OFF- and ON-crop control trees. These data are important for improving our understanding of olive tree productivity and management. Shoots with the greater number of fruit/10 shoots were located on the east (untreated) side of the trees, with the exception of Treatments 3 and 4, urea (4%) applied at FB to the west side of the tree in 2025 and Treatment 12, grower standard winter pruning on all sides of the tree with topping annually, which was completed prior to when the bloom estimates were done (Table 2). The results were anticipated based on the fact that the east side of these trees had greater sum of estimated bloom values than the west side (Table 1). The results suggest that foliar-applied urea (4%) at FB had no effect on crop reduction, whereas foliar-applied urea (4%) at 10 DAFB successfully reduced crop load on the treated side of the tree. The results indicated that 8% foliar-applied urea was more effective for reducing crop load (0.26 fruit/10 shoots than 6% foliar-applied urea (1.56 fruit/10 shoots) for the west (treated) sides of the trees. The significance and utility of the pre-harvest on-tree fruit counts await confirmation with the yield data (kg/tree) in subsequent years. We especially want to know which side of the tree produces the majority of the fruit in the "resting year" for crop reduction strategies applied *biennially* versus those applied *annually.*

To determine the effects of the 12 treatments on fruit size and fruit color, just prior to harvest, we collected and weighed 6,720 individual fruit. These data were used for calculating and statistically analyzing fruit size distribution once the trees were harvested and total yield per tree (kg/tree) was obtained. With regard to treatment effects on fruit color, the majority of fruit on all trees in all treatments was totally green. Only 17 trees out of the 168 data trees (10%) had fruit with color and only 25 fruit out of 6,720 fruit evaluated (0.3%) had any color: 17 fruit were more green > red/black in color; 8 were red/black > green; and 8 were totally black. The trees having fruit with color were not related to any specific treatment and > 99% of all harvested fruit were totally green.

There were no significant differences in total yield or yield of M+L size fruit between the untreated ON-crop control trees (Treatment 1) and trees treated with foliar-applied urea (4%) @ FB to one side of the tree and then the other side – *annually* or *biennially* (Treatments 4 and 5), foliar-applied urea (4%) @ 10 DAFB to one side of the tree and then the other side – *annually* or *biennially* (Treatments 6 and 7), and foliar-applied Accede at 200 ppm or 800 ppm @ FB to one side of the tree and then the other side of the tree every other year – *biennially* (Treatments 8 and 10) (Tables 1 and 2). Thus, these treatments had limited effect in reducing crop load. In contrast, total yield and yield of M+L size fruit were significantly reduced for trees in the three pruning treatments (Treatments 2, 11 and 12) or treated with foliar-applied Accede (400 ppm) @ FB to one side of the tree then the other side – *biennially* (Treatment 9). Intermediate total yield and yield of M+L size fruit were obtained for trees treated with foliar-applied NAA (165 ppm) @ FB to one side of the tree then the other side – *biennially* (Treatment 3). It is important to note that Treatments 4 versus 5, 6 versus 7, and 2 versus 11, are applied *annually* and *biennially*, respectively, were all

treated in 2025 and thus, it was expected that total yields for the paired treatments would not be significantly different.

For the 'Manzanillo' olive trees in the orchard in Ivanhoe, the sum of estimated floral intensity at full bloom was significantly correlated with total yield (kg/tree) ($r = 0.60$; $P < 0.0001$) but less strongly correlated with yield of M+L size fruit (kg/tree) ($r = 0.40$; $P < 0.0001$), as previously observed for the 'Manzanillo' olive trees at Lindcove. It is important to note that the strong linear relationship between total yield (kg/tree) and yield of M+L size fruit (kg/tree) up to the threshold value of 120 kg/tree ($r = 0.78$; $P < 0.0001$) and the decrease in yield of M+L size fruit after this threshold value observed in the Ivanhoe orchard is the same as previously observed for the trees at Lindcove ($r = 0.77$; $P < 0.0001$). The pre-harvest on-tree fruit counts were only a modest predictor of final yield as kg/tree ($r = 0.55$; $P < 0.0001$) but a slightly better predictor of final yield at harvest as number of fruit per tree ($r = 0.61$; $P < 0.0001$).

Based on the sum of the estimated bloom for the 'Manzanillo' olive trees in the Ivanhoe orchard, our model predicted the majority of the trees would have total yields greater than 120 kg per tree, with concomitant low yields of M+L size fruit of approximately 30 kg/tree (Fig. 1) if not treated with a crop reduction strategy. The untreated ON-crop control trees performed as the yield model predicted, producing 54.8 kg M+L size fruit per tree at 116 kg total yield per tree but suggested that the estimated bloom of 5.7 was too high as it indicated the need to implement a crop reduction strategy (Table 1) (Fig. 1). Because bloom intensity was over-estimated, use of crop reduction strategies resulted in total yields that were too low to achieve maximum yield of M+L size fruit (Table 1). The trees at Ivanhoe have little lower canopy compared to the trees at Lindcove, for which we clearly did not adequately compensate when estimating bloom. Bloom estimates should have been approximately 25% lower. We will test this hypothesis in 2026.

Black scale (*Saissetia oleae*) was not present in the 'Manzanillo' olive orchard in Ivanhoe. We used temperature data loggers to record temperatures within the canopy from mid-June to mid-September to determine if crop reduction strategies that result in closed (untreated ON-crop control trees) to partially open (pruning at 28 DAFB on one side of the tree and then the other side every other year - *biennially*) to open canopies (grower standard winter pruning of the entire tree and topping) affect the number of days canopies experience temperatures that might impact black scale populations. Temperatures ≥ 35°C dehydrate and kill 1st instars, ≥ 40°C early in the season kill unhatched eggs and in mid-summer 2nd and 3rd instars, reducing the number of crawlers migrating from leaves to twigs, and temperatures ≥ 45°C kill adult black scales (Australia Olive Association, n.d.; El Aalaoui et al., 2025; Tena et al., 2007). ON-crop trees (closed canopy) accumulated more days (24 days) at temperatures ≥ 33°C, < 35°C than trees subjected to grower standard winter pruning of the entire tree and topping (open canopy) (7 days), with trees having a partially open canopy (pruned 28 DAFB on one side of the tree and then the other *biennially*) accumulating an intermediate number of days (16 days) that was not significantly different from the other two treatments ($P < 0.01$) (Table 3). Pruning treatments (degree of canopy closure to openness) did not significantly affect the number of accumulated days for the other temperature ranges. Untreated ON-crop control trees accumulated more days for temperature ranges ≥ 33°C, < 35°C and ≥ 35°C, < 40°C (56 days total) but significantly fewer days at higher temperatures ≥ 35°C, < 40°C, ≥ 40°C, < 45°C, ≥ 40°C and ≥ 45°C (8 days total) ($P < 0.006$). There were no significant effects for a given treatment across all the temperature ranges. The results indicate that the canopies of untreated ON-

crop control trees remain cooler than the partially open and open canopies of the other two treatments. The ON-crop trees accumulated approximately 50% of 56 days at temperatures ≥ 33°C, < 35°C and ≥ 35°C, < 40°C in June and July, which would likely impact black scale nymphs. The grower standard practice of winter pruning of the entire tree and topping (open canopy) also accumulated 19 days at ≥ 40°C, < 45°C ($P < 0.043$) and 20 days at ≥ 45°C ($P < 0.013$) during June and July (data not shown). The results of this first year are consistent with the concept that open canopies are hotter than closed canopies and suggest that pruning, especially topping, will increase canopy temperature, which in turn could reduce back scale populations and associated honeydew production and growth of sooty mold and increase olive fruit quality and reduce insecticide use. We are continuing this research to establish the consistency of the results, to determine the effect of topping and what happens during the "resting year" of trees pruned *biennially*.

Lindcove REC, Exeter: Treatment effects on yield, fruit size and fruit quality and the relationships among estimated bloom, pre-harvest on-tree fruit counts, total yield and yield of CVS fruit at the Lindcove REC in Exeter.

At full bloom (6 May 2025), floral intensity was estimated on the east and west sides of each tree (north-south rows). All trees had a sum of estimated floral intensity less than 4.5 ± 0.25, which based on our model indicated that a crop reduction strategy should not be implemented (Table 4). However, to meet the objective of the research, trees in treatments pruned biennially were pruned on the east side of the tree as planned (which, coincidently, was the side with the lowest bloom estimate) (4 June 2025). Trees scheduled to be pruned on both sides of the tree in 2025 were also pruned on 4 June. Trees were topped in 2024 and are scheduled to be topped again in 2026.

The 'Manzanillo' olive trees were harvested on 2 October 2025. Just prior to harvest, we counted the number of fruit per 10 shoots on both the east and west sides of the trees (north-south running rows) for half the replications (640 shoots) in the Lindcove REC orchard to determine which side of the trees produced the majority of the fruit in response to the treatments. The majority of fruit/10 shoots/side were on the west (untreated) side of the trees, except trees in Treatment 3, which were pruned on both sides of the tree. There was no significant difference in average sum of the fruit /10 shoots on the east plus west sides of trees pruned on one side of the tree and then the other side *biennially* versus trees pruned on both sides of the trees in every other row every other year. In addition, just prior to harvest, we collected and weighed 2,560 individual fruit to calculate fruit size distribution (kg/tree) and determine treatment effects on fruit color. At Lindcove, the presence of colored fruit was low but occurred on more trees than at Ivanhoe, with 58% of the trees in the experiment having fruit with color: 51 fruit were more green > red/black in color, 24 were red/black > green and 35 totally black. The trees with colored fruit were evenly distributed among treatments. Despite colored fruit being present on more than half the trees in the research, the total number of fruit having color was only 6.3% of all fruit analyzed (2,560 fruit); 94% of the fruit were totally green.

To determine whether pruning one side of the tree and then the other side every other year (*biennially*) *vs*. pruning both sides of the trees in every other row every other year have different effects on total yield and yield of M+L size fruit required the use of two sets of trees for each (Treatments 1 and 2 *vs*. 3 and 4, respectively) (Table 4). Consistent with the fact that the sum of the estimated bloom indicated that a crop reduction strategy should not be implemented, pruning the trees as planned resulted in low total yields (kg/tree) with yields of M+L size fruit too low to

provide a good income. There were no significant treatment effects on the sum of the estimated bloom (Table 4), number of fruit/10 shoots/side (Table 5), total yield or yield of M+L size fruit (Table 4) for the individual Treatments 1-4. When the two treatments necessary to answer the question were combined and compared (Treatments 1 and 2 *vs*. Treatments 3 and 4), there were also no significant differences due to treatment on the sum of the estimated bloom, total yield and yield of M+L size fruit (Table 4). However, pruning one side of the tree and then the other side every other year (*biennially*) resulted in 18.8 kg/tree greater total yield and 23.3 kg/tree greater yield of commercially valuable M+L size fruit than pruning both sides of the trees in every other row every other year (Table 4). Thus, when trees were pruned on one side of the tree and then the other side every other year (*biennially*), yield of M+L size fruit was 44% of total yield, whereas when trees were pruned on both sides of the trees in every other row every other year yield of M+L size fruit was only 16% of total yield.

Pruning one side of the tree and then the other side every other year (*biennially*) *vs*. pruning both sides of the trees in every other row every other year had no significant effect on 3-year (2023+2024+2025) cumulative total yield (kg/tree) or yield of commercially valuable M+L size fruit (kg/tree) (Table 6) or as cumulative total number of fruit per tree or number of M+L size fruit per tree (data not sown). There was no statistically significant difference in the severity of alternate bearing between the two pruning treatments per block. Trees pruned on one side of the tree and then the other side every other year (*biennially*) produced 57 kg/tree more total yield and 32 more kg/tree of commercially valuable M+L size fruit than trees pruned on both sides of the trees in every other row every other year at the end of 3 years. ABI was low at 0.36 for total yield (kg/tree) and 0.74 for yield of M+ size fruit for both pruning strategies for the 2023-2024 2-year cycle. For the 2024-2025 2-year cycle, the ABI for total yield (kg/tree) was 0.59 and 0.64 and 0.70 and 0.76 for yield of M+L size fruit, respectively, for trees pruned on one side of the tree and then the other side every other year (*biennially*) *vs*. pruning both sides of the trees in every other row every other year.

For the ‘Manzanillo’ olive trees in the orchard at the Lindcove REC in Exeter, in 2025 the sum of the estimated floral intensity of bloom was significantly correlated with total yield (kg/tree) (r = 0.81; $P < 0.0001$) and with yield of M+L size fruit ($r = 0.79$; $P < 0.0001$). There was a strong linear relationship between total yield (kg/tree) and yield of M+L size fruit (kg/tree) up to the threshold value of 120 kg/tree ($r = 0.86$; $P < 0.0001$). At very low yields, the model overestimated the yield of M+L size fruit. These new data will enable us to revise the model to improve its accuracy. Note that this relationship in 2025 was very similar to that observed for the trees at Lindcove in 2024 (r = 0.77; $P < 0.0001$). The pre-harvest on-tree fruit counts as a predictor of final yield at Lindcove (kg/tree) (r = 0.59; $P < 0.0021$) was similar to that of Ivanhoe (r = 0.55; $P < 0.0001$). At the Lindcove REC, the use of on-tree fruit counts to predict final yield at harvest as number of fruit per tree ($r = 0.53$; $P < 0.0069$) was less effective than observed at Ivanhoe ($r = 0.61$; $P < 0.0001$). The sum of the estimated bloom strongly predicted yield but was less effective in predicting the sum of the preharvest number of fruit/10 shoots ($r = 0.48$; $P < 0.0141$) at Lindcove.

The strong correlations between the sum of the estimated bloom and total yield (kg/tree) and yield of M+L size fruit for the ‘Manzanillo’ olive trees at the Lindcove REC indicated that the trees, which had low values for the sum of the estimated bloom in 2025, should not be pruned. However,

pruning was imposed to maintain the research plan at the cost of losing the opportunity to demonstrate the utility of our model.

Future goals.

New, this year, we collected on-tree fruit counts (number of fruit on 10 randomly selected shoots on each of two sides of treated trees (20 shoots/tree) to determine on which side of the trees fruit are produced when crop reduction strategies are applied to the entire tree, only one side of the tree *annually* versus *biennially* or not applied (ON-crop control trees). In 2025, we determined that the untreated side of the tree contributed the majority of the fruit in the Ivanhoe orchard, which was last pruned in 2023. In 2026, we will have our first opportunity to collect data to determine which side of the tree is contributing the majority of the fruit in the year following *annual* treatment and during the "resting year" for trees treated *biennially.* These data are important for improving our understanding of olive tree productivity and improving tree management to mitigate alternate bearing and maintain maximum yields of commercially valuable medium plus large size fruit.

While collecting the data for the number of fruit/10 shoots/side per tree, Dr. Fichtner observed that shoots that had "some fruit" seemed to have "a lot" of fruit. We tested her hypothesis and she was correct. For the 'Manzanillo' olive trees in the Ivanhoe orchard, we counted fruit on a total of 1,677 shoots. Only 311 shoots had at least 5 fruit/shoot, but of the 311 shoots with at least 5 fruit/shoot, 65.9% (205 shoots/311 shoots) had more than 5 fruit/shoot. The average number of fruit was 9.3 fruit/shoot. Similarly, at Lindcove, out of the total of 521 shoots evaluated, 203 had at least 5 fruit/shoot, with 73.9% (150 shoots/203 shoots) having more than 5 fruit/shoot; the average number was 8.0 fruit per shoot. The results for Ivanhoe and Lindcove are strikingly similar despite the very different treatments employed within and between the orchards and the total yields obtained in each orchard (Tables 1 and 3). Further, data analysis is planned to gain insight into the basis for this phenomenon.

The result of analyzing canopy temperature as a function of canopy openness in response to crop reduction strategies provided encouraging results. This research will be continued and expanded to determine the accumulation of temperatures that sustain and increase the reproductive population and fecundity and egg and instar survival, especially in April through June and better interpret the accumulation of sustaining and lethal temperatures relative to the life cycle of the black scale. We are also increasing the number of trees monitored to improve accuracy.

Two major efforts in 2026, are (*i*) to improve our bloom estimates and model using the sum of the estimated bloom as a support tool for deciding when a crop reduction strategy should or should not be implemented. With our no cost extension through June 2026, we used our model as a tool to decide how to prune trees in Treatment 11: pruning (hedging and topping) @ 28 days after full bloom to one side of the tree then the other e on a flexible schedule, using a decision support tool based on estimated sum of the bloom on the two opposing sides of the tree – *flexible schedule.* In 2026, we also have the opportunity to test different sampling protocols, using statistical analyses to determine the accuracy and utility of each. This is possible because there are eight treatments (112 trees) that are not treated in 2026, making the sum of the estimated bloom directly related to yield obtained at harvest. The goal is to create a protocol for estimating the sum of the bloom on two sides of the tree that can be used to rapidly and accurately evaluate the bloom status of a block

to use with our revised model to make a decision about crop reduction for that block. The yield data for 2026 will be required to meet this goal.

Outreach during Year 3 (2025) and the NCE through June 30, 2026.

During this period, Dr. Elizabeth Fichtner and Dr. Carol Lovatt have participated in outreach programs and written grower publications that have contributed significantly toward educating table and oil olive growers about factors that initiate alternate bearing, mechanisms that perpetuate the repeating cycles of ON/OFF crops, and strategies that mitigate alternate bearing and increase yield of commercially valuable size fruit.

Recent and upcoming grower education meeting presentation:

1) North Sacramento Valley Olive Day, 24 March 2026, Orland, CA, oral presentation entitled "Alternate Bearing in Olive".

2) North Coast Olive Field Day, 21 July 2026, Petaluma, CA, oral presentation, poster and handouts, entitled "Alternate Bearing in Olive - *Initiation, perpetuation of OFF/ON yield cycles and mitigation strategies that reduce the severity of alternate bearing and increase yield of commercially valuable size fruit*."

Grower education publications:

1) Fichtner, E.J. and C.J. Lovatt (2025). Table olive yields benefit from a new approach to the age-old practice of pruning. Progressive Crop Consultant.

Grower education blogs:

In addition: Dr. Fichtner has posted some of these communications on her ANR blog at https://my.ucanr.edu/blogs/ElizabethFichtnerProgrammaticNews/index.cfm

1) Fichtner, E.J. and C.J. Lovatt (2025). Table olive yields benefit from a new approach to the age-old practice of pruning.

References:

Australian Olive Association, Ltd. Pest & Disease Industry Fact Sheet, Black scale: the pest and its management. https://australianolives.com.au/wp-content/uploads/2018/06/ FACT-SHEET-Black-Scale-2016.pdf

Chao, Y.Y. 2014. Alternate Bearing in Olive (*Olea europaea* L.). MS Thesis. University of California, Riverside, CA.

El Aalaoui, M., Mokrini, F., and Sbaghi, M. 2025. Impact of temperature on development and reproduction of the olive black scale *Saissetia oleae* (Olivier) (Hemiptera: Coccidae). Bull Entomol Res. 115(3):296-307. DOI: 10.1017/S0007485325000112. PMID: 40025983.

Fichtner, E., Lovatt, C.J. 2018. Alternate bearing in olive. Acta Hortic. 1199:103-108. doi:10.17660/ActaHortic.2018.1199.17

Fichtner, E., Lovatt, C.J. 2023. Alternate bearing in olive - *Mitigation with properly timed foliar-applied naphthaleneacetic acid or pruning.* Acta Hortic. In review.

Fichtner, E.J., Y.Y. Chao, L. Ferguson, J.S. Verreynne, L. Tang and C.J. Lovatt. 2021. Repeating cycles of ON and OFF yields in alternate bearing olive, pistachio, and citrus trees — *Different mechanisms, common solutions*. Acta Hortic. 1315. DOI 10.17660.

Lavee, S. 2007. Biennial bearing in olive (*Olea europaea*) Naturales - Ser. His. Nat. 17(1):101-112.

Pearce, S.C. and S. Dobersek-Urbanc. 1967. The measurements of irregularity in growth and cropping. J. Hort. Sci. 42(3):295–305.

Ravetti, L.M. 2014. Technology for improving the efficiency of mechanical harvesting in modern olive growing. Acta Hort. 1057:221-229.

Sibbett, S. (2000). Alternate bearing in olive trees. California Olive Oil News. 3(12),1

Tena A, Soto A, Garcia-Marí F. 2007. Parasitoid complex of black scale *Saissetia oleae* on citrus and olives: Parasitoid species composition and seasonal trend. BioControl 53: 473–487.

Table 1. Estimated floral intensity (bloom) of 'Manzanillo' olive trees in the new orchard in Ivanhoe, CA, prior to the application of the fruit thinning treatments in 2025, except treatment 12 completed in March, to determine the effects of the treatments listed in the table on total yield and yield of M+L size fruit (kg/tree) in October and return bloom, yield and severity of alternate bearing the following year.

	2025 Bloom estimates[y] (Before 2025 treatments applied)			2025 total yield (kg/tree) M+L size fruit) (kg/tree)
2025 Treatments	East side of tree	West side of tree	Sum per tree	
#1 Untreated ON-crop control (last pruned and topped in winter 2022–2023) (alternate bearing control)	3.3 a	2.4 ab	5.7 ab	116.8 ab (54.8 a)
#2 Pruning (hedging, with topping in year 2) 28 DAFB on one side of tree and then the other side every other year—*biennially*	3.1 a	2.5 ab	5.6 ab	57.3 de (18.6 cd)
#3 Foliar-applied NAA (165 ppm) @ FB to one side of the tree then the other side of the tree every other year—*biennially*	3.3 a	2.3 ab	5.6 ab	87.7 bcd (27.9 bcd)
#4 Foliar-applied urea (4%) @ FB to one side of the tree then the other side of the tree the following year—*annually*	3.3 a	3.0 a	6.2 a	122.8 a (46.4 ab)
#5 Foliar-applied urea (4%) @ FB to one side of the tree then the other side every other year—*biennially*	3.3 a	2.7 ab	6.0 a	107.0 ab (39.9 ab)
#6 Foliar-applied urea (4%) @ 10 DAFB to one side of the tree then the other side of the tree the following year—*annually*	3.0 a	2.7 ab	5.7 ab	109.0 ab (41.8 ab)

#7 Foliar-applied urea (4%) @ 10 DAFB to one side of the tree then the other side every other year—*biennially*	2.6 ab	1.9 b	4.5 b	98.4 abc (39.1 abc)
#8 Foliar-applied Accede (200 ppm) @ FB to one side of the tree then the other side every other year—*biennially*	3.0 a	2.6 ab	5.7 ab	105.5 ab (40.0 ab)
#9 Foliar-applied Accede (400 ppm) @ FB to one side of the tree then the other side every other year—*biennially*	3.0 a	1.9 b	4.9 ab	67.5 cd (29.3 bcd)
#10 Foliar-applied Accede (800 ppm) @ FB to one side of the tree then the other every other year—*biennially*	3.2 a	2.5 ab	5.6 ab	115.3 ab (36.3 abc)
#11 Pruning (hedging, with topping in year 2) @ 28 days after full bloom to one side of the tree then the other side on a flexible schedule, using a decision support tool based on estimated sum of the bloom on the two opposing sides of the tree—*flexible schedule*	3.1 a	2.3 ab	5.3 ab	56.9 de (19.0 cd)
#12 Control – grower standard practice of pruning two sides of the tree and topping in winter—*annually*	2.0 b	0.9 c	2.9 c	28.3 e (11.6 d)
P-value	0.0698	0.0005	0.0006	< 0.0001 (0.0018)

[z] Bloom was evaluated on the following scale: 0, no inflorescences; 1, low floral intensity; 2, medium floral intensity; and 3, high floral intensity.

[y] Full bloom was 5 May 2025. Bloom estimates were made 5 May 2025. Foliar sprays at FB were applied on 7 May 2025 and at 10 days after full bloom (DAFB) on 16 May 2025. Pruning was done on 4 June 2025. All fruit thinning treatments were applied to the west side of the tree.

Table 2. Treatment effects on pre-harvest on-tree fruit counts (fruit number/10 shoots/2 sides/tree) for 'Manzanillo' olive trees in the new orchard in Ivanhoe, CA, to determine which sides of the trees produced the majority of the fruit in response to the treatments. The treatments were applied To the West side of the tree in 2025. These data are important for improving our understanding of olive tree productivity and management. The 'Manzanillo' olive trees in Ivanhoe were harvested 25-29 September 2025.

	2025 Pre-harvest on-tree fruit counts			2025 total yield (kg/tree)
2025 Treatments	East side of tree (number of fruit per 10 shoots)	West side of tree (number of fruit per 10 shoots)	Sum of E+W sides of tree (number of fruit per 20 shoots)	M+L size fruit) (kg/tree)
#1 Untreated ON-crop control (last pruned and topped in winter 2022–2023) (alternate bearing control)	3.9 a	2.4 bcd	6.3 ab	116.8 ab (54.8 a)
#2 Pruning (hedging, with topping in year 2) 28 DAFB on one side of tree and then the other side every other year—*biennially*	2.9 a	1.3 cd	4.2 bc	57.3 de (18.6 cd)
#3 Foliar-applied NAA (165 ppm) @ FB to one side of the tree then the other side of the tree every other year—*biennially*	3.7 a	2.2 bcd	5.9 abc	87.7 bcd (27.9 bcd)
#4 Foliar-applied urea (4%) @ FB to one side of the tree then the other side of the tree the following year—*annually*	3.3 a	3.8 a	7.1 a	122.8 a (46.4 ab)
#5 Foliar-applied urea (4%) @ FB to one side of the tree then the other side every other year—*biennially*	2.5 a	2.9 ab	5.4 abc	107.0 ab (39.9 ab)
#6 Foliar-applied urea (4%) @ 10 DAFB to one side of the tree then the other side of the tree the following year—*annually*	3.6 a	2.8 ab	6.4 ab	109.0 ab (41.8 ab)

#7 Foliar-applied urea (4%) @ 10 DAFB to one side of the tree then the other side every other year—*biennially*	3.0 a	2.6 abc	5.6 abc	98.4 abc (39.1 abc)
#8 Foliar-applied Accede (200 ppm) @ FB to one side of the tree then the other side every other year—*biennially*	2.7 a	2.0 bcd	4.7 abc	105.5 ab (40.0 ab)
#9 Foliar-applied Accede (400 ppm) @ FB to one side of the tree then the other side every other year—*biennially*	2.4 a	2.1 bcd	4.5 bc	67.5 cd (29.3 bcd)
#10 Foliar-applied Accede (800 ppm) @ FB to one side of the tree then the other every other year—*biennially*	2.7 a	2.5 abcd	5.2 abc	115.3 ab (36.3 abc)
#11 Pruning (hedging, with topping in year 2) @ 28 days after full bloom to one side of the tree then the other side on a flexible schedule, using a decision support tool based on estimated sum of the bloom on the two opposing sides of the tree—*flexible schedule*	2.3 a	1.2 d	3.6 c	56.9 de (19.0 cd)
#12 Control – grower standard practice of pruning two sides of the tree and topping in winter—*annually*	2.1 a	2.5 abcd	4.6 abc	28.3 e (11.6 d)
P-value	0.3784	0.0290	0.0030	0.0001 (0.0018)

Table 3. Effect of pruning treatments compared to untreated ON-crop control trees on the cumulative number of days canopies sustained temperatures putatively lethal to black scale instars and adults from 15 June to 14 September 2025. In 2025, pruning biennially was 28 days after full bloom (4 June 2025) on the west side of the tree; grower standard practice was winter pruning and topping of the entire tree (3-5 March 2025).

Treatment	≥ 33°C, < 35°C	≥ 35°C, < 40°C	≥ 40°C, < 45°C	≥ 40°C	≥ 45°C	*P-value*
	Jun-Sep	June-Sep	Jun-Sep	Jun-Sep	Jun-Sep	
ON-crop control	24 a^{A}	26 a^{A}	4 a^{B}	4 a^{B}	0 a^{B}	0.006
Pruning biennially	16 ab^{A}	30 a^{A}	11 a^{A}	24 a^{A}	13 a^{A}	0.42
Grower standard	7 b^{A}	17 a^{A}	8 a^{A}	30 a^{A}	22 a^{A}	0.17
P-value	0.01	0.23	0.43	0.58	0.07	

Average number of days above the specified threshold temperature for the stated temperature range with four individual tree replications for each treatment. Values in a vertical column followed by a different lowercase letter or in a horizontal row followed by a different uppercase letter are significantly different at the specified *P* level by Tukey's HSD.

Table 4. Estimated floral intensity (bloom) of 'Manzanillo' olive trees at the Lindcove REC in Exeter, CA, prior to application of the 2025 fruit thinning treatments, which included pruning (hedging) 28 days after full bloom (DAB) (4 June) to one side of the tree and then the other side *biennially* versus pruning 28 (DAB) (4 June) on both sides of the trees in every other row every other year and the effect of these treatments on total yield and yield of commercially valuable medium plus large (M+L) size fruit (kg/tree) in October.
Note: To compare pruning strategies, the results for trees in treatments 1 and 2 vs. trees in treatments 3 and 4 must be added together to represent treatment effects of the two management strategies in a block.

	2025 Bloom estimates (Before 2025 treatments applied)			2025 yield (kg/tree) (M+L size fruit) (kg/tree)
Treatment	East side of tree	West side of tree	Sum per tree	
#1) Pruned 28 DAB on East side of the tree in 2023; pruned on the West side in 2025	0.8 a	1.3 a	2.2 a	38.3 a (14.6 a)
#2) Pruned 28 DAFB on East side of the tree in 2023; pruned on the West side in 2025	0.9 a	1.8 a	2.7 a	32.7 a (13.6 a)
#3) Pruned 28 DAFB on both sides of the tree in years 2023 and 2025	0.6 a	1.0 a	1.6 a	24.2 a (6.8 a)
#4) Pruned 28 DAFB on both sides of the tree in 2024	0.3 a	0.3 a	0.6 a	25.6 a (4.3 a)
P-value	0.2247	0.2741	0.1533	0.5822 (0.1735)
#1 + #2) Pruned 28 DAFB on East side of the tree in 2023; pruned on the West side in 2025	1.7 a	3.4 a	5.3 a	72.9 a (32.2 a)
#3 + #4) Pruned 28 DAFB on both sides of the tree in every other row every other year	1.2 a	1.3 a	2.5 a	54.1 a (8.9 a)
P-value	0.1161	0.2298	0.1606	0.991 (0.3378)

[z] Bloom was evaluated on 6 May 2025, using the following scale: 0, no inflorescence; 1, low floral intensity; 2, medium floral intensity; and 3, high floral intensity.
[y] Full bloom was 6 May 2025. All trees were pruned on 4 June 2025, and all trees were topped the previous year on 6 June 2024.
[x] Mean values within a vertical column followed by different letters are significantly different at the specified *P* level by Fisher's Protected LSD test.

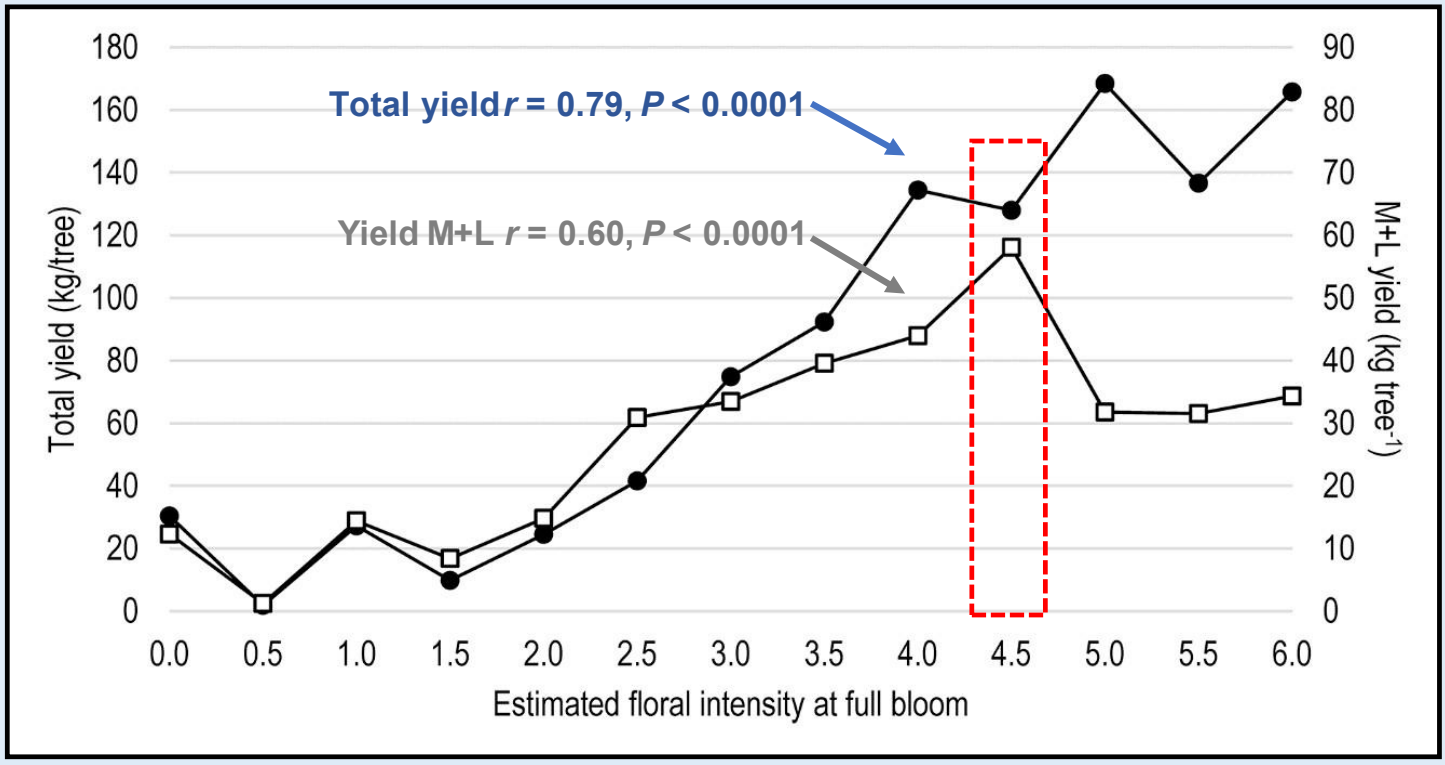
Table 5. Effects of pruning (hedging) 28 days after full bloom (DAB) (4 June) to one side of the tree and then the other side *biennially* versus pruning 28 (DAB) (4 June) on both sides of the trees in every other row every other year on pre-harvest on-tree fruit counts (fruit number/10 shoots/2 sides/tree) and on total yield and yield of commercially valuable medium plus large (M+L) size fruit (kg/tree) at harvest (2 October 2025) of 'Manzanillo' olive trees at the Lindcove REC in Exeter, CA,.
Note: To compare pruning strategies, the results for trees in treatments 1 and 2 vs. trees in treatments 3 and 4 must be added together to represent treatment effects of the two management strategies in a block**.**

	2025 Pre-harvest on-tree fruit counts			2025 yield (kg/tree) M+L size fruit) (kg/tree)
Treatment	East side of tree	West side of tree	Sum per tree	
#1) Pruned 28 DAB on East side of the tree in 2023; pruned on the West side in 2025	3.2 a	4.7 a	7.7 a	38.3 a (14.6 a)
#2) Pruned 28 DAFB on East side of the tree in 2023; pruned on the West side in 2025	3.0 a	4.0 a	7.0 a	32.7 a (13.6 a)
#3) Pruned 28 DAFB on both sides of the tree in years 2023 and 2025	4.2 a	3.5 b	7.7 a	24.2 a (6.8 ab)
#4) Pruned 28 DAFB on both sides of the tree in 2024	3.9 a	4.7 a	8.6 a	25.6 a (4.3 b)
P-value	0.9486	0.0233	0.2160	0.5822 (0.1735)
#1 + #2) Pruned 28 DAFB on East side of the tree in 2023; pruned on the West side in 2025	3.1 a	4.5 a	7.5 a	72.9 a (32.2 a)
#3 + #4) Pruned 28 DAFB on both sides of the tree in every other row every other year	4.1 a	4.0 b	8.1 a	54.1 a (8.9 a)
P-value	0.7424	0.0790	0.2199	0.991 (0.3378)

Table 6. Effects of pruning (hedging) 28 days after full bloom (DAB) (4 June 4) to one side of the tree and then the other side *biennially* versus pruning 28 (DAB) (4 June) on both sides of the trees in every other row every other year on total yield and yield of commercially valuable medium plus large (M+L) size fruit (kg/tree) at harvest for 2023, 2024 and 2025 and 3-year cumulative yield of 'Manzanillo' olive trees at the Lindcove REC in Exeter, CA.
Note: To compare pruning strategies, the results for trees in treatments 1 and 2 vs. trees in treatments 3 and 4 must be added together to represent treatment effects of the two management strategies in a block**.**

Treatment	2023 yield (kg/tree) M+L size fruit) (kg/tree)	2024 yield (kg/tree) M+L size fruit) (kg/tree)	2025 yield (kg/tree) M+L size fruit) (kg/tree)	2023-2025 yield (kg/tree) M+L size fruit) (kg/tree)
#1) Pruned 28 DAB on East side of the tree in 2023; pruned on the West side in 2025	116.6 a (10.8 a)	112.5 a (52.5 a)	38.3 a (14.6 a)	224.5 a (82.7 a)
#2) Pruned 28 DAFB on East side of the tree in 2023; pruned on the West side in 2025	131.3 a (19.1 a)	88.9 a (35.6 a)	32.7 a (13.6 a)	244.4 a (71.4 a)
#3) Pruned 28 DAFB on both sides of the tree in years 2023 and 2025	93.9 a (9.6 a)	94.1 a (34.1 a)	24.2 a (6.8 ab)	192.6 a (51.6 a)
#4) Pruned 28 DAFB on both sides of the tree in 2024	110.5 a (7.1 a)	88.6 a (37.9 a)	25.6 a (4.3 b)	190.7 a (56.7 a)
P-value	0.5579 (0.5960)	0.4126 (0.1990)	0.5822 (0.1735)	0.7486 (0.2663)
#1 + #2) Pruned 28 DAFB on East side of the tree in 2023; pruned on the West side in 2025	108.4 (13.2 a)	210.6 a (91.3 a)	72.9 a (32.2 a)	459.2 a (156.1 a)
#3 + #4) Pruned 28 DAFB on both sides of the tree in every other row every other year	92.8 a (7.7 a)	196.3 a (78.6 a)	54.1 a (8.9 a)	402.8a (124.0 a)
P-value	0.7878 (0.5569)	0.6972 (0.5015)	0.9910 (0.3378)	0.2700 (0.3378)

Relationships among total yield (● yield of M+L size fruit (□ and estimated floral intensity of 'Manzanillo' olive trees.



Trees with an estimated floral intensity < 4.5 ± 0.25 should not be treated with a crop reduction strategy.

Trees with bloom estimates > 4.5 ± 0.25 would be treated with NAA or pruned on one side of the tree.

Figure 1. Relationships among Estimated floral intensity (sum of estimated bloom on the east and west side of trees in north-south running rows) at full bloom (x-axis), Total Yield (kg/tree) (left y-axis), and Yield of Medium + Large size fruit (kg/tree) (right y-axis).

Workgroup/Department: Olive / Plant Sciences, UC Davis

Project Year: April 1, 2025 –June 31, 2026. Anticipated Duration of Project: 1 year
Final report

Project Title:

Evaluation of effects of Accede® (ACC) at two different application rates on enhancing horticultural maturity and abscission zone development and commercial trunk shaking efficiency in table olives

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Summary of the Final report:

Building on last year's findings, we continued orchard management by skirting trees to a 4 feet height and conducting fruit removal force (FRF) monitoring during pre-harvest time as planned. Following the IR-4 protocol, we tested lower concentrations of Accede for mechanical harvest efficiency this year (2025). Four Accede concentrations were evaluated: 0 (control), 400, 800, and 1500 ppm, with 1500 ppm serving as a positive control. All three Accede treatments significantly increased mechanical harvest efficiency, showing a clear dose-dependent trend that needs further analysis.

Ongoing work includes:

- Residue testing to determine Accede usage by olive fruit;
- Analysis of Accede effect on fruit quality, based on USDA grading sheet
- Economic analysis of Accede application cost-effectiveness.

Procedures

1. Orchard preparation

Day 0 (50% bloom) was recorded as May 8th 2025 for the growing season. The field application of the experiment was conducted at the Leslie J. Nickels Trust Soils Laboratory, moderate- density 'Manzanillo' orchard in Arbuckle, Colusa County in 2025 growing season; 202 trees/acre in 12, 30-tree N-S rows, planted in 2001.

The orchard was mechanically hedged every other row at 5-feet and 10-degree angle, skirted for all rows at 4 feet, topped for all rows at 14 feet on June 5th 2025. Trees was hand pruned within the canopy to increase light interception. No NAA thinning was performed as the fruit size was determined not to be affected, according to the estimation of inflorescence density.

2. Test the effect of ACC application on the trunk shaker harvest efficiency

We monitored the fruit removal force as we did in previous years.

Accede application was performed on October 1st, 2025 (146 dpa), based on the established criteria for application, including average FRF reaching 0.3 kg.

Application was performed by an air-blast equipped spray truck. Each block on the map included 15 olive trees. Five blocks of trees were sprayed for each test concentration (0, 400, 800, and 1500 ppm) of Accede with 0.025% surfactant (Activator 90), at the rate of 100 gallons per acre (GPA). There are total 20 blocks in this year's experiment (4 treatment (3 Accede concentrations + control) x 5 blocks).

South													South
Tree#	Row 13	Row 12	Row 11	Row 10	Row 9	Row 8	Row 7	Row 6	Row 5	Row 4	Row 3	Row 2	Row 1
30		cau flagged	cau flagged	cau flagged	cau flagged	cau flagged		cau flagged	cau flagged	cau flagged	cau flagged	cau flagged	
29		cau flagged	cau flagged	cau flagged	cau flagged	missing		cau flagged	cau flagged	cau flagged	cau flagged		
28													
27													
26												cau flagged (dying)	
25													
24													
23		control	400 ppm	1500 ppm	1500 ppm	400 ppm		400 ppm	800 ppm	control	1500 ppm	400 ppm	
22													
21						missing							
20													
19													
18													
17													
16	edge row	cau flagged	cau flagged	cau flagged	cau flagged	cau flagged	Sevillano	cau flagged	cau flagged	cau flagged	cau flagged	cau flagged	edge row
15		cau flagged	cau flagged	cau flagged	cau flagged	cau flagged	row	cau flagged	cau flagged	cau flagged	cau flagged	cau flagged	
14													
13													
12													
11													
10						missing							
9													
8		400 ppm	800 ppm	800 ppm	control	1500 ppm		control	800 ppm	1500 ppm	800 ppm	control	
7													
6													
5													
4													
3													
2		cau flagged	cau flagged	cau flagged	cau flagged	cau flagged		cau flagged	cau flagged	cau flagged	cau flagged	cau flagged	
1		cau flagged	cau flagged	cau flagged	cau flagged	missing		missing	cau flagged	cau flagged	cau flagged	cau flagged	
North													North

The middle 12 trees of each 15-tree block were used for harvest efficiency calculation, and they underwent mechanical harvest and hand gleaning. Mechanical harvest was performed on October 10th, 2025 (9 days after Accede application), within the 7-10 day after application (established recommended waiting period after application). Hand gleaning was performed during the period of October 20th to October 22nd, 2025.

Harvester efficiency of each treatment was calculated as:

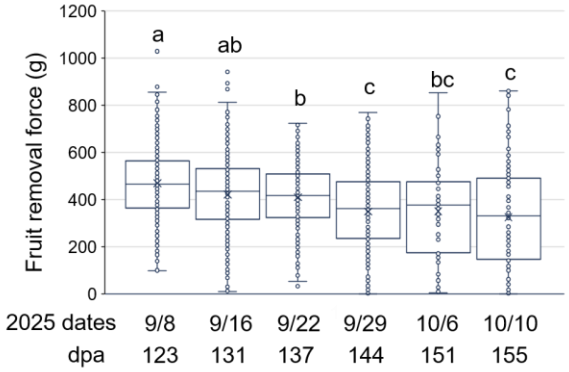
$$Efficiency = \frac{Mechanically\ harvested\ (lb)}{Manually\ harvested\ (lb) + \ Mechanically\ harvested\ (lb)} \times 100$$

3. Accede effect on fruit quality
For each of the 20 blocks, one sample of mechanical harvest and one sample hand gleaning harvest were sent to USDA grading station for fruit quality grading.

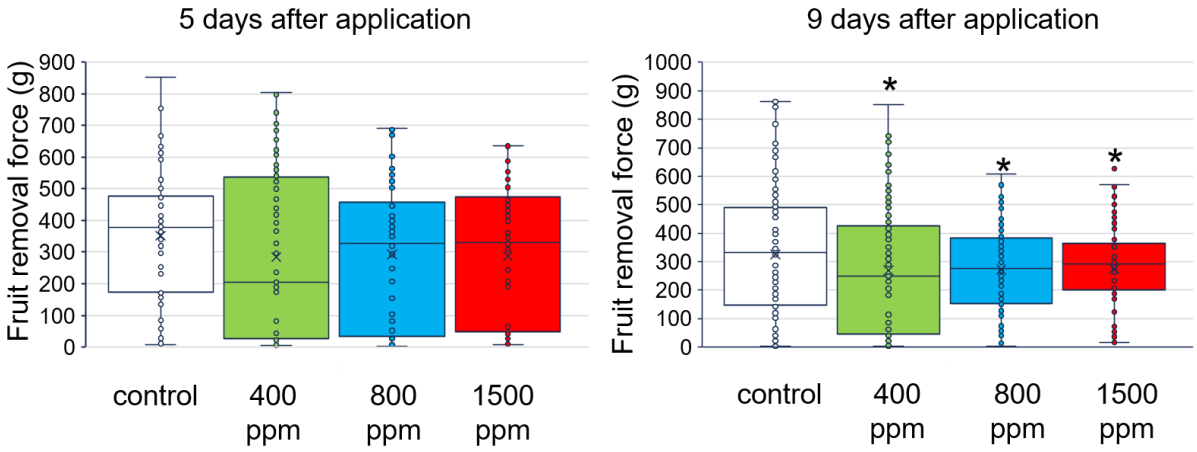
Results:

1. fruit removal force monitoring

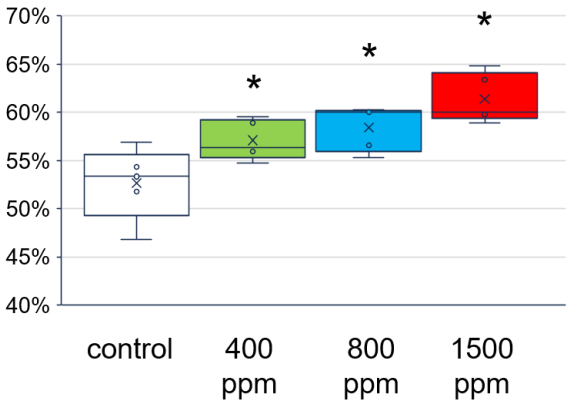
We continued to observe the same trend of fruit removal force decreasing around the end of September. On September 29th 2025, we observed a significant decrease of fruit removal force which was approaching 0.3 kg. Accede application was performed two days afterwards on October 1st.



Also, similar as previous years, we observed a significant decrease of FRF on 9 days after Accede application, which coincides the day of trunk shaking.



2. harvest efficiency



We observed significant increase of mechanical harvest efficiency in all Accede treatment groups (400, 800, and 1500 ppm, n = 5 block). There was clearly a dose-dependent effect which needs further analysis for cost-effectiveness.

Average time to harvest 12 trees via trunk shaking mechanical harvest was around five minutes, and for total 240 trees in this trial was around 100 minutes (half working day, 4-hour including crew resting time, shaker radiator water refilling time), resulting 10575 lb fruit harvested.

Total time to harvest of 240 trees by hand gleaning crew entailed 6 pickers for two full working days and 3 pickers for a half working day (6 pickers for 16 hour plus 3 pickers for 4 hour), resulting in 7811 lbs of fruit harvested.

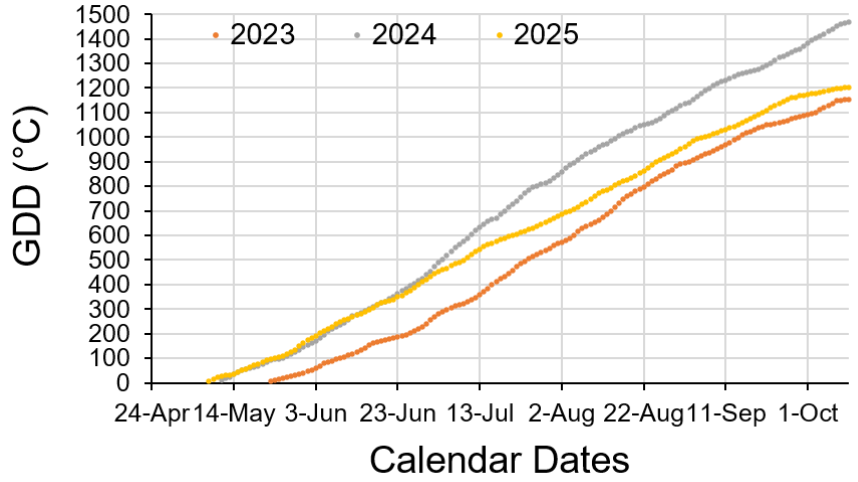
3. phototoxicity monitoring

We observed that application of Accede at 1500 ppm x 100 GPA did not generate any significant leaf drop on the third year of application, indicating that Accede does not generate phototoxicity problem.

4. GDD model for olive growth

We continued monitoring growing degree days (GDD) throughout the 2025 growing season to further develop a GDD-based model for optimizing the timing of mechanical harvesting in table olives and to provide a predictive framework for the broader olive industry. The table below summarizes the application and harvest timing over the past three years. In all three seasons, Accede was applied at 1,500 ppm ACC using a spray volume of 100 GPA, followed by trunk shaking 7-10 days later.

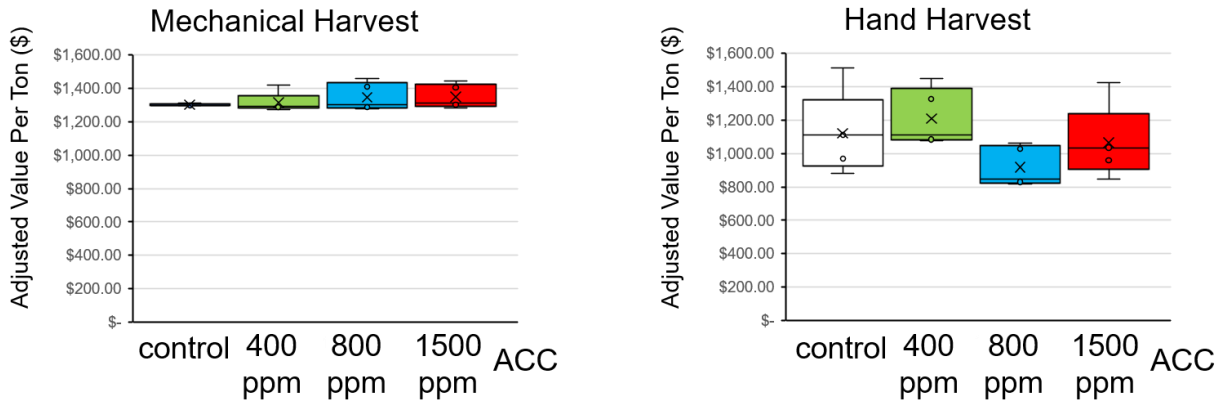
$$GDD = \frac{(T_{max} + T_{min})}{2} - T_{base,} \quad where\ T_{base} = 15°C$$



	Spray Date/GDD	Trunk Shaking Date/GDD
2023	9/28 (1080°C)	10/5 (1119°C)
2024	9/30 (1369°C)	10/7 (1442°C)
2025	10/1 (1173°C)	10/10 (1203°C)

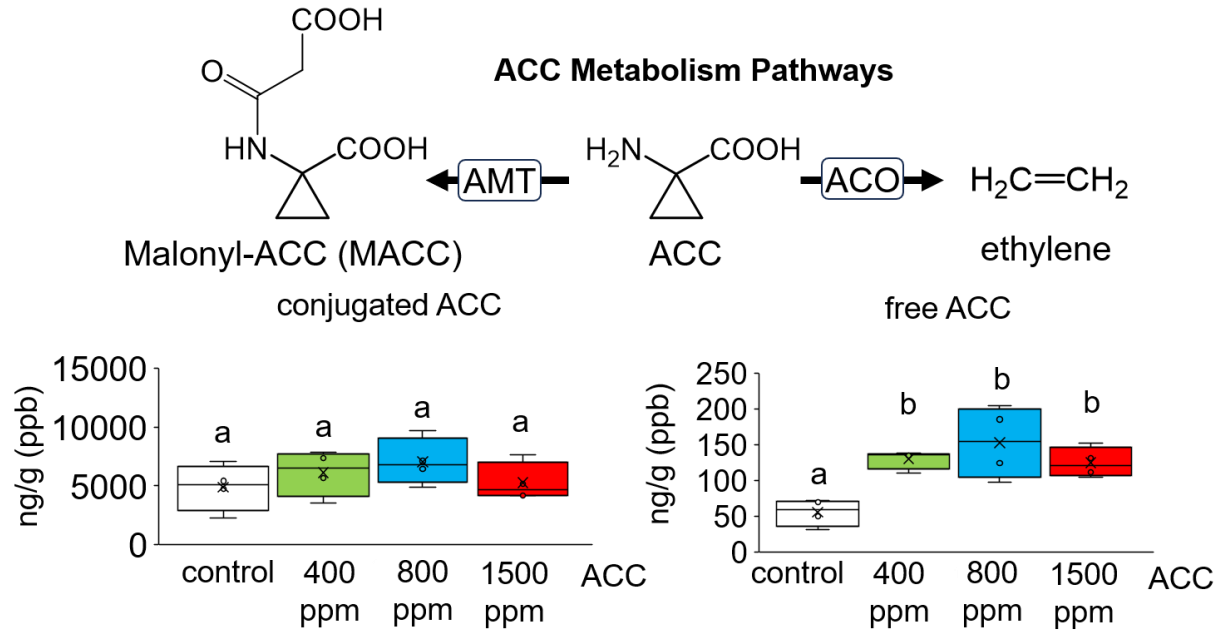
5. Accede effect on fruit quality

Similar to the previous two years, we did not observe any effect of Accede on harvest quality. Fruit quality remained unchanged between the ACC-treated and control groups (mechanically harvested fruit: P = 0.54; hand-harvested fruit: P = 0.15; one-way ANOVA), while Accede significantly improved mechanical harvest efficiency.



6. Residue test

This is not part of the IR-4 process. Accede is exempted from IR-4 residue test as 1-aminocyclopropane carboxylic acid (ACC, active ingredient of Accede) is a natural compound in plants. We proceeded as we indicated in the proposal for the residue test, to help answer the question how much Accede we applied is used by the plants.



Although free ACC was slightly but significantly higher in the treated groups than in the control, the difference was only at the ppb level, representing less than 0.1% of the applied ACC, which was applied in the field at the ppm level. No differences in residual conjugated ACC were detected among treatment groups. These results indicate that the vast majority of the applied exogenous ACC had been metabolized by the olive fruits by harvest. Furthermore, chemical analyses supported the field-observed gradient effect, demonstrating that increasing the application rate did not result in higher ACC residue levels in the fruit, as the vast majority of applied ACC was converted to ethylene.

7. Economic analysis

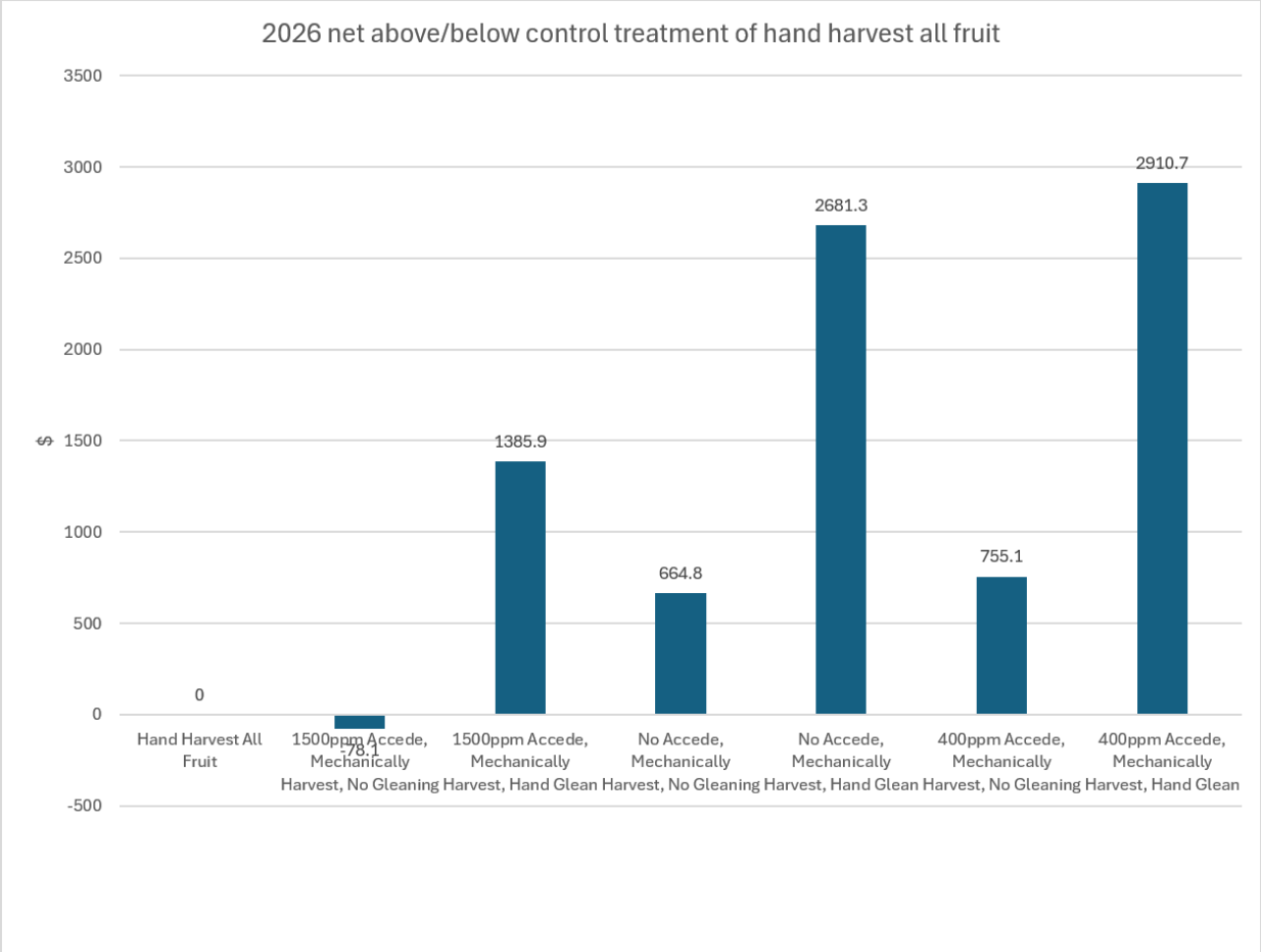
The affordability of Accede® remains dependent on several factors, many of which will vary from year to year. The price of olives in a given year, whether a grower intends to hand-glean, and the price of Accede® itself will all play heavily into the bottom line of use. For the economic analysis, we compared net profits using 400ppm ACC at 100GPA or 1500pm ACC at 100GPA, with and without subsequent hand gleaning, to net profits when completely hand harvesting an orchard. An estimated cost of $575/ton to hand harvest and $750/acre for contract custom harvesting, as quoted to us by collaborators, was used. The most recent quoted price of $345/20oz container of Accede® was used to estimate costs. Each scenario was calculated based on tons/acre harvested mechanically vs. by hand, cost of material and application for Accede, and adjusted value per ton of fruit as reported by Musco after USDA grading of subsamples.

2026 Harvest Yields and Adjusted Values Per Ton						
Row Labels	*Average of TotalYieldPer Acre(ton)*	*Average of Harvest Efficiency*	*Average of MH Tons/acre*	*Average of Adjustment Per Ton ($)*	*Average of HH Tons/acre*	*Average of Adjustment Per Ton ($)2*
400ppm	7.9	57.10%	4.5	$1,313.32	3.4	$1,209.16
800ppm	7.7	58.44%	4.5	$1,346.51	3.2	$917.31
1500ppm	7.7	61.39%	4.7	$1,349.34	3.0	$1,063.30
Control (0ppm)	7.9	52.65%	4.1	$1,302.43	3.7	$1,120.45
Entire orchard	7.8	57.39%	4.5	$1,327.90	3.3	$1,077.55

Economic analysis results are reported by comparing profits to the baseline of an entirely hand-harvested calculations; i.e. a negative ‘profit’ means only that the treatment will net a grower less than just hand harvesting the entire orchard, and a positive value means growers will make more by employing that treatment.

The least economically valuable treatment based on 2026 costs and fruit values is applying 1500ppm Accede®, mechanically harvesting whatever you can get off the tree, and not going back to glean what remained. Growers will actually make $78 *less* per acre doing this compared to hand harvesting the entire orchard. The most profitable combination of practices is applying 400ppm Accede®, mechanically harvesting, and coming back through with a crew to glean what remains. Growers would see approximately $2,910 more per acre implementing this strategy. Interesting, not applying any Accede®, mechanically harvesting, and hand gleaning what’s left on the trees returns $2,681 more per acre than hand harvesting the entire orchard. The 2023 UC

Davis Table Olive Cost Study (non-modern acreage, entirely hand harvested) shows that table olive production *loses* $666 per acre after cash and operating costs. This economic analysis in this report reinforces the improved economic viability mechanical harvesting can bring to the table olive industry.



If Accede® is registered for use in California, growers will likely need to consider their orchard's historical harvest efficiency, crop load, labor costs quoted to them by contractors, and estimates of fruit values each year. This could be a simple online tool where growers could input estimates for their own fields to calculate how much more profitable Accede® could make their harvest and whether gleaning will be worth it that year. Ultimately, mechanically harvesting after an application of 400ppm ACC and finishing by gleaning is the most profitable combination of practices in the 2026 harvest year.

Final Report

Project Year 2025

Anticipated Period of Performance: Year 1 of 2 proposed

Project #: Y24-7360

Title: Designing a web app for predicting risk of olive fruit fly—a tool for California olive growers and pest control advisors

Project Investigators

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2. Santosh Bhandari, MS. UC ANR Associate Specialist, UCCE Tulare County

Project Collaborators

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2. Sudan Gyawaly, PhD. UC ANR IPM Advisor, Area IPM Advisor, Butte, Sutter, Glenn, Colusa, Tehama Counties.
3. Cindy Kron, PhD. UC ANR IPM Area Advisor, North Coast.
4. Kent Daane, PhD. Professor of Cooperative Extension, UC Berkeley

Project Cooperators

1. Jim Stewart, Ag IPM Consultants, Inc.
2. Bert Quezeda, Ag IPM Consultants, Inc.
3. Ernie Simpson

Successful Solicitation of External Funding

Our team secured $10,000 in supplemental funding from the University of California Sustainable Agriculture Research and Education Program (SAREP). With this funding we leased 4 smart traps and purchased 4 smart probes to allow for real-time, in-orchard collection of weather data and trap catch data in the southern San Joaquin Valley and the Sacramento Valley. These funds allow us to bypass the use of regional weather stations and conventional traps and proceed to a more detailed dataset allowing for the development of a prediction model.

Project Summary

Olive fruit fly (*Bactrocera oleae*) (OLFF) is the most important insect pest of olive worldwide. The California Olive Committee has funded long term pest management programs in the Sacramento Valley (SV) and southern San Joaquin Valley (SSJV), generating a large dataset available for analysis of the impact of weather variables on pest activity. This data was organized into an interactive web app, allowing users to search for historic OLFF populations at all locations over the duration of the trapping program.

Additionally, the historic data was analyzed and used to develop a preliminary model to assist growers with assessing pest risk based on anticipated weather parameters, thus allowing for assessment of risk prior to the physical detection of the insect in orchards. To improve upon the preliminary predictive model, smart traps were installed at four sites in the SV to gather concurrent, real-time estimates of pest populations and weather data. At each of the four sites the efficacy of Smart Traps, an autonomous smart trap used by European OLFF researchers, and Smart Probes, another smart technology used for evaluation of pest populations in storage facilities, were compared. Data gathered from Smart Traps and conventional traps were utilized to generate predictive models for OLFF risk. This work resulted in the development of an interactive online dashboard that can be accessed by future researchers, growers, and PCAs to evaluate historical OLFF trends in both regions. Smart Traps were found superior to Smart Probes for remote detection of OLFF; however, even Smart Traps were found to require routine maintenance in the field. The prediction model developed from Smart Trap data exhibited over 10-fold higher accuracy than a similar model generated from conventional trap data. Smart Traps have been installed at field sites again in 2026, with the plan to further improve predictive model accuracy with two years of field data. The goal is to post the interactive online dashboard of historic OLFF populations as well as the predictive model online as a tool for growers and PCAs.

Progress Toward Objectives

Objective 1: Evaluate historic trends in OLFF populations by analysis of trap-catch data from COC-sponsored OLFF monitoring programs.

Historic OLFF trapping data was collected from both the southern San Joaquin Valley and the Sacramento Valley. For the southern San Joaquin Valley, trapping was conducted at consistent sites from 2007-2024, thus providing a comprehensive dataset allowing for repeated measures analyses. The Sacramento trapping program has consistently utilized 11 trapping sites since 2013; consequently, the long-term evaluation of population trends includes data from 2013-2024. Trapping techniques varied between the two sites, with liquid McPhail traps utilized in the north and yellow sticky traps used in the south. Due to the differences in trapping techniques between the two regions, population data from each region was analyzed separately.

Figure 1. QR Code for interactive web app portraying historic OLFF populations.

An interactive web application has been developed using Shiny app in R that allows users to access OLFF count data along with relevant weather information throughout the desired time period in both regions (santoshbhandari.shinyapps.io/data/). The link and QR code are attached to this report. A draft entitled "Industry sponsored program enables evaluation of historic olive fruit fly populations in California table olives" has been composed and will be submitted to CAPCA Advisor for publication in the September issue of the trade journal.

Objective 2: Collect in-orchard weather data concurrent with OLFF trap counts for model development.

Utilizing SAREP funds, we leased four Smart Traps from Trapview and purchased four Smart Probes from AI Vision Food to obtain in-orchard weather data concurrent with OLFF trap counts. Trapview traps and AI technology have been utilized by OLFF researchers in Europe. The AI Vision product was designed for real-time detection of insect pests in storage facilities and the company expressed interest in applying the product to orchard systems.

To compare the value of Smart Traps, Smart Probes, and conventional yellow sticky traps, two sites were selected in the Sacramento Valley (Glenn Fairground and 6491-6499 Eucalyptus) and two in the southern San Joaquin Valley (Strathmore and Exeter) for trap deployment. Traps were installed on April 11, 2025, in the southern San Joaquin Valley and April 12, 2025, in the Sacramento Valley. The three traps were established at each site (Figure 1). A solar panel is used to power the Smart Trap and associated weather station. Weekly OLFF trap catches have been monitored throughout the season and monitoring will be ongoing until late October.

Smart Traps. The Smart Trap technology is exciting to try because it has been successfully utilized by OLFF researchers in Europe. The trap is autonomous, meaning that the sticky surface is rotated weekly and pest detection and enumeration is conducted through AI technology allowing researchers to monitor pest populations in real time. The data is communicated via cell phone signal technology, allowing for remote monitoring.

The disadvantage of Smart Traps is largely related to the overall cost. Lease of the trap for the season is approximately $1000. Although the product is autonomous, it still requires intermittent monitoring by a human on site to troubleshoot jamming of the sticky roll or loss of power due to foliage growth over the associated solar panel. This technology may be of value for use in regional, industry-sponsored trapping programs; however, it would be costly for use by individual growers and PCAs.

Smart Probes. Dr. Pan, an agricultural engineer associated with UC Davis solicited collaborators for evaluation of integrating Smart Probe use in orchard systems. Smart Probes have been successfully utilized to monitor insect pests in warehouses. The probes are semi-autonomous; they rely on weekly manual change of the sticky surface and in situ transmission of data. They are designed to take daily photos of trapped insects but require a Wi-Fi signal to download the data. Consequently, the user needs to be physically in the field to download the data using a Wi-Fi signal generated from a smartphone.

The Smart Probes cost approximately $80 each but no OLFF were detected with the probes. Additionally, in orchard systems, the probes lack the semi-autonomous characteristic that makes them valuable in warehouses, notably the inability to gather real- time insect population data without Wi-Fi.

Objective 3: Develop an algorithm and web-based app using Python programming language that can predict future populations of OLFF based on the input of weather variables.

Data collected from Smart and conventional traps were further used to create and compare the performance of predictive models for predicting future populations of OLFF based on input weather parameters. Separate models were created for Smart Traps and conventional traps to assess the performance in predicting future OLFF populations.

Data Collection:
Smart Traps recorded:

- OLFF activity: Burst events/flash responses (frequency and timing of sudden OLFF spikes)
- Population data: Olive fruit fly counts (from periodic trap maintenance)
- Weather variables:
    - Air temperature (°F, 15-min intervals)
    - Relative humidity (%, 15-min intervals)
- System status: Battery level, signal strength, trap integrity, data transmission success

Conventional traps were used to detect and count weekly OLFF populations and were replaced every week. Weather data (temperature and relative humidity) were used from smart traps.

Data Integration and Preprocessing

1. Data preprocessing: Screening for missing values, sensor errors, and outliers
2. Temporal alignment: Synchronize OLFF activity data with concurrent weather measurements
3. Data normalization: Scaling continuous variables to facilitate machine learning model training

Machine Learning Model Development

Random Forest Classifier
Objective: Predict presence/absence of OLFF activity

- Training data: Labeled OLFF trap catch records (presence/absence) with corresponding weather features
- Algorithm: Random Forest (scikit-learn Python library)
- Hyperparameters: Optimized during model development; n estimators = 50, min_samples_leaf = 2, max_depth = 10]
- Output: Binary classification (0 = no OLFF; >=1 OLFF detected)
- Evaluation metrics:
    - Accuracy: Proportion of all classifications that were correct (positive or negative)
    - Precision (true positives / [true positives + false positives]): Proportion of true positives out of the predicted positives
    - Recall (true positives / [true positives + false negatives]): Proportion of true positives out of the actual positives
    - F1-score: Harmonic mean of precision and recall

Voting Regressor (Using Random Forest and Gradient Boosting)
Objective: Predict population size (total OLFF counts)

- Training data: Continuous OLFF count data paired with weather features
- Algorithm: Voting Regressor (scikit-learn Python library)
- Hyperparameters:

  ('rf',RandomForestRegressor(max_depth=10,min_samples_leaf=2, n_estimators=50,random_state=42)),('gb',GradientBoostingRegressor(learning_rate=0.01, n_estimators=50, random_state=42)])
- Output: Predicted count of total OLFF
- Evaluation metrics:
    - Mean Squared Error (MSE): Average squared differences between the predicted and true values. The model with least MSE works best indicating that the predicted outcomes are near to the actual outcomes.

Model Validation and Testing

1. Train-test split: Partitioned data into training set (80%) and independent test set (20%) from different orchard sites
2. Cross-validation: Implemented k-fold cross-validation (k=5) to assess model stability and prevent overfitting

Model Deployment

1. Python implementation: Finalized trained model as Python scripts suitable for real-time predictions



Figure 2. Conventional traps (A), Smart Probes (B) and Smart Traps (C) with associated solar panels and weather stations (D) were established in orchards.

2. Risk classification: Convert model predictions to actionable risk categories:
    - No Risk: Predicted probability equivalent to 0
    - High Risk: Predicted probability equivalent to 1

For each trap type, a joblib file was obtained which was further used to deploy predictive model using Visual Studio Code 1.119.0. The model was locally deployed on computer using Operating System Windows NT x64 and further broadcasted as hyperlinks in Hugging Face. Same value of weather and temporal features was used as inputs to compare the prediction outcome of both trap types.

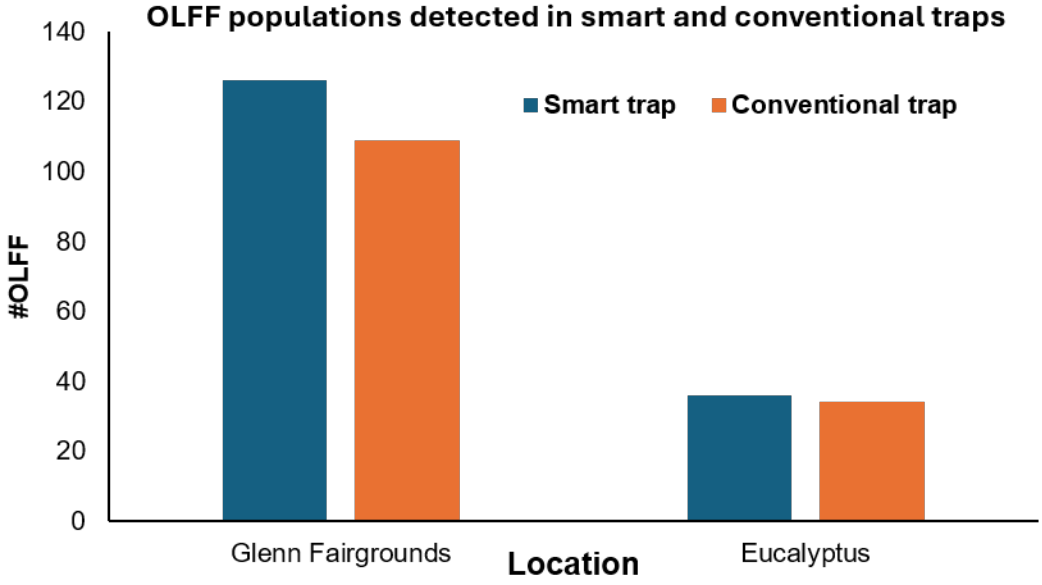


Figure 3. Total seasonal frequency of OLFF trapped at Sacramento Valley sites from April 2025-October 2025. Values for conventional traps represent the average of trap catches from two traps at each site.

Trap Comparison: In the southern San Joaquin Valley, OLFF populations were extremely low during the 2025 season, making it difficult to compare the use of trap technologies. In the Sacramento Valley, however, two sites (Glenn Co. Fairgrounds and 6491-6499 Eucalyptus) had OLFF populations high enough to evaluate total trap catches for the season (Figure 2) and generate population dynamics data with concurrent weather station data (Figure 3). At both sites, higher trap catches were observed in conventional traps than smart traps; however, there are too few sites with high enough OLFF populations to make a statistical comparison of trap efficacy. Interestingly, the two trap types detected different population bursts at each site over time (Figure 3).

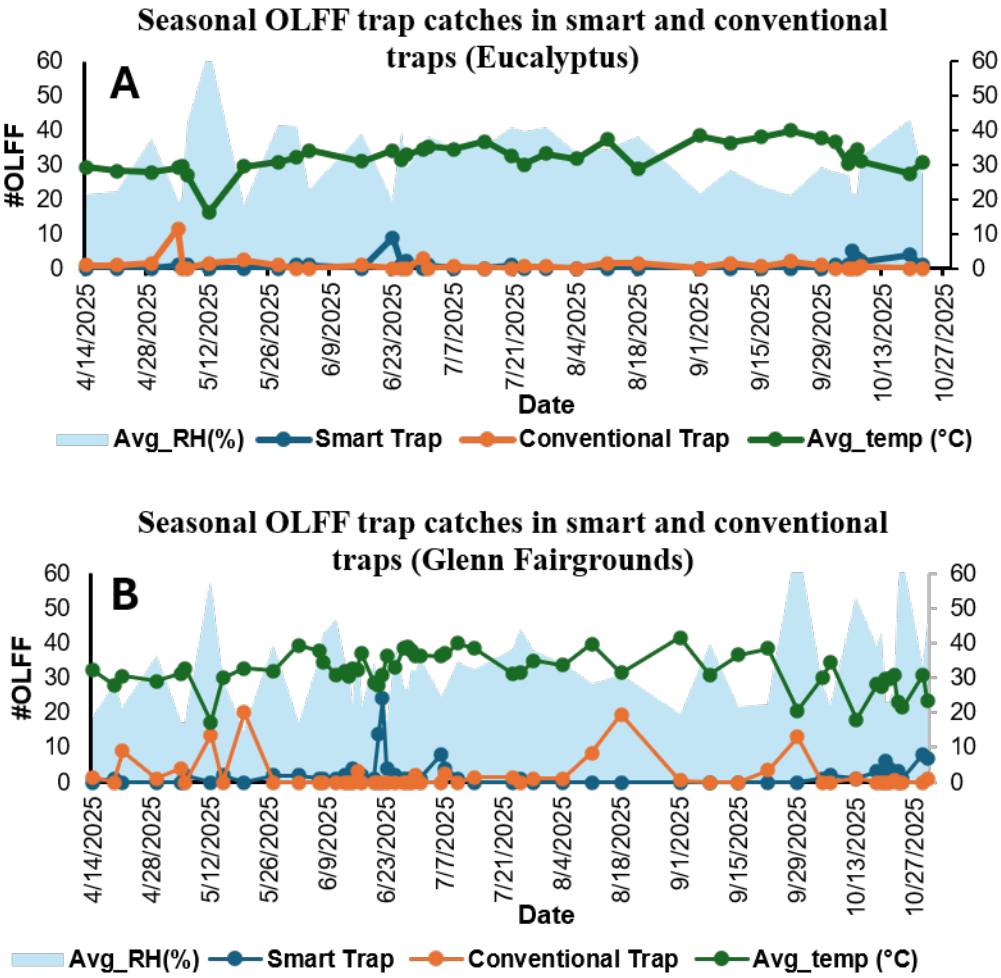


Figure 4. Conventional and smart traps were installed at two sites in the Sacramento Valley, Glenn Fairgrounds (A), and Eucalyptus (B). Weather stations associated with smart traps log temperature and relative humidity data.

Performance metrics of predictive models generated from smart traps and conventional traps:

Preliminary Model. As a precursor to the current project, a preliminary predictive model was generated using historic OLFF trapping data. This Python-based predictive model was created from historic OLFF population data and weather records derived from California Irrigation Management Information System (CIMIS) stations closest to trapping regions. Historic OLFF data was sourced from the COC-sponsored monitoring program that has generated replicated weekly trap catch data since 2007 from 10 sites in the SSJV and since 2013 from 13 sites in the SV. The large dataset was used to train the model to predict future OLFF occurrence. The entire dataset was divided into 80% for training and 20% for testing purposes. Within the training



Figure 5. QR Code for Access to Predictive Model based on 2025 Smart Trap Data

dataset, cross-validation was made using k=5. The performance metrics of the model on test dataset were recorded as follows: accuracy = 0.71, precision = 0.70, recall = 0.68, F1-score = 0.69, Cross-validation MSE = 120.78 (Table 1).

Smart traps and Conventional traps. The data collected from smart traps and conventional traps in 2025 was used to generate improved predictive models. The smart traps provided in-orchard weather data that could be utilized in concert with the pest population data from either the smart trap or the conventional traps in the same orchard. Model performance was better when trained on OLFF data from smart traps than conventional traps (Table 1). For OLFF classification, the Random Forest model with smart trap data achieved 0.78 accuracy, 0.81 precision, 0.81 recall and 0.81 F1-score, while the model based on conventional trap data achieved 0.68 accuracy, 0.50 precision, 0.33 recall and 0.40 F1-score, which together show significantly more robust classification and better generalization with smart-trap data. The smart trap model was more accurate in predicting future OLFF counts than the conventional trap model, with a lower cross-validation MSE (13.20 versus 17.70), suggesting it has better predictive ability for future OLFF population levels.

Table 1. Evaluation metrics for OLFF predictive model classification and regression from the historic trapping data and data from the 2025 trapping season.

Data Source	Accuracy	Precision	Recall	F1-Score	Cross-Validation MSE
Historic trap data	0.71	0.70	0.68	0.69	120.78
Smart trap	0.78	0.81	0.81	0.81	13.20
Conventional trap	0.68	0.50	0.33	0.40	17.70

The OLFF predictive model based on 2025 smart trap data can be accessed by the following URL: https://huggingface.co/spaces/santoshme/OLFF_prediction_using_Smart_traps
A QR Code has been made to allow for easy access to the predictive model (Figure 5). The user-interface of the model is illustrated in Figure 6.

Future Efforts

During the 2026 season, our team has deployed smart and conventional traps at two locations in the SV and two locations in the SSJV. The additional data gathered in 2026 will be used to improve preliminary models with the expectation of improved accuracy. We plan to introduce the interactive data platform for access to historic OLFF data to growers, PCAs and researchers

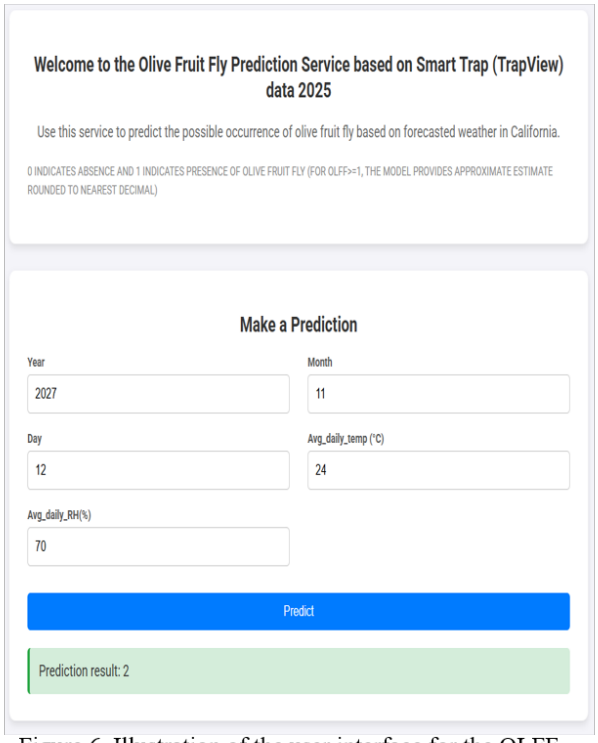


Figure 6. Illustration of the user interface for the OLFF predictive model based on 2025 smart trap data in California.

through publication in a trade magazine like Progressive Crop Consultant or CAPCA Advisor.

Summary of Accomplishments

1. Analysis of historic OLFF data and composition of CAPCA Advisor article for publication in September 2026.

2. Development of interactive web-based platform for access to historic OLFF trap catch records, available for growers, PCAs, and researchers.

3. Implementation of smart trap technologies for OLFF monitoring in California and comparison of efficacy of smart traps, smart probes, and conventional traps.

4. Development of a predictive risk model for evaluation of future risk of OLFF based on weather patterns. Model will be further improved at the close of the 2026 trapping season.

****INFORMATION ONLY****

FROM: RESEARCH SUBCOMMITTEE

SUBJECT: GRANT APPLICATION

BACKGROUND:

The COC will be applying for research related grants in the upcoming grant cycle. Applications are due in September.

Staff is seeking feedback on grant topics.

If there is a specific research topic/ project that the Committee has shown interest in, we can approach the researcher to partner on a grant!

****INFORMATION ONLY****

FROM: RESEARCH SUBCOMMITTEE

SUBJECT: PRODUCT REGISTRATION UPDATE

BACKGROUND:

Product	Active Ingredient	Registrant	Status
Kasugamycin	Kasumin 2L	United Phosphorous, Inc.	Submission is currently in progress with the EPA. Given the current administration/MAHA initiative, approval is expected to be challenging. Staff met with UPL in June and was advised to pursue broader industry support through a coalition. In July, staff also met with the EPA to discuss the submission and next steps. The current priority is to build an industry coalition and strengthen the letter of support by incorporating additional data and statistics that demonstrate the need for Kasumin. Staff is working closely with Dr. Jim Adaskaveg and UPL to develop the supporting language and ensure the submission effectively communicates the importance of this registration.
Syllit	Dodine	United Phosphorous, Inc.	Still at CDPR
Ph-D	Poloyxin	United Phosphorous, Inc.	Registered for Peacock Spot. Download the label here: https://we.tl/t-Vg50xWiNkANYFbmV

****ACTION REQUIRED****

FROM: RESEARCH SUBCOMMITTEE

SUBJECT: DISCUSSION AND APPROVAL OF 2027 RESEARCH PRIORITIES

BACKGROUND:

- Each year the Research Subcommittee sets priorities of research they would like executed on their behalf for the following year. These efforts are to fund more specific and calculated research to enhance the benefits to the industry. Once the priorities are set, they are provided to the University of California liaisons to request proposals from researchers. Additionally, priorities are distributed to land grant universities across the nation and to private research facilities. Proposals will be reviewed for funding in November by the subcommittee.
- On the following page are the 2026 Research Priorities.

2026 RESEARCH PROJECTS FOR THE CALIFORNIA OLIVE COMMITTEE

	Researcher	Project	Amount
1	Dr. Carol Lovatt and Elizabeth Fichtner	Integrating Alternate Bearing Mitigation Strategies in a Commercial Table Olive Orchard (Year 4/4)	$36,922
2	Elizabeth Fichtner	Designing a Web App for Predicting Risk of Olive Fruit Fly—a Tool for California Olive Growers and Pest Control Advisors (Year 2/2)	$20,432
3	Georgia Drakakaki and Becky Wheeler-Dykes	Evaluation of Effects of Accede® (ACC) at Two Different Application Rates on Abscission Zone Development and Trunk Shaking Efficiency in Table Olives	$97,799
4	Georgia Drakakaki and Minmin Wang	DNA Evaluation to Authenticate Manzanilla and Hojiblanca Table Olive Cultivars	$22,625
5	Olivier Ceberio	Collaborative Nutrient Calibration with California Olive Growers Using Nutriscope	$48,840
6	Rodrigo Almeida	Ecology of Olive Associated Xylella fastidiosa Strains in California	$46,618
7	Christopher Simpson	Sacramento Valley Olive Fruit Fly Monitoring Project	$13,500
8	Bert Quezada and Jim Stewart	Southern San Joaquin Valley Olive Fruit Fly Monitoring Project	$12,000
		TOTAL	**$298,736**



OOCC Research Priorities for 2026-2027

Control of the following existing or potential threats to the industry:

- Research How to Grab Carbon Money
- Understanding Sap Analysis
- New Canopy Management Trial
- Loosening Agents like Accede
- Nitrogen/Nutrient Analysis Oil yield analysis 10,000 acres and everyone sharing tissues vs yield and finding sweet ranges on elements
- Foliers Sprays and their effectiveness efficacy for absorption and if it helps with yield
- Anything to help hold the bloom on the plants
- Super high-density bloom volume self-fertile? They are only self-fertile to a small degree
- More consistent yields and then it all falls off. Another 2% would make a huge difference
- Green Olive Knot – showing up on fruit; possible reduced efficacy of copper treatment?
- Neofabraea Treatments
- Wider range of pesticide options for organic and conventional
- Detecting residues in oil

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California Olive Committee Research Priorities for 2026

- Olive Fruit Fly Trapping
- OFF management techniques with an emphasis on examining new traps that attract flies. Also, OFF management techniques focused on needing a membrane and a new delivery system.
- Management of Olive Knot with an emphasis on developing new methods of control via soil applications. Management of Olive Knot focused on systemic rather than topical treatments.
- Management of Peacock Spot
- Evaluation of drone technology and satellite mapping pertaining to moisture evaluation and crop load estimates
- Mechanical harvesting on existing and new high density orchards
- Development of Loosening Agents
- Olive DNA evaluation to distinguish between different varieties in the market place
- Chemical control of Glassy-winged sharpshooter/Leaf Hoppers
- Determine costs of preventative measures relating to the spread of Xylella-Fastidiosa (XF)
- Pollination assist techniques focused on Manzanillo/ Field measurement tool to determine optimal pollination timing
- Investigation of Urea as a thinning agent. What is the cost and optimal application rate? Where is it currently being used?
- Determine what research has already been conducted regarding sterilization of OFF
- Attract and Kill trap for Olive Fruit Fly
- Black Scale Control from a Natural Insect Pest
- GWSS research on mass trapping
- Biological Research on Black Scale
- Unexplained Crop Failures specifically in the South
- Health Claims backed with Research for Canned California Ripe Olives