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AGENDA

California Olive Committee
Research Subcommittee Meeting

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

August 7, 2025
9:00 A.M.

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 page 2
   b. Research Subcommittee Chairman's comments
   c. Approval of Previous Research Committee Minutes
      i. November 13, 2024 Minutes (action item) page 3

II. **Review of 2024 Research Final Reports** page 12

III. **Grant Application** page 52

IV. **Product Registration Update** page 53

V. **Discussion and Approval of 2026 Research Priorities** (action item) page 55

VI. **Other Business**

VII. **Adjournment**

2023-2025 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 13, 2024
3:30 p.m

Zoom/Conference Call
http://US02web.zoom.us/j/82779827437

MINUTES

I. CALL TO ORDER

Chairman Dennis Burreson called the meeting of the Research Subcommittee to order at 3:31 p.m., and the following members were present:

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

STAFF	
Todd Sanders	California Olive Committee
Elise Oliver	California Olive Committee
Ethan Cranmer	California Olive Committee
Janette Ramos	California Olive Committee

GUESTS	
Jeremy Sassilli	USDA
Rick Benson	Producer Member

Emily Symmes - Suterra
Vijay Pai - Suterra

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

- **MOVED by RICCHIUTI, duly seconded by C. BURRESON, and carried THAT the minutes for August 7, 2024, be approved as presented. (MOTION 11-13-24 #1)**

II. GUEST SPEAKER-SUTERRA

a. Olive Fruit Fly Attract and Kill Trap

Suterra was present to speak about their product BioMagnet Oro, an Attract and Kill Trap for the Olive Fruit Fly. Please see below link to their website! This product is not yet commercially available, but Suterra would like to know more about current industry practices related to the Olive Fruit Fly.
Suterra | BioMagnet™ Attract and Kill System
They are seeking to learn more about the industry and current needs:

- What are the current control methods for OFF?
- Are growers seeing a resistance to current controls?
- What is the severity of the fly and how difficult is it to control?
- Inputs in 2022 were cut in half. Was this due to weather?
- What is the economic damage to the grower?

III. DISCUSSION AND REVIEW OF 2024 PROJECTS

Each year, the Subcommittee funds research projects and requests progress reports from researchers. Provided in your packet are the current research progress reports for five projects and the final olive fruit fly reports for the northern and southern regions.

2024 Project Titles

TOPIC	LEADERS	AMOUNT
Management of Foliar Diseases-A. Olive Knot and B. Evaluation of New Fungicides For Control of Olive Leaf Spot – **page 12**	J.E. Adaskaveg	$13,715*
Epidemiology and Management of Olive Knot Caused by Pseudomonas Savastanoi pv. Savastanoi – **page 11**	J.E. Adaskaveg	$21,150*
Integrating Alternate Bearing Mitigation Strategies in a Commercial Table Olive Orchard-**page 13**	Carol Lovatt Elizabeth Fichtner	$33,825
Evaluation of effects of Acceede (ACC) on tree architecture, and harvester type on enhancing horticultural maturity and abcission zone development and commercial trunk shaking efficiency in table olives-**page 27**	Georgia Drakakaki Becky Wheeler-Dykes	$131,380**

Survey of Xylella fastidiosa diversity within California olive trees-**page 34**	Rodrigo Almeida	$29,752
Southern San Joaquin Valley Olive Fruit Fly Monitoring-**page 42**	Jim Stewart	$12,000
Sacramento Valley Olive Fruit Monitory Project-**page 43**	Ernie Simpson	$9,250
Total		**$251,072**

*Projects co-funded by the Olive Oil Commission of California.
**Project that Valent has contributed $8,500 to, reducing the fiscal impact to $122,880

IV. PRESENTATION OF 2025 PROPOSALS

As a reminder, please see below 2025 research priorities that were established at the August 7, 2024 meeting.

California Olive Committee Research Priorities for 2025

- 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

The above highlighted priorities were discussed at length in August of 2024. Staff has the below updates.
1. Evaluation of Drone Technology and Satellite Mapping Pertaining to Moisture Evaluation and Crop Load Estimates:
Pat Ricchiuti alerted staff that this technology already exists with a company called AgMonitor. Below is a link to their website and the email for Olivier Jerphagnon with AgMonitor.
olivier@agmonitor.com

2. Attract and Kill trap for Olive Fruit Fly:

Information was provided earlier from Suterra.

3. Black Scale Control from a Natural Insect Pest:

Mike Silveira mentioned he had previously worked with a scientist at USDA-ARS Parlier who worked on this. Dr. Victoria (Vicky) Yokoyama retired a few years ago. COC Staff coordinated with USDA-ARS Parlier to receive a proposal pertaining to black scale.

4. GWSS research on mass trapping:

COC Staff reached out to David Haviland, who is extremely familiar with GWSS due to table grapes. He let us know that mass trapping has never been used nor is there any thought it would work. The yellow traps that are used are considered blunder traps. The yellow gives them a slight attractiveness, but they aren't really attractive (like a pheromone-based trap would be). As a result, the traps are not really effective and aren't good for anything more than general monitoring. The reality is that if you get 10 or 20 GWSS on a trap, there are hundreds, and possibly thousands, in the trees or vines around it. His estimate is that the numbers of traps that you would need to have an effective mass-trapping program would be astronomical and cost prohibitive.

V. APPROVAL OF 2025 BUDGET - ACTION

Each year the Research Subcommittee approves various research projects funded by the Full Committee. The Subcommittee must determine which proposed projects to recommend to the Full Committee for funding. As estimated budget of **$493,218** (with no-cost extensions) is proposed based on the submitted projects.

#	Researcher	Project	Amount
1	Dr. Jim Adaskaveg*	Epidemiology and management of olive knot caused by Pseudomonas Savastanoi pv. Savastanoi (year 1)	$15,490
2	Rodrigo Almeida	Survey of Xylella fastidiosa genetic diversity within California olive trees (year 2)	$30,361
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)	$115,129.20
4	Dr. Carol Lovatt and Elizabeth Fichtner	Integrating Alternate Bearing Mitigation Strategies in a Commercial Table Olive Orchard (year 3)	$29,156
5	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	Franklin Lewis	Development of screening tools to determine Xylella fastidiosa tolerance in olives	$10,443
7	Joel Kimmelshue-Land IQ**	Olive Acreage Mapping	$30,700

8	Nicholas Manoukis	New prospects for the control of black scale in California olive groves	$73,000
9	R.A. Van Steenwyk	Improved monitoring of olive fruit fly through gammahexalactone lures and improved attract-and-kill control of olive fruit fly through the combination of gamma hexalactone and GF-120	$66,596
10	Ernie Simpson	Sacramento Valley Olive Fruit Fly Monitoring Project	$12,500
11	Jim Stewart	Southern San Joaquin Valley Olive Fruit Fly Monitoring Project	$12,000
	2024 NCE-Carol Lovatt	Integrating Alternate Bearing Mitigation Strategies in a Commercial Table Olive Orchard	$13,530
	2024 NCE-Drakakaki	Evaluation of effects of Accede (ACC), on tree architecture, and harvester type on enhancing horticultural maturity and abcission zone development and commercial trunk shaking efficiency in table olives	$52,552
	2024 NCE-Rodrigo Almeida	Survey of Xylella fastidiosa diversity within California olive trees	$11,900.80
		Contingency Fund	
		Total with No-Cost Extensions	$493,218
		Total without No-Cost Extensions	$415,235.20

*The COC traditionally co-funds this project with the OOCC.
**The COC will ask Valent if they are able to contribute any funds to reduce the fiscal impact as they did in 2024.
***The COC will also present this proposal to the OOCC to co-fund.

- **MOVED by SILVEIRA, duly seconded by PFEIFFER, and carried THAT the Research Subcommittee fund Dr. Adaskaveg's project for $15,490, for Fiscal Year 2025. (MOTION 11-13-24 #2)**

- **MOVED by C. BURRESON, duly seconded by MASANES AUTARD, and carried THAT the Research Subcommittee fund both Rodrigo Almeida's project for $30,361, and Franklin Lewis's project for $10,443, combining the two, and assist in funding the two projects for a total of $40,804, for Fiscal Year 2025. (MOTION 11-13-24 #3)**

- **MOVED by SILVEIRA, duly seconded by TINSLEY, and carried THAT the Research Subcommittee fund Georgia Drakakaki and Becky Wheeler-Dykes' project for $115,129.20, for Fiscal Year 2025. (MOTION 11-13-24 #4)**

- **MOVED by SILVEIRA, duly seconded by TINSLEY, and carried THAT the Research Subcommittee approve Dr. Carol Lovatt and Elizabeth Fichtner's project for $29,156, pending they add a trial on Accede to be received by the Full Committee at the December meeting. (MOTION 11-13-24 #5)**

- **MOVED by C. BURRESON, duly seconded by MASANES AUTARD, and carried THAT the Research Subcommittee fund Elizabeth Fichtner's project for $19,860, for Fiscal Year 2025. (MOTION 11-13-24 #6)**

- **MOVED by ZAVOLTA, duly seconded by PFEIFFER, and carried THAT the Research Subcommittee fund Nicholas Manoukis' project for $73,000 for Fiscal Year 2025. (MOTION 11-13-24 #7)**

- **MOVED by SILVEIRA, duly seconded by NEELEY, and carried THAT the Research Subcommittee fund Ernie Simpson's project for $12,500 and Jim Stewart's project for $12,000 for a combined total of $24,500, for Fiscal Year 2025. (MOTION 11-13-24 #8)**

- **MOVED by PFEIFFER, duly seconded by ZAVOLTA, and carried THAT the Research Subcommittee approve the Budget of $317,939.20 for Fiscal Year 2025. (MOTION 11-13-24 #9)**

VI. APPROVAL OF AUTHORITY TO THE EXECUTIVE DIRECTOR AND CHAIRMAN FOR INTER-ITEM TRANSFERS OF THE RESEARCH SUBCOMMITTEE BUDGET

ACTION

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

- **MOVED by PFEIFFER, duly seconded by C. BURRESON and carried THAT the Research Committee grant authority to the Executive Director and Chairman to approve inter-item transfers of the Research Subcommittee Budget. (MOTION 11-13-24 #10)**

VII. OTHER BUSINESS

- Sanders formally introduced, and welcomed our new employee, Ethan Cranmer. Ethan, will be Program Supervisor for the California Olive Committee.

VIII. ADJOURNMENT

Chairman Dennis Burreson adjourned the Research Subcommittee meeting at 5:03 p.m.

Todd W. Sanders
Executive Director
California Olive Committee

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SUMMARY OF MOTIONS FOR NOVEMBER 13, 2024

Motion 11-13-24 #1 **APPROVED**

MOVED by RICCHIUTI, duly seconded by C. BURRESON, and carried THAT the minutes for August 7, 2024, be approved as presented.

Motion 11-13-24 #2 **APPROVED**

MOVED by SILVEIRA, duly seconded by PFEIFFER, and carried THAT the Research Subcommittee fund Dr. Adaskaveg's project for $15,490, for Fiscal Year 2025. (MOTION 11-13-24 #2)

Motion 11-13-24 #3 **APPROVED**

MOVED by C. BURRESON, duly seconded by MASANES AUTARD, and carried THAT the Research Subcommittee fund both Rodrigo Almeida's project for $30,361, and Franklin Lewis's project for $10,443, combining the two, and assist in funding the two projects for a total of $40,804, for Fiscal Year 2025.

Motion 11-13-24 #4 **APPROVED**

MOVED by SILVEIRA, duly seconded by TINSLEY, and carried THAT the Research Subcommittee fund Georgia Drakakaki and Becky Wheeler-Dykes' project for $115,129.20, for Fiscal Year 2025.

Motion 11-13-24 #5 **APPROVED**

MOVED by SILVEIRA, duly seconded by TINSLEY, and carried THAT the Research Subcommittee approve Dr. Carol Lovatt and Elizabeth Fichtner's project for $29,156, pending they add a trial on Accede to be received by the Full Committee at the December meeting.

Motion 11-13-24 #6 **APPROVED**

MOVED by C. BURRESON, duly seconded by MASANES AUTARD, and carried THAT the Research Subcommittee fund Elizabeth Fichtner's project for $19,860, for Fiscal Year 2025.

Motion 11-13-24 #7 **APPROVED**

- **MOVED by ZAVOLTA, duly seconded by PFEIFFER, and carried THAT the Research Subcommittee fund Nicholas Manoukis' project for $73,000 for Fiscal Year 2025. (MOTION 11-13-24 #7)**

Motion 11-13-24 # 8 **APPROVED**

MOVED by SILVEIRA, duly seconded by NEELEY, and carried THAT the Research Subcommittee fund Ernie Simpson's project for $12,500 and Jim Stewart's project for $12,000 for a combined total of $24,500, for Fiscal Year 2025.

Motion 11-13-24 #9 **APPROVED**

MOVED by PFEIFFER, duly seconded by ZAVOLTA, and carried THAT the Research Subcommittee approve the Budget of $317,939.20 for Fiscal Year 2025.

Motion 11-13-24 #10 **APPROVED**

MOVED by PFEIFFER, duly seconded by C. BURRESON and carried THAT the Research Committee grant authority to the Executive Director and Chairman to approve inter-item transfers of the Research Subcommittee Budget.

******INFORMATION ONLY******

FROM: RESEARCH SUBCOMMITTEE

SUBJECT: REVIEW OF 2024 RESEARCH FINAL REPORTS

BACKGROUND:

2024 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
Dr. Jim Adaskaveg	Management of Foliar Diseases-A. Olive Knot and B. Evaluation of New Fungicides For Control of Olive Leaf Spot*	$13,715	
Dr. Jim Adaskaveg	Epidemiology and Management of Olive Knot Caused by Pseudomonas Savastanoi pv. Savastanoi*	$21,150	
Carol Lovatt and Elizabeth Fichtner	Integrating Alternate Bearing Mitigation Strategies in a Commercial Table Olive Orchard pg. 13	$33,825	6/30/2025
Georgia Drakakaki, Becky Wheeler Dykes, and Leslie J Nickels Trust	Evaluation of Effects of Accede (ACC) on Tree Architecture, and Harvester Type on Enhancing Horticultural Maturity and Abscission Zone Development and Commercial Trunk Shaking Efficiency in Table Olives** pg. 31	$131,380	6/30/2025
Rodrigo Almeida	Survey of Xylella Fastidiosa Diversity within California Olive Trees pg. 41	$29,752	6/30/2025
Jim Stewart	Southern San Joaquin Valley Olive Fruit Fly Monitoring	$12,000	
Ernie Simpson	Sacramento Valley Olive Fruit Monitor Project	$9,250	
	Total	**$251,072**	

*Projects co-funded by the Olive Oil Commission of California.
**Project that Valent has contributed $8,500 to, reducing fiscal impact to $122,880.

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 2 2024 Final Report with NCE through June 30, 2025)

Project Year: 2024 Anticipated Period of Performance: year 2 of 3 requested

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:

Ismael Gutierrez, I.G. Harvesting, 113 E. Hickory St., Lindsay, CA 93247; Phone: 559-805-8181; E-mail: Gutierrezismael559@gmail.com

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

IG carries out the grower standard winter pruning practice.

DC coordinates the application of treatments, applies the foliar applications and pruning treatments to the 'Manzanillo' olive trees at Ivanhoe (approval for DC to spray off the Lindcove REC and on the cooperator's property has been secured). DC also provided us with the 'Manzanillo' olive orchard at Lindcove, Exeter, CA, to determine whether pruning one side of the tree 28 DAFB and then the other side *biennially* is superior to pruning both sides of the trees in every other row every other year (there was not room for this at Woodlake or Ivanhoe). DC carries out the pruning treatments at Lindcove. DC will coordinate the harvests at both Ivanhoe and Lindcove.

Objectives for 2024 (Year 2): ***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 commercially valuable size fruit 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 tend 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., heat 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 2024 (Year 2): ***Justification.*** Results of our prior COC-funded research demonstrated that the young developing fruit of the ON crop of 'Manzanillo' olive trees inhibit summer vegetative shoot growth and thereby reduce 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 increase abscission of floral buds for next year's bloom starting in September, as well as inhibit spring bud break (Chao, 2014; Fichtner and Lovatt, 2018; Fitchner et al., 2021). These latter effects are consistent with reports that late-harvested ON crops further reduce return bloom. For ON-crop olive trees, the negative effects of fruit set on a shoot (localized effect) are stronger than the effects of the total number of fruit (crop load) on the tree (whole tree 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, 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 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 the low number of inflorescences at bloom based on the 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 2024, our research was conducted in a 'Manzanillo' table olive orchard in Woodlake, 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, not 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 and would thereby affect black scale survival, associated honeydew production and sooty mold growth, fruit quality and pesticide use.

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 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 the second to third instar stages. Proposed herein are pruning strategies timed closer to June when the scale first instars have hatched and are most vulnerable to hot, dry conditions. By increasing scale mortality at this critical period, damage resulting from the scale's associated honeydew production and growth of sooty molds may be lowered, resulting in reduced use of insecticide sprays targeting black scale.

Objectives for 2024 (Year 1): ***Plant material and experimental plan.*** There are three research objectives and goals:

(1) to test the results of our prior COC-funded research in a second commercial 'Manzanillo' table olive orchard to confirm that foliar-applied NAA at full bloom (FB) or 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 mitigating alternate bearing and increasing yields of medium + large size fruit to near equal distribution over multiple years compared to the ON-/OFF-yields of alternate bearing (untreated) control trees, trees pruned on one side of the tree 28 DAFB annually, and trees pruned on two sides of the tree in winter annually (grower standard practice). The goal is to determine the management strategy that maximizes yield of commercially valuable size fruit both during and after mitigation of alternate bearing.

(2) to use the sum of the bloom (floral intensity) estimates on two sides of each olive tree to decide when to carry out or not carry out a crop reduction strategy (NAA or pruning) in order to maintain high yields of medium + large size fruit, to test how well the relationships among estimated bloom, total yield and yield of medium + large size fruit from our previous COC-funded research hold up in a second orchard and to make and test 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 maintain yields of medium + large size fruit.

(3) to quantify the effects of the crop reduction strategies, which range from pruning both sides of the tree annually, one side annually, one side every other year, to no pruning for three years (NAA treated trees and the untreated alternate bearing control trees) on the resurgence of black scale populations, honeydew, associated sooty molds, and fruit quality in a 'Manzanillo' table olive orchard. The goal is to determine, to the degree climatic conditions during the 3-year experiment permit, whether the integration of specific alternate bearing mitigation strategies 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.

<u>Research Accomplished in 2024</u>.

<u>To meet the objective 1 at Woodlake</u>, we planned to continue the field experiment established in 2023 in the commercial 'Manzanillo' olive orchard in Woodlake. The experiment is in a randomized complete block design with 17 individual tree replications per treatment and seven 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 2021), e.g., alternate bearing control
(2) Foliar applied NAA @ full bloom (FB) to one side of the tree then the other side of the tree every other year (*biennially*)
(3) Pruning (hedging and topping) @ 28 days after full bloom (DAFB) to one side of the tree then the other side every other year (*biennially*)
(4) Foliar-applied cytokinin biosynthesis stimulator applied two weeks after a set of trees are pruned (hedging and topping) @ 28 DAFB on one side of the tree then the other side every other year (*biennially*). The cytokinin biosynthesis stimulator is applied annually to increase yield of medium + large size fruit in the current year and to stimulate summer vegetative shoot growth to increase return bloom
(5) Pruning (hedging and topping) @ 28 DAFB to one side of the tree then the other side every other year (*biennially*) on a flexible schedule, using a decision support tool based on estimated sum of the bloom on the two opposing sides of the tree. This orchard runs east-west, bloom estimates were made on the north and south sides of the tree
(6) Pruning 28 DAFB to one side of the tree and then the other side of the tree *annually*
(7) Control – grower standard practice of pruning two sides of the tree and topping in winter *annually*

Pruning is done as described in each treatment by our cooperator I.G. Harvesting. Liqui-Stik Concentrate® NAA (Loveland Products), which is identical to and has the exact same label and application rate as AMVAC's Olive Stop®, which we used in our previous experiment, is applied according to the label directions by our cooperator D. Cleek. He also applies the material that stimulates cytokinin biosynthesis (this is not a plant growth regulator and does not require registration by the State DPR or Federal EPA). It is applied 42 days (6 weeks) after FB to a set of trees pruned (hedging and topping) 28 DAFB on one side of the tree and then the other side every other year (*biennially*). The cytokinin biosynthesis stimulator is applied *annually* to increase yield of medium + large size fruit in the current year, even in the Year 1 ON-crop year, and to stimulate summer vegetative shoot growth to increase return bloom compared to other treatments.

Despite the ON bloom in 2023, there was very little crop set or harvested making 2023 an OFF-crop year. Thus, an ON bloom/ON-crop year was anticipated in 2024. This proved to be the case. The trees had an ON bloom. The sum of the bloom on the north and south sides of the trees (east-west rows) in all treatments was greater than the 4.25 ± 0.25 value in our model that indicates trees should have crop load reduced on one side of the tree biennially. The sum of the bloom estimate ranged from 4.7 to 5.8, except for trees receiving the grower standard winter pruning practice annually, which had already been pruned and had a sum of estimated bloom of 3.9. Despite the 2024 ON bloom, an OFF crop was set comprised predominantly of shotberries. We decided to discontinue the work at this site and save our COC funds to re-establish the research in a new commercial orchard in Ivanhoe in 2025 under our NCE through June 30, 2025.

To meet objective 1 at the Lindcove REC in Exeter, we continued our research on the second pruning trial established in 2023 at the Lindcove REC in Exeter, CA. At this site, we are comparing (1) 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 (2) 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, whereas both sides of trees in rows 8, 10 and 12 are pruned in years 2 and 4. There were not enough trees to include this comparison at our Woodlake site. Moreover, this orchard was added to serve 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 Woodlake and 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 this year, then we learn that the model's efficacy is influenced by climate.

Trees at the Lindcove REC, Exeter, CA, were harvested by I.G. Harvesting in mid-October 2024. Total yield and fruit size distribution as kg/tree are determined and used to calculate yield and fruit size distribution as kg and number of fruit per tree to quantify treatment effects on yield of M+L size fruit and the relationship with total yield.

Thus, starting in 2024 (year 2) at Lindcove, we were able to calculate alternate bearing index (ABI) for total yield and yield of medium + large size fruit. ABI = (year 1 yield – year 2 yield)/ (year 1 yield + year 2 yield), in which yield is in kilograms of fruit per tree and the difference in yield between years 1 and 2 is expressed as an absolute number. An ABI of zero means no alternate bearing, whereas an ABI of one is complete alternate bearing, i.e., crop one year, no crop the other year (Pearce and Dobersek-Urbanc, 1967). Analysis of variance (ANOVA) is used to test for treatment effects on bloom estimates, yield and fruit quality parameters, and ABI using the General Linear Model procedure of SAS (version 9.3; SAS Institute, Cary, NC). When ANOVA testing indicates significant differences, post-hoc comparisons will be determined utilizing Fisher's protected least significant difference (LSD) test. Pearson's product moment correlation coefficients are calculated to identify significant relationships ($r > 0.5$, $P \leq 0.05$). Significant correlations will be subjected to regression analyses, using the least squares method for the generalized linear model. The experiment is designed to determine the management strategy that maximizes yield of commercially valuable size fruit both during and after mitigation of alternate bearing, the goal of objective 1.

To meet objective 2, we estimate the floral intensity at full bloom at our research orchards in Woodlake and Lindcove 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 calculate the sum of the estimated bloom. Bloom estimates are made on the south and north sides of the trees (east-west rows) in the Woodlake orchard and east and west sides of trees (north-south rows) in the Lindcove orchard. Due to low fruit set and final yield in the Woodlake orchard again in 2024, the bloom data could not be used to analyze relationships among bloom estimates, total yield and yield of CVS medium plus large size fruit to determine how well our earlier results obtained at the Lindcove REC succeeded in the Woodlake orchard. The efficacy of the model awaits further testing in a new commercial orchard in 2025. Prior results suggested that the variability in the relationship between the range in total yields that result in high yields of medium + large size fruit is limited. If the yield data from this second experiment prove this to be the case, the sum of bloom estimates on two opposing sides of the tree should be able predict when and when not to impose a crop reduction strategy to better maintain yields of medium + large 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.

To meet objective 3, in addition to going into an ON-crop year, the 'Manzanillo' table olive orchard we selected had a history of black scale and had not been treated for black scale in recent years. Whereas black scale population numbers were monitored in spring and fall of 2023, there was no evidence of black scale in 2024. The presence of honeydew droplets on olive leaves in spring, which correspond to a rapid increase in scale size, is often the earliest signal of increased scale density in the orchard. Honey dew and sooty mold were not observed in May 2024 on the terminal ends [20 inches long (about 50 cm)] of four branches that were evaluated on one tree per each of the 7 treatments in 6 replication on a scale of 0-3 (0 = no honeydew or no sooty mold, 1 = presence of honeydew or sooty mold, 2 = honeydew or sooty molds on < 30% of the branch, and 3 = honeydew or sooty mold on > 30% of the branch. Scale density was evaluated by counting the number of mature scales (third instar to adult) on the terminal ends of the four branches on each tree per 7 treatments for six replications again in October. No scale was detected at that time. Thus, no scale data was collected in 2024, an additional reason we chose to end our research in this orchard.

To the degree climatic conditions during the 3-year experiment permit, the treatments in our experiment provide a range in canopy openness and closure and pruning times, which combined with our detailed analyses of black scale at two periods of the life cycle, plus honeydew and sooty mold ratings, will enable us to determine whether the integration of specific alternate bearing mitigation strategies 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 (goal 3).

The new research orchard in Ivanhoe does not have black scale. To meet objective 3 in 2025, we placed temperature data loggers in the canopy of the trees in the treatments that create a gradient from open to closed canopies to determine if, when and for how long branches experience temperatures of ≥ 38°C (100.4°F), which cause a high rate of black scale nymph mortality.

Results for 2024.

Woodlake. At the start of the experiment ($Time_{zero}$), there were no significant differences in the sum of bloom estimates at full bloom for the north and south sides of the trees in the 'Manzanillo' olive orchard in Woodlake (east-west rows) (Table 1). Remember the bloom estimates were completed before any treatments were applied, except the grower standard winter pruning treatment. At Woodlake, the sums of estimated floral intensity were all greater than 4.5 ± 0.25, the threshold value identified in our earlier research as the threshold above which trees need to be treated with a crop reduction strategy in order to maximize yield of medium plus large (M+L) size fruit. At Woodlake, in Treatment 5, for which pruning is carried out on a flexible schedule based on the sum of the bloom estimate, three trees had bloom estimates for the sum of the north and south sides of the tree that were below 4.5, these trees would not to be pruned. Due to the very low fruit set, characterized by a predominance of shotberries, the pruning treatments were not carried out at Woodlake and the trees were not harvested in 2024. The funds were carried forward with a NCE and used for our 2025 research, enabling us to submit a reduced budget for 2025.

Lindcove. The bloom estimates on the east and west sides of the 'Manzanillo' olive trees in the orchard at the Lindcove REC in Exeter (north-south rows) were all less than 4.5 ± 0.25 for trees pruned on one or both sides in 2023 and not scheduled for pruning in 2024; whereas the trees not pruned in 2023 and scheduled to be pruned on both sides in 2024 had an estimated sum of floral intensity within the range of 4.5 ± 0.25 and were pruned in 2024 (Table 2). The sum of estimated floral intensity was 30% lower in 2024 than in 2023 (Table 3).

In 2024, 'Manzanillo' olive trees at the Lindcove REC in Exeter had total yields ranging from 89 to 112 kg/tree (Table 2). Yield was 46% greater in 2024 than in 2023, despite the 30% lower sum of estimated bloom in 2024 compared to 2023 (Table 3*). The data were consistent with the poor fruit set we observed at the Woodlake site in 2023. At Lindcove, at the request of growers, we are comparing pruning on one side of the tree and then the other side every other year (*biennially*) (treatments 1 and 2) versus pruning both sides of the tree in every other row every other year (treatments 3 and 4). Due to treating every other row, two sets of trees are required for each treatment. The sum of the yield for trees treated on one side of the tree and then the other side biennially (treatments 1 and 2), which were pruned in 2023 but not in 2024, was greater (210 kg/2 trees; 54,443 fruit/2 trees) than the yield of trees pruned on both sides in one row but not the other row in 2023 with the rows pruned in 2024 reversed (treatments 3 and 4) (196 kg/2 trees; 53,101 fruit/2 trees) (Table 2). The differences in total yield were accompanied by differences in yield of CVS M+L fruit. Trees pruned on only one side of the tree biennially produced 91 kg/2 trees M+L size fruit (24,298 fruit/2 trees), whereas pruning trees on both sides of the tree in every other row every other year resulted in 79 kg/2 trees (20,085 fruit/2 trees) M+L size fruit. However, the yield differences are not statistically significant. In addition, there were no significant treatment effects on 2-year cumulative total yield and 2-year cumulative yield of CVS M+L fruit (data not shown). The alternate bearing index (ABI) for the 2-year 2023/2024 AB cycle was low (ABI = 0.39) for total yield, but high (ABI = 0.74) for yield of M+L size fruit, due to the very low yield of M+L size fruit in 2023. At Lindcove, where trees produced a strong bloom and both good total yields and yields of CVS medium plus large size fruit in 2024, there was a strong significant correlation between the sum of the estimated bloom and total yield ($r = 0.77$; $P < 0.0001$). The relationship between the sum of the estimated bloom and yield of commercially valuable M+L size fruit was weaker but highly significant ($r = 0.58$, $P < 0.0001$). There was a strong, significant relationship between total yield and yield of CVS M+L fruit ($r = 0.73$; $P < 0.0001$). These relationships are consistent with our previous results and the model we created. The 2024 bloom estimates for the trees at the Lindcove REC predicted total yields and yields of M+L size fruit that fit our model, but the model remains to be tested in a second commercial 'Manzanillo' olive orchard.

*For convenience, we included the yield data obtained with the 'Manzanillo' olive trees at the Lindcove REC in 2023 (Table 3) in kg in this report for comparison with the 2024 yield data in kg (Table 1). In our 2023 Final Report, the yield data were reported in lbs. but mislabeled as kg. The treatment effects remain the same.

Results of the NCE through June 30, 2025.

Ivanhoe. In winter 2025, we interviewed several 'Manzanilla' olive growers and evaluated multiple orchards against a set of criteria necessary to complete our COC-funded research over the next several years. The best fit was an orchard in Ivanhoe. We evaluated every tree in the block for uniform size and health and selected trees suitable for the project. All treatments included in the research in the 'Manzanillo' olive orchard at Ivanhoe are numbered and listed in Table 3. Trees for treatment 12 – grower standard winter pruning – were selected and tagged within the randomized complete block design. The pruning for treatment 12, planned for February, was completed the first week of March, just slightly late. Just prior to full bloom trees were evaluated for uniform floral intensity and the final set of 168 trees were selected and tagged in a randomized complete block design with 13 individual tree replications per treatment.

At full bloom (May 5, 2025), floral intensity was estimated on the east and west sides of each tree (rows are oriented north-south). With the exception of the trees in treatment 12, which were pruned in the winter, 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 4). Crop reduction treatments were applied to the side of the trees that had the lowest bloom (west side of the trees) to ensure a good total yield and yield of CVS M+L fruit in 2025 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, 00 and 800 ppm)) were completed just after full bloom on May 7, 2025. In addition, two subset of trees were treated with urea at two higher concentrations 6% and 8%) to test for phytotoxicity so we will know if the higher concentrations of urea are safe to use if required next year. Urea (4%) treatments applied 10 days after full bloom (DAFB) were applied on May 16, 2025. Pruning on one side of the tree and then the other was completed on June 4, 2025. Trees are scheduled to be topped in 2026. The olive trees in Ivanhoe will be harvested in October 2025.

Since the orchard in Ivanhoe does not have black scale, to meet objective 3 in 2025, we placed temperature data loggers in the canopy of the trees in the treatments that create a gradient from very open to very closed canopies to determine if, when and for how long branches experience temperatures of ≥ 38°C (100.4°F), which cause a high rate of black scale nymph mortality.

Lindcove. At full bloom (May 6, 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 implementation of a crop reduction strategy was not required (Table 5). However, to meet the objective of the research, trees in treatments pruned biennially were pruned on the east side of the tree on June 4, 2025. Trees scheduled to be pruned on both sides of the tree in 2025 were also pruned on June 4th. Trees were topped in 2024 and scheduled to be topped again in 2026. The 'Manzanillo' olive trees at the Lindcove REC are scheduled to be harvested in October 2025.

Future goals.

We selected a new 'Manzanillo' olive orchard to test the accuracy and utility of our model of the relationships among bloom, total yield, and yield of M+L size fruit. We installed temperature data loggers to measure if, when and for how long branches experience temperatures of ≥ 38°C

(100.4°F), which cause a high rate of black scale nymph mortality, in the treatments that create a gradient from very open to very closed canopies to determine the effect of canopy density on black scale populations. The remaining goals for 2025 are to complete the harvest to determine total yield and fruit size distribution per tree and to analyze the relationships among estimated floral intensity, total yield and yield of CVS M+L fruit and test the validity of our model for the 'Manzanillo' olive trees in the Ivanhoe orchard and at the Lindcove REC orchard, for which we will have 3 years of bloom, total yield and yield of M+L size fruit.

Outreach during Year 2 (2024) and the NCE through June 30, 2025.

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.

Grower education meeting presentations:

1) California Olive Oil Commission Annual Member Meeting, March 2024, Monterey, CA, oral presentation, entitled "Mechanisms and Mitigation of Alternate Bearing in Olive."

2) North Coast Olive Field Day, July 2024, St. Helena, 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 (2024). Olive yields benefit from a new strategy using naphthaleneacetic acid to manage crop load. Progressive Crop Consultant. Nov/Dec. 2024

2) 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. In Press.

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 (2024). Olive yields benefit from a new strategy using naphthaleneacetic acid to manage crop load.

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

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Table 1 (2024 Woodlake). Estimated floral intensity (bloom) of 'Manzanillo' olive trees in Woodlake, CA, prior to the application of the 2024 fruit thinning treatments, including foliar-applied naphthaleneacetic acid at approximately full bloom (May 6), pruning 28 days after full bloom (June 26) to one side of the tree and then the other side *annually* or *biennially*, with a set of trees pruned *biennially* that were treated 14 days later (July 5) with a foliar-applied cytokinin biosynthesis stimulator to increase yield of M+L size fruit in the current year and return bloom the following year, grower standard practice of pruning trees on both sides *annually* in winter, and untreated ON-crop control trees and the effect of these treatments on total yield (kg/tree) in October.

	2024 Bloom estimates[y] (Before 2024 treatments applied)			
2024 Treatment	South side of tree	North side of tree	Sum per tree	2024 total yield (kg/tree)
1) Untreated ON-crop control (last pruned and topped in winter 2021–2022) (alternate-bearing control)	2.9 a	2.1 ab	5.0 ab	
2) Foliar-applied NAA at FB to the south side of tree in 2023 and the other (north) side of the tree every other year (2025)	2.6 a	2.1 ab	4.8 ab	
3) Pruning (hedging and topping) 28 DAFB on the north side of tree in 2023 and then the other (south) side every other year (2025)	2.8 a	1.93 bc	4.7 b	
4) Foliar-applied cytokinin biosynthesis stimulator annually to the whole tree 14 days after pruning as in Treatment #3 was completed at 28 DAFB	2.8 a	2.0 ab	4.8 ab	
5) Pruning (hedging and topping) 28 DAFB to the north side of tree in 2023 and then the other (south) side every other year (2025) on a flexible schedule based on estimated floral intensity	2.7 a	2.1 ab	4.8 ab	

6) Pruning (hedging and topping) 28 DAFB on the north side of the tree in 2023 and then the other (south) side of tree annually (2024 and 2025)	2.9 a	2.3 a	5.2 a
7) Grower standard practice of pruning both sides of tree and topping in winter 2023 and annually (2024 and 2025)	2.3 b	1.7 c	3.9 c
P-value	< 0.0001	0.0084	< 0.0001

[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 May 6, 2024. Bloom estimates were made April 30, 2024. NAA was applied May 6, 2024. Winter pruning was March 27, 2024; no other pruning treatments were required in 2024. The cytokinin synthesis biostimulator was not applied in 2024, because there was no fruit set and we planned to select a new orchard for 2025.
[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 2 (2024 Lindcove). Estimated floral intensity (bloom) of 'Manzanillo' olive trees at the Lindcove REC in Exeter, CA, prior to the application of the 2024 (year 2) fruit thinning treatments, which included pruning (hedging with topping to 14 feet in 2024) 28 days after full bloom (DAFB) (June 3) to one side of the tree and then the other side *biennially* versus pruning 28 (DAFB) (June 3) 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.

	2024 Bloom estimates[y] (Before 2024 treatments applied)			2024 yield (kg/tree)
Treatment	East side of tree	West side of tree	Sum per tree	(M+L size fruit) (kg/tree)
1) Pruned 28 DAFB on east side of the tree in 2023; pruned on the west side in 2025	2.5 a	1.4 bc	3.9 ab	112.5 a (52.5 a)
2) Pruned 28 DAFB on east side of the tree in 2023; pruned on the west side in 2025	2.1 a	1.0 c	3.1 b	88.9 a (35.6 a)
3) Pruned 28 DAFB on both sides of the tree in years 2023 and 2025	2.0 a	2.0 ab	4.0 ab	94.1 a (34.1 a)
4) Pruned 28 DAFB on both sides of the tree in 2024	2.1 a	2.3 a	4.4 a	88.6 a (37.9 a)
P-value	0.5072	< 0.0001	0.1732	0.4126 (0.1990)

[z] Bloom was evaluated on April 29, 2024, using the following scale: 0, no inflorescence; 1, low floral intensity; 2, medium floral intensity; and 3, high floral intensity.
[y] Full bloom was May 3, 2024. All trees were pruned on June 3, 2024, and all trees were topped on June 6, 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 3 (2023 Lindcove). Estimated floral intensity (bloom) of 'Manzanillo' olive trees at the Lindcove REC in Exeter, CA, prior to the application of the 2023 (year 1) fruit thinning treatments, which included pruning (hedging) 28 days after full bloom (DAFB) (June 20) to one side of the tree and then the other side *biennially* versus pruning 28 (DAFB) (June 20) 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 larges (M+L) size fruit (kg/tree) in October.

	2023 Bloom estimates[y] (Before 2023 treatments applied)			2023 total yield (M+L size fruit) (kg/tree)
2023 Treatments	East side of tree	West side of tree	Sum per tree	
#1 Pruned 28 DAFB on west side of the tree in 2023; pruned on the east side in 2025	2.6 a	2.6 a	5.2 a	52.9a (4.9 a)
#2 Pruned 28 DAFB on west side of the tree in 2023; pruned on the east side in 2025	2.5 a	2.6 a	5.1 a	59.6 a (8.7 a)
#3 Pruned 28 DAFB on both sides of the tree in years 2023 and 2025	2.5 a	3.8 a	6.3 a	46.6 a (9.6 a)
#4 Pruned 28 DAFB on both sides of the tree in 2024	2.6 a	2.6 a	5.2 a	50.1 a (3.2 a)
P-value	0.8623	0.5123	0.6078	0.5579 (0.5960)

[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] All trees were pruned on June 20, 2023; trees were not topped in 2023.
[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 4 (2025 Ivanhoe). 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	
#2 Foliar-applied NAA @ FB to one side of the tree then the other side of the tree every other year—*biennially*	3.1 a	2.5 ab	5.6 ab	
#3 Pruning (hedging, with topping in year 2) 28 DAFB on one side of tree and then the other side every other year—*biennially*	3.3 a	2.3 ab	5.6 ab	
#4 Foliar-applied urea @ 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	
#5 Foliar-applied urea @ FB to one side of the tree then the other side every other year—*biennially*	3.3 a	2.7 ab	6.0 a	
#6 Foliar-applied urea @ 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	

#7 Foliar-applied urea @ 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
#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
#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
#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
#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
#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
P-value	0.0698	0.0005	0.0006

[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 May 5, 2025. Bloom estimates were made May 5, 2025. Foliar sprays were applied on applied May 7, 2025, and 10 days after full bloom (DAFB) on June 16, 2025. Pruning was done on June 4, 2025. All treatments were applied to the west side of trees.
[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. Estimated floral intensity (bloom) of 'Manzanillo' olive trees at the Lindcove REC in Exeter, CA, prior to the application of the 2025 fruit thinning treatments, which included pruning (hedging) 28 days after full bloom (DAB) (June 4) to one side of the tree and then the other side *biennially* versus pruning 28 (DAB) (June 4) 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.

	2025 Bloom estimates (Before 2025 treatments applied)			2025 yield (kg/tree)
Treatment	East side of tree	West side of tree	Sum per 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	0.8 a	1.3 a	2.2 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	
3) Pruned 28 DAFB on both sides of the tree in years 2023 and 2025	0.6 a	1.0 a	1.6 a	
4) Pruned 28 DAFB on both sides of the tree in 2024	0.3 a	0.3 a	0.6	
P-value	0.2247	0.2741	0.153	

[z] Bloom was evaluated on May 6, 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 May 6, 2025. All trees were pruned on June 4, 2025, and all trees were topped the previous year on June 6, 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.

Workgroup/Department: Olive / Plant Sciences, UC Davis

Project Year: April 1, 2024 – March 31, 2025. Anticipated Duration of Project: 1 year
(UC Davis Sponsored Programs Proposal # xxxxx- submitted)

Project Title:
Evaluation of effects of Accede® (ACC), tree architecture, and harvester type on enhancing horticultural maturity and abscission zone development and commercial trunk shaking efficiency in table olives

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2024 Season Summary

During the 2024 growing season, we tested the combination of skirt pruning and foliar spray of Accede^{TM} (ACC, 1-aminocyclopropane-1-carboxylic acid) at 1500 ppm, 100 GPA rate in promoting mechanical harvest efficiency. ACC was applied on September 30th (1369 GDD) and the mechanical harvest was performed after 7 days on Oct 7th (1442 GDD). Spring skirt pruning does not generate a yield penalty. We followed last year's protocol that we timed the ACC application again at the point where the fruit removal force was around 0.3 kg, and we observed significant fruit removal force decrease compared to control in both 3 days and 7 days after ACC application. Combination of skirt pruning and ACC application induced 23.4% increase of trunk shaker mechanical harvest efficiency, compared to the unskirted control.

Through this season's work, we have established a recommendation of mechanical harvesting protocol for high efficiency

1. Skirting pruning during May - June

2. During pre-harvest (early September or starting at GDD 1000°C), Monitor fruit removal force, until it drops below 0.3 kg.
3. Appy 1500 ppm ACC afterwards, and harvest after 7-10 days post application.

This year's results showed that:

(1) Skirting low branches in spring does not affect the total yields of the trees.

(2) ACC application after fruit removal force dropping below 0.3 kg can increase the mechanical harvesting efficiency by ~15%, similar to last year's results.

(3) Cellular analyses confirmed that ACC promotes the formation of fruit abscission zone (FAZ). In FAZ cell layer of ACC treated fruits, alkalization of cytosol and decrease of plasmodesmata callose were observed as in ripe fruits. This underlines natural cellular mechanisms of FAZ formation that can be accelerated with ACC application.

(4) We have initiated the IR-4 application process. Next year we will obtain the third year's data to fulfill the IR-4 application requirements.

Material and Methods

As indicated in the plotmap on the next page. Individual rows of 1-13 were sprayed with 1500 ppm ACC or the control spray + 0.025% non-ionic surfactant (Activator 90). Half of each row is skirted. Except row 1, 3, 12, and 13, all the rows are harvested by trunk shaker and hand gleaned afterwards. Harvester performed a 15-tree run and we performed timing experiment on 10/7/24 during 8 am to 2 pm, and hand-gleaning was performed on 10/15/24 and 10/16/24 during 7 am to 2:30 pm, to compare the efficiency of mechanical harvester and hand gleaning method.

At harvest, the mechanically harvested yield of 15-tree plots were weighed, and a subsample was submitted for grading and determination of price per ton for each plot. Grading samples were submitted to Musco Orland Receiving Station for quality grading. We will report the grades among ACC treated fruits and control samples in the final report.

Harvester efficiency of each treatment was calculated as:

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

Pull tests will be performed by 12 rows x 4 trees per row x 5 olives per tree = 240 olives per pull test on 8/23, 8/30, 9/9, 9/18, 9/23, 9/29, 10/3, and 10/7.

Nickels Olive Accede Trial 2024 Map N

row/tree	1	2	3	4	5	6	7	8	9	10	11	12	13
1	#1	#3	#5	#7	#4	#6		#2	#8	#4	#8	#2	#6
2													
3													
4													
5													
6													
7	X	X	X	X	X	X		X	X	X	X	X	X
8													
9													
10													
11													
12													
13													
14													
15													
16	#2	#4	#6	#8	#3	#5		#1	#7	#3	#7	#1	#5
17													
18													
19													
20													
21													
22	X	X	X	X	X	X		X	X	X	X	X	X
23													
24													
25													
26													
27													
28													
29													
30													
	1	2	3	4	5	6	7	8	9	10	11	12	13

Note: Planted 7-8-01. Tree spacing =12'x18' or 202 trees/ac

Treatments: :

Treatment 1	ACC + Skirting + TS
Treatment 2	ACC + No Skirting +TS
Treatment 3	ACC + Skirting + TS
Treatment 4	ACC + No Skirting + TS
Treatment 5	Control + skirting +TS
Treatment 6	Control + no skirting + TS
Treatment 7	Control + skirting + TS
Treatment 8	Control + no skirting + TS

Results of the 2024 season

Fruit removal force reaches ~0.3 kg in late September

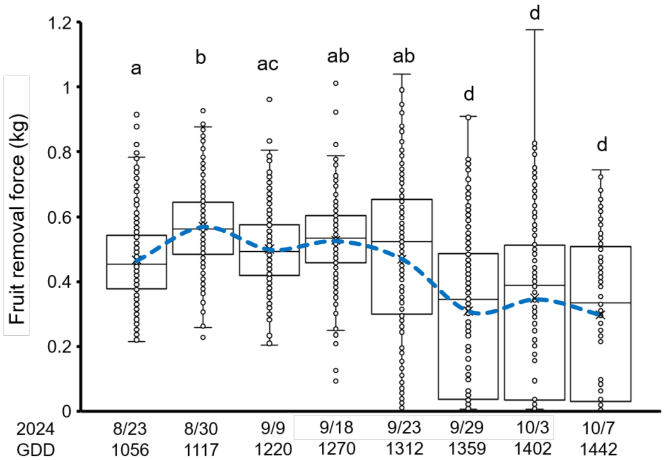


Figure 1. Fruit removal force during pre-harvest stages of olive fruit development. Each biological replicate is one fruit. Blue dashed line indicates the change of average during the sampling period. Different letter indicates significant difference between groups (n = 120 or 240, one-way ANOVA, Scheffe's Test, $p < 0.05$). Growing degree day (GGD), is shown on the x axis and is calculated using 15°C as base value and May 10th, 2024 as half bloom day, and mechanical harvest was performed on 10/7/24.

We continued to monitor fruit removal force in relation to growing degree days (GDD) and calendar dates. A similar trend was observed throughout the past three years and a major drop of fruit removal force was also observed near the end of September this year, at around 1350 GDD (**Figure 1**). We followed the criteria of 0.3 kg fruit removal force and sprayed with ACC at 1500 pm, with a 100 gallons per acre (GPA) rate on September 30th, 2024. The mechanical harvest was performed on October 7th, 2024, 7 days after spraying the orchard.

ACC application significantly reduces FRF

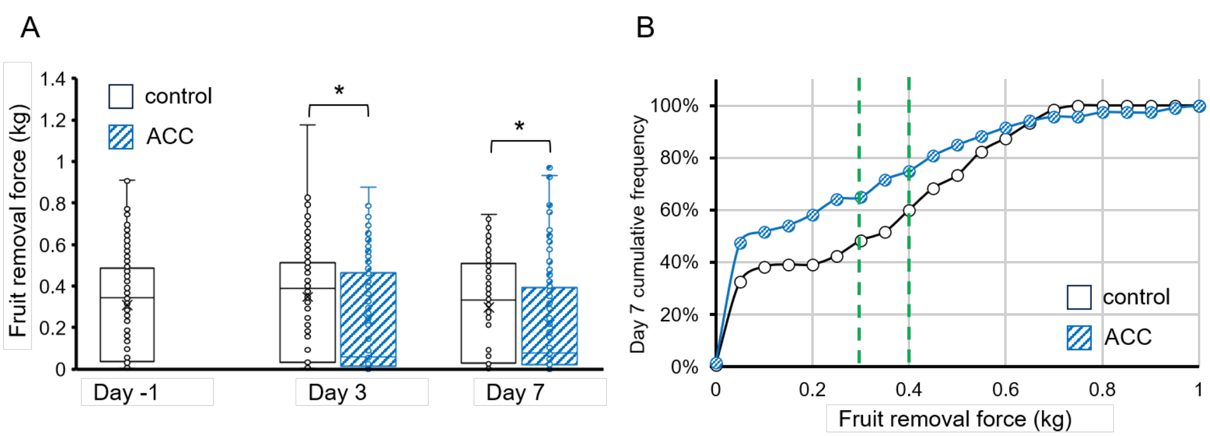


Figure 2. (A) Fruit removal force before and after ACC treatment. Each biological replicate is one fruit. Asterisk indicates significant difference between control and ACC treated group (n = 120, t-test, $p<0.05$). **(B) Cumulative frequency of fruit removal force of fruits sampled on the harvest day.** Green dashed lines suggest fruit removal force range corresponding to mechanical harvest removal rates.

ACC treatment (1500 ppm, 100 GPA) was performed on 9/30/24 (GDD 1369°C), and no significant FRF changes were observed during the 8 days in the control group (**Figure** 2) in the course of the ACC application period (9/30-10/7). However, in the ACC treated group, a significant lower FRF was observed on both the 3rd-day and 7th -day after treatment.

Cumulative frequency of FRF on 7th-day after treatment (**Figure 2B**) suggest that the fruits with lower than 0.4 kg FRF, represent 75% and 60% of the population in ACC treated and control group, which approximately matches the mechanical harvest efficiency of ACC treated and control group. Our data of the 2024 season (**Figure 2B**) suggested that this year the threshold for using the trunk shaker to remove a fruit from the tree was between 0.3 - 0.4 kg.

Spring skirting pruning does not affect yield

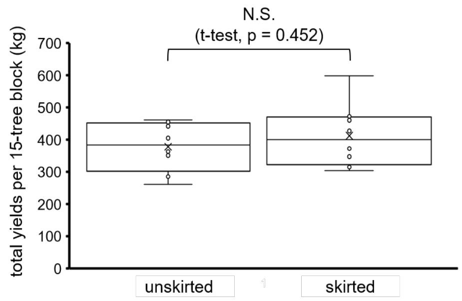
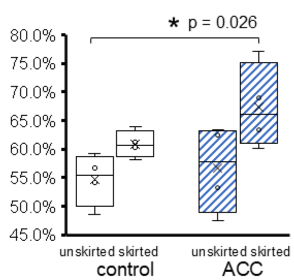


Figure 3. Total yields of two pruning treatment (unskirted vs skirted). Each biological replicate is a block of 15 trees (n = 8).

We found that low branches dangling on the receiver of trunk shaker cannot be efficiently harvested by the trunk shaker. Sometimes lower branches even directly block the receiver and get knocked off by the receiver. We performed a skirting pruning test (4 feet above the ground) this spring. The total yield of 15-trees, including the weight of mechanical harvest and hand gleaned fruits, are not significantly different between the unskirted and skirted groups (**Figure 3**). These results suggest that skirting improves mechanical harvesting efficiency without the penalty of yield. Skirting pruning should be the practice to follow, preparing the orchard in the spring for the upcoming fall mechanical harvesting.

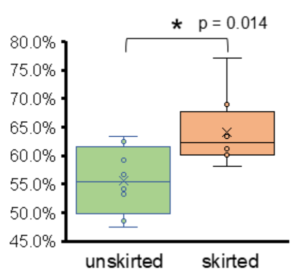
Both skirting pruning and ACC application increased mechanical harvest efficiency

A



	control	ACC	efficiency increase by ACC
unskirted	54.7%±2.3%	56.6%±3.8%	*3.5%*
skirted	60.9%±1.2%	67.4%±3.7%	*10.7%*
efficiency increase by skirting	*11.3%*	*19.1%*	*Combinational increase: 23.4%**

B



	combined
unskirted	55.6%±2.1%
skirted	64.2%±2.2%*
efficiency increase by skirting	*15.5%*

Figure 4. Efficiency comparison (**A**) of pruning and ACC treatments. Asterisk indicates significant higher efficiency (23.4%) observed in the group treated by both ACC spray and skirt pruning, compared to the no treatment control (n = 4, t-test, p = 0.026). (**B**) by combining spray treatment groups. Asterisk indicates significant higher efficiency is observed in skirted group (n = 8, t-test, p = 0.014). Each biological replicate is a block of 15-tree.

We tested effect of skirting and ACC spray on mechanical harvest this year. Both induced an increase in harvesting efficiency. Combinational treatment of ACC spray and skirting induced a **23.4% increase of harvesting efficiency** (**Figure 4A**), while improved efficiency was also observed by skirting alone (15%) (**Figure 4B**).

This year's result confirmed the efficacy of ACC implemented using current established orchard management practices. Further our 2024 results provided 2^{nd} year supporting evidence for the IR-4 application of ACC in the table olive mechanical harvesting.

Economic analysis

Figure 5 depicts estimates of harvest costs and returns were made using the values per ton as reported by the processor, price of Accede at the time of application, costs of harvest extended by labor contractors, and yields of mechanical and hand-gleaning harvest in this trial. The data was used to compare the harvest costs and returns of several scenarios combining either applying Accede or not applying Accede; hand-gleaning after mechanical harvest or leaving the remaining crop in the field; skirting the trees or not skirting the trees. This analysis does not include any other management practices; it only considers changes to harvest costs and returns based on yield and quality differences as affected by skirting, application of Accede, mechanical harvest, and hand-gleaning. Additionally, the costs were calculated for both an application at 1500ppm as well as the potential returns of an application at 750ppm. This calculation was made to better understand the potential economic benefits of achieving the same efficacy with lower rates, as we will be testing in the 2025 iteration of the project. The cost and return of a conventional hand harvest with no Accede or skirting was used as the control comparison.

The best margins in the scenarios modeled were achieved by skirting, applying Accede, and following the mechanical harvest with hand-gleaning. Skirting the trees improved returns in all scenarios as it reduced the amount of crop that would be hand-gleaned. Using a lower rate of Accede increases returns by more than $850 per acre, making the efficacy at these lower rates a critical aspect of future studies. In almost all scenarios, mechanically harvesting improves the net return by reducing harvest costs. A key take-away from the 2024 research results is that skirting trees is an immediately implementable practice that improves harvest efficiency of trunk shaker style mechanical harvesters.

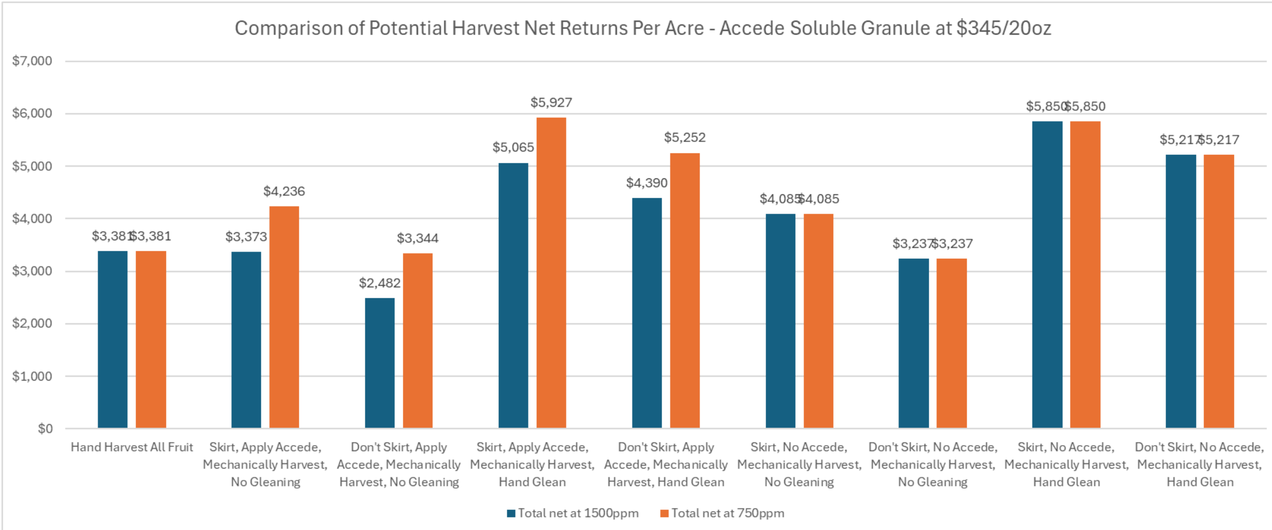


Figure 5. Economic comparison of potential net returns based only on harvest costs and yield values. The comparison examines sixteen combinations of practices and compares the net returns to a hand harvested crop with no skirting and no Accede application (bars on left end of chart).

Comparison of growing degree days during the 2022 - 2024 growing seasons

We are working to build the growing degree day (GDD) model for the table olive mechanical harvest and general olive industry (**Figure 6**). Using the **formula (1)** with T_{base} as 15°C, which is a basic growing degree day model formula, a very similar trend of 2022 and 2024 was observed, deviating far from 2023. We will continue to monitor the GDD and will establish a revised model accompanied to the fruit removal force to better predict the ACC application and mechanical harvest.

$$GDD = \frac{(T_{max} + T_{min})}{2} - T_{base} \qquad (1)$$

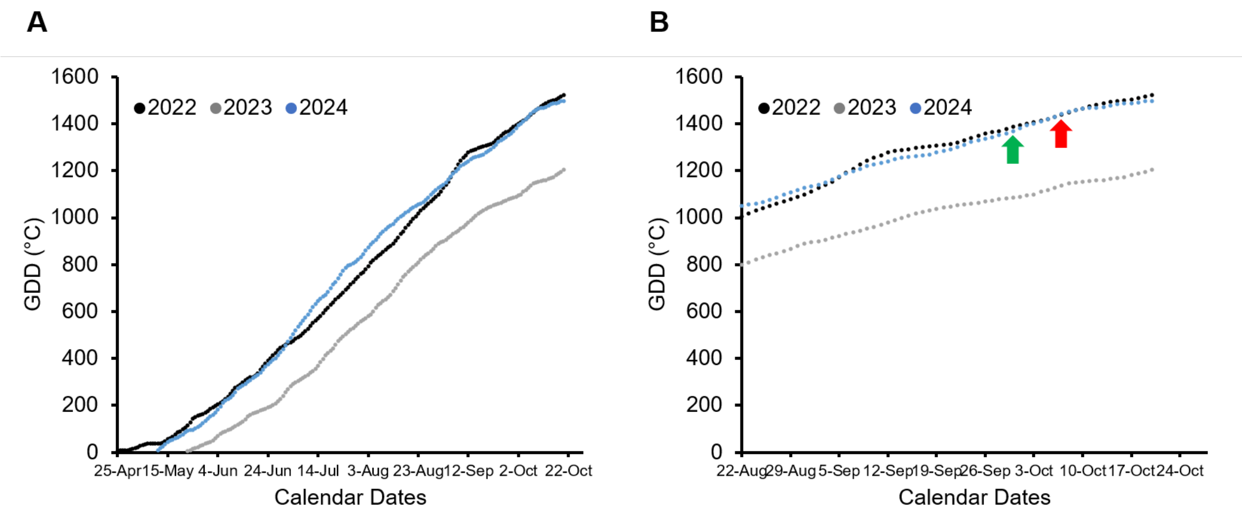


Figure 6. Growing degree days comparison for 2022 – 2024 growing season. (A) Full season heat unit accumulation starting from half bloom day. **(B)** Zoom-in of pre-harvest period. Green arrow indicates 2024 ACC application date (9/30/24, 1359 GDD) and red arrow indicates 2024 harvest date (10/7/24, 1442 GDD).

Live staining confirms the efficacy of ACC to promote FAZ formation at the cellular level

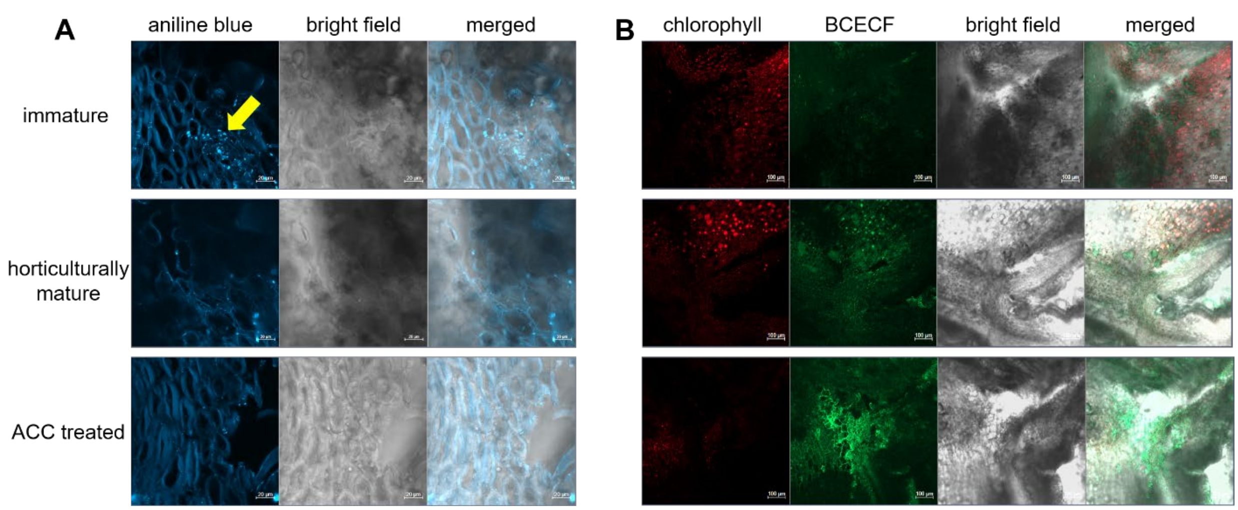


Figure 7. Live staining of callose (A) and cytosolic pH (B) at olive FAZ. (**A**) Fluorochrome aniline blue staining of callose at plasmodesmata. Yellow arrow points to blue fluorescent spots that indicate the presence plasmodesmatal callose at the FAZ. Scale bar = 20 µm. (**B**) BCECF cytosolic staining of FAZ. Higher green signal indicates higher pH. Scale bar = 100 µm.

Less plasmodesmata callose staining signals were observed in horticulturally mature samples compared to immature samples at FAZ, suggesting that the symplasmic trafficking of different molecules is promoted during the maturation process. ACC treated samples also showed a higher rate of FAZs with low plasmodesmata callose (**Figure 7A**), suggesting that ACC application advances the maturation process. We observed the same effect in ethephon treated samples in previous years' study.

Alkalization of abscission zone cytosolic pH was previously suggested as an indicator of fruit abscission zone formation (Sundaresan et al., 2015). We now observed this phenomenon in a tree crop, olive. More cells with alkalized cytosol were observed in horticulturally mature and ACC treated samples (**Figure 7B**).

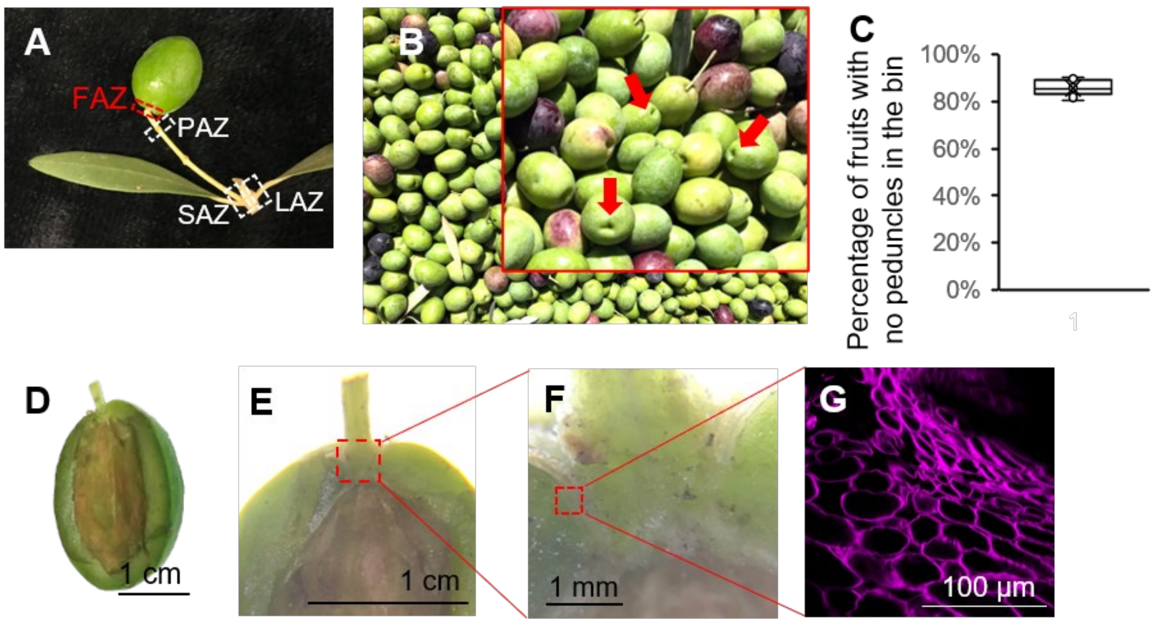


Figure 8. Identification of major abscission zones in table olive mechanical harvest. (**A**) Possible abscission zones for fruits to detach from trees. FAZ, fruit abscission zone. PAZ, peduncle abscission zone. SAZ, secondary abscission zone. LAZ, leaf abscission zone. (**B**) Harvester bin images. Red arrows indicate fruits detach at fruit abscission zone (FAZ). (**C**) Harvester bins were imaged and manually counted for fruits with no peduncles (n = 12 bins). (**D - G**) Zoom-in illustration highlighting the region of interest used to examine cellular changes at the FAZ.

Our manuscript on small-trial ethephon application will be submitted next month (July 2025). **Figure 8** is showing the fruit abscission zone selection we present in this paper and we will adopt this method in ACC related studies. **Figure 8G** shows the cell layers at FAZ characteristic of differential cell sizes along the region that are about to abscise.

In summary, live staining of plasmodesmata callose and cytosol pH confirms the efficacy of ACC in promoting the formation of fruit abscission zone at cellular level.

Quality evaluation of mechanical harvested and hand harvested samples

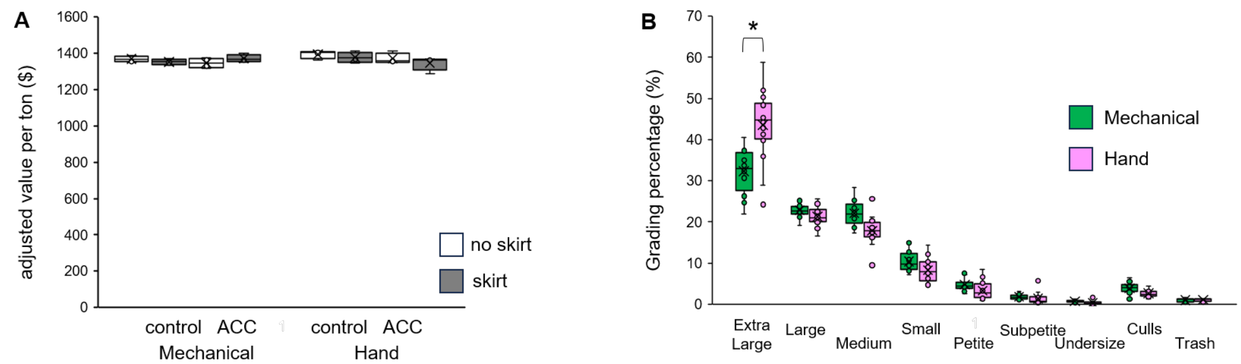


Figure 9. Quality grades of 2024 trial (**A**) Adjusted value per ton of mechanical and hand harvested samples. N = 4 for each group and each group contains 15 trees. 10 lb samples were graded for each group at the processing facility of Musco family olive company. (**B**) Grading percentage of each category in mechanical and hand harvested samples. N = 16 for each group pooling all the treatment.

Figure 9A shows that ACC or skirting treatment does not affect the value of harvested fruit, and the observation of 2024 season that ACC treatment does not affect fruit quality is consistent with the result we observed in 2023. No statistical difference was observed between control versus ACC treatment, control versus skirting treatment, or mechanical versus hand harvested sample (t-test or single factor ANOVA, $p > 0.05$ in all comparison). Interestingly, we observe hand harvested sample contains a significant higher percentage of extra-large fruits in 2024 season.

In summary, mechanical harvest with skirting preparation of the orchard and Accede application to reduce fruit removal force does not show undesirable effect in fruit quality for harvesting.

Our 2024 results provide a second year of robust data supporting Accede's role in enhancing mechanical harvest in table olives without compromising yield or quality. This season's findings, together with prior data, strengthen our IR-4 efforts of Accede which aims at establishing mechanical harvest as a standard practice to promote efficiency and sustainability in olive production.

Survey of *Xylella fastidiosa* diversity within California olive trees

UC Berkeley
Department of Environmental Science, Policy, and Management

PI: Professor Rodrigo Almeida
Cooperator: Patrick Lee

Aims:

1. Determine the genetic identity of *Xylella fastidiosa* (*Xf.*) strains causing disease in ornamental olive trees.
2. Identify environmental factors associated with high strain diversity to inform future management practices.

Methods:

Field collections:

Maps generated with data from Love et al. (2022) provide geographically explicit locations of all olive trees throughout Los Angeles and San Diego counties. Areas with high densities of olive trees were chosen for sampling. In San Diego, this process was repeated until the majority of the county was sampled.

Only olive trees showing symptoms of *Xf.* infection (canopy dieback, leaf scorch, etc.) were sampled. Initial sampling protocol was based on (EPPO 2018); ~20 cm of olive branch tissue was collected from each symptomatic olive tree using a pole pruner or hand shears.

Diagnostic testing:

All samples were screened for *Xf.* using a robust qPCR assay (Harper et al. 2010). This test determines whether *Xf.* cells are present in the sample, and also allows for approximation of bacterial population size.

Bacterial Isolation:

An attempt to isolate *Xf* cells in pure culture was made for a subset of samples. Media preparation, tissue homogenization, and growing conditions were all chosen from a robust and widely used protocol (Hill & Purcell 1995). Isolated *Xf* cells were then stored in -80C for future experiments.

Genetic typing:

Multi-locus sequence typing (MLST) is a genetic typing scheme that can be used to broadly categorize the genetic identity of bacterial isolates. MLST protocols developed for *Xf.* will be used to determine the sequence type (ST) for all positive *Xf.* infections detected initially by qPCR (Yuan et al. 2010). Whole genome sequencing (WGS) provides a much higher coverage of the bacterial genome, but requires cells isolated in pure culture. All bacterial isolates obtained from the field will be sequenced using WGS platforms.

Reciprocal inoculation experiment:

This assay will identify which strains of *Xf.* from urban areas are able to cause disease in olive trees. Isolates of *Xf.* acquired from the field in 2023 & 2025 will be inoculated into healthy olive trees using established protocols. A droplet of *Xf.* cells in a buffer solution will be pipetted onto the stalk of the plant. Then the stem will be punctured using a needle, and the suspension of cells will enter the xylem through the opening. Olive trees will then be tested for *Xf.* in the weeks following the inoculation to confirm the infection success. The trees will then be kept in the greenhouse for a minimum of 1 year to monitor symptom development. In addition to field-collected strains from our research group, *Xf.* strains that have previously been used in olive inoculation trials will also be included for comparison (Krugner et al. 2014).

<u>Summary of work completed:</u>

Overview:

Three collection trips were conducted from June to September 2024, when we expected to find more disease symptoms and higher pathogen loads in olive trees. Two hundred-forty six symptomatic olive trees were sampled across San Diego county (Figure 1) and the greater Los Angeles area (Figure 2). Common symptoms included canopy dieback (Figure 3) and leaf scorching (Figure 4).

In our interim report submitted to the COC in 2024, we preliminarily reported that 33% of all samples have tested positive for *Xylella fastidiosa* (*Xf.*) via qPCR. In 2025, we continued to process samples and refine our testing protocols, including the retesting of the samples collected in 2023-2024, with our updated results, 88% of all olive samples are positive for *Xf.* Our current data indicate that *Xf* is very prevalent in ornamental olive trees in Southern California; being also widely spread in the landscape.

Genetic typing:

Our preliminary MLST results suggest that a diverse array of *Xf* strains are currently circulating in Southern California urban forests (Figure 6). Because we are concerned of other tree species also serving as sources of pathogen inoculum to olive trees, we also incorporated data from three other species into this analysis. A summary of these results is presented in Table 1. Each Sequence Type (ST) is understood as being a distinct genotype of the pathogen, with an understanding that there is also genetic variation within STs, which we are not studying here. Generally, plants hosting the same ST as in olive trees may serve as pathogen sources to olives. The results presented in Table 1 show that STs present in olive trees are also found in sweetgum and the New Zealand Christmas tree. In addition, 5 STs were identified in olive trees, including one novel genotype, indicating significant genetic diversity of *Xf* in olive trees in Southern California.

Table 1: Diversity of Sequence Types (STs) detected in ornamental olives and other common trees.

ST	5	7	10	24	26	39	58	81	Novel ST	Total ST #
Olive (*Olea europaea*)	✓	✓					✓	✓	✓	5
Sweetgum (*Liquidambar styraciflua*)	✓			✓	✓					3
NZ Christmas tree (*Metrosideros excelsa*)		✓	✓		✓					3
Purple-leaf plum (*Prunus cerasifera*)			✓	✓	✓	✓				4

Two subspecies of *Xf* (*Xylella fastidiosa* subsp. *multiplex* and *Xylella fastidiosa* subsp. *sandyi*) were detected in ornamental olive trees in Southern California. While *Xf.* subsp. *multiplex* was expected to be the primary subspecies associated with olive, the high number of olive trees infected with *Xf.* subsp *sandyi* was a novel result. This subspecies of *Xf* has previously been isolated from olive trees in Southern California (O'Leary et al. 2020) but is most commonly associated with oleander (*Nerium oleander*) (Purcell et al. 1999). This suggests that olive trees are broadly susceptible to multiple subspecies of *Xf.* that are frequently detected in Southern California urban areas.

In total, 5 STs were detected in ornamental olive trees across Los Angeles and San Diego counties. The individual bacterial strains group by ST with some minor exceptions (Figure 6). At least one of these STs has not been previously identified, suggesting that urban centers indeed harbor undescribed *Xf.* diversity. Several of these STs have not been detected in California before, at least to our knowledge. ST5 and ST7 were detected in Sweetgum and New Zealand (NZ) Christmas trees in addition to olive. This implies that sweetgum and NZ Christmas trees may act as reservoir hosts for olive-associated strains of *Xf.*

Reciprocal inoculation experiment:

The first trial in this experiment is scheduled to proceed in July. All plants have been potted and allowed to grow to sufficient size to ensure success in the inoculation trial. Our group has significant experience with experiments of this nature, and we anticipate a high rate of success for each inoculation. These experimental manipulations will allow us test the pathogenicity to olive trees of various STs/strains collected so far. We recently contacted colleagues in Brazil working with *Xf*/olive and found that symptoms may take up to 3 years to appear under their experimental conditions. We are starting to consider options for maintaining plants longer than the usual one greenhouse season used for most plant species.

Isolation attempts:

Attempts to isolate *Xf.* in pure culture were unsuccessful across samples from 77 olive trees last year. Obtaining *Xf.* isolates from olive is notoriously difficult, but further optimization of culturing protocols is possible. Our lab group has obtained feedback from colleagues in both the United States and Europe to improve our chances of isolation success in the future. Burbank et al. successfully isolated strains of *Xf.* from olive trees in California (O'Leary et al. 2020), and the group led by Saponari et al. have developed protocols to successfully isolate *Xf.* subsp. *pauca* from olive trees in Italy. That is a very distinct group of *Xf.*, but we work closely with the Italian group leading research on the olive disease there, and their feedback is helpful in considering improvements to our protocol. We anticipate that changes to our current protocols will increase the likelihood of obtaining more *Xf.* isolates from olive trees this season.

Summary:
While olive trees were sampled in a biased manner, meaning plants with disease symptoms were sampled, other aspects of the sampling procedure were random. The fact that 88% of the plants sampled suggest that most olive trees presenting scorching symptoms are positive for *Xf.*; in fact, there is an expectation that the diagnostic test is not perfect, meaning that false negatives are present in the dataset, increasing even further the number of positive trees in the landscape. Such high proportions of symptomatic trees expressing symptoms are unusual. In addition, we identified five different genotypes (STs) of the pathogen infecting olive trees. These is remarkable and these are genetically distinct groups of the pathogen, but they are all associated with symptomatic trees. These results, together with data from Europe and South America, suggest that olive is a very permissive host plant species. While ultimate proof of pathogenicity requires experimental manipulations, such as those we are initiating, the scenario emerging from Southern California is one where sick trees are tightly associated with the presence of *Xf*, and that multiple genotypes of *Xf* present in the landscape are infecting these trees.

Future research:

Additional field sampling in Los Angeles and Orange counties will be conducted later this year. The goal will be to expand the geographical coverage of the Los Angeles area as only a portion was sampled in 2024. Additionally, expanding into Orange County may lead to insightful connections between San Diego and Los Angeles, as it is geographically situated between the two counties.

As previously mentioned, the isolation of *X. fastidiosa* strains from olive remains a priority. Trees that have previously tested positive for *X. fastidiosa* will be resampled in order to maximize the likelihood of successful isolation of bacterial colonies.

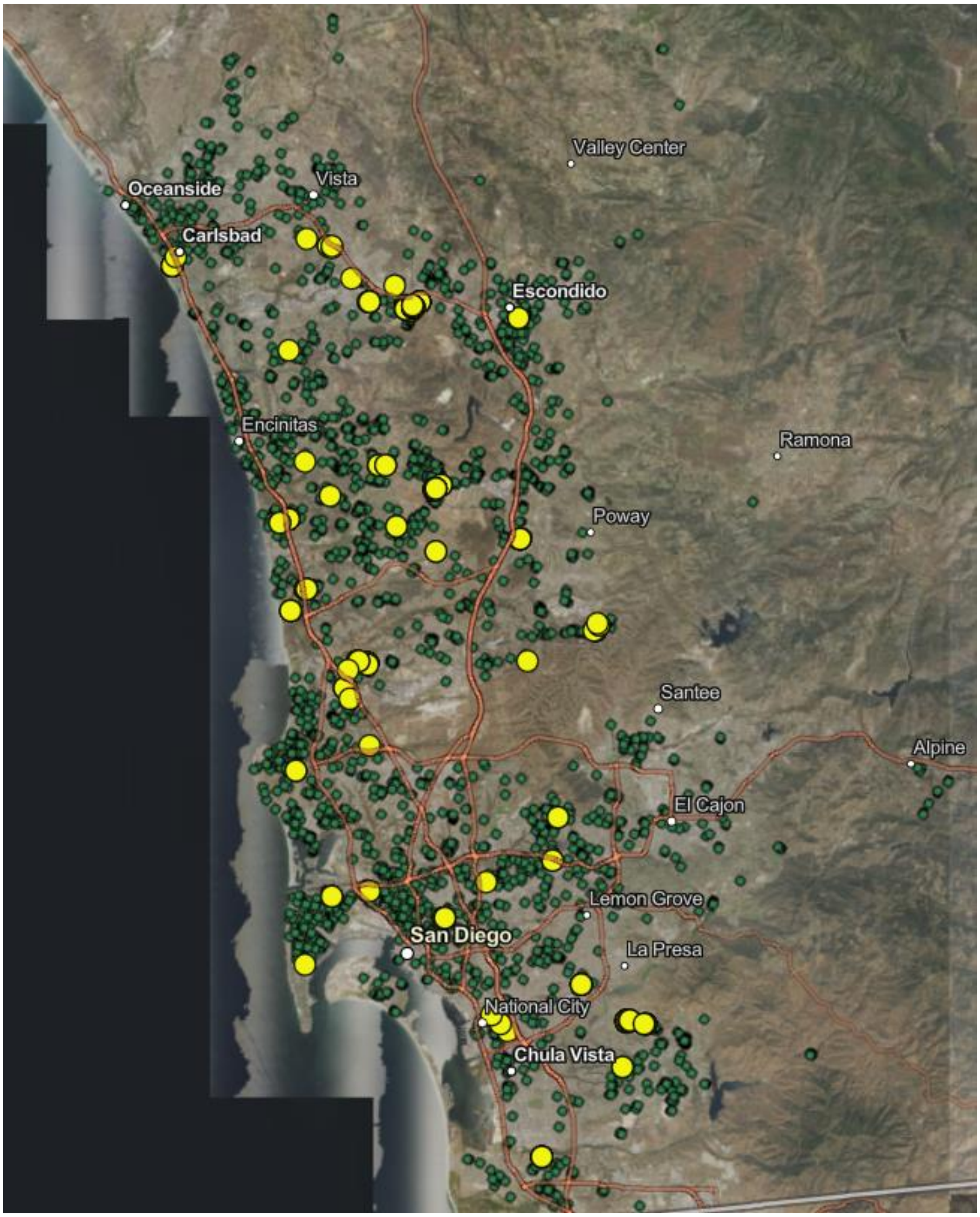


Figure 1: Distribution of olive trees in San Diego county. Green dots represent the distribution of all olive trees. Yellow dots indicate trees that were sampled for *Xf.* in June - September 2024.

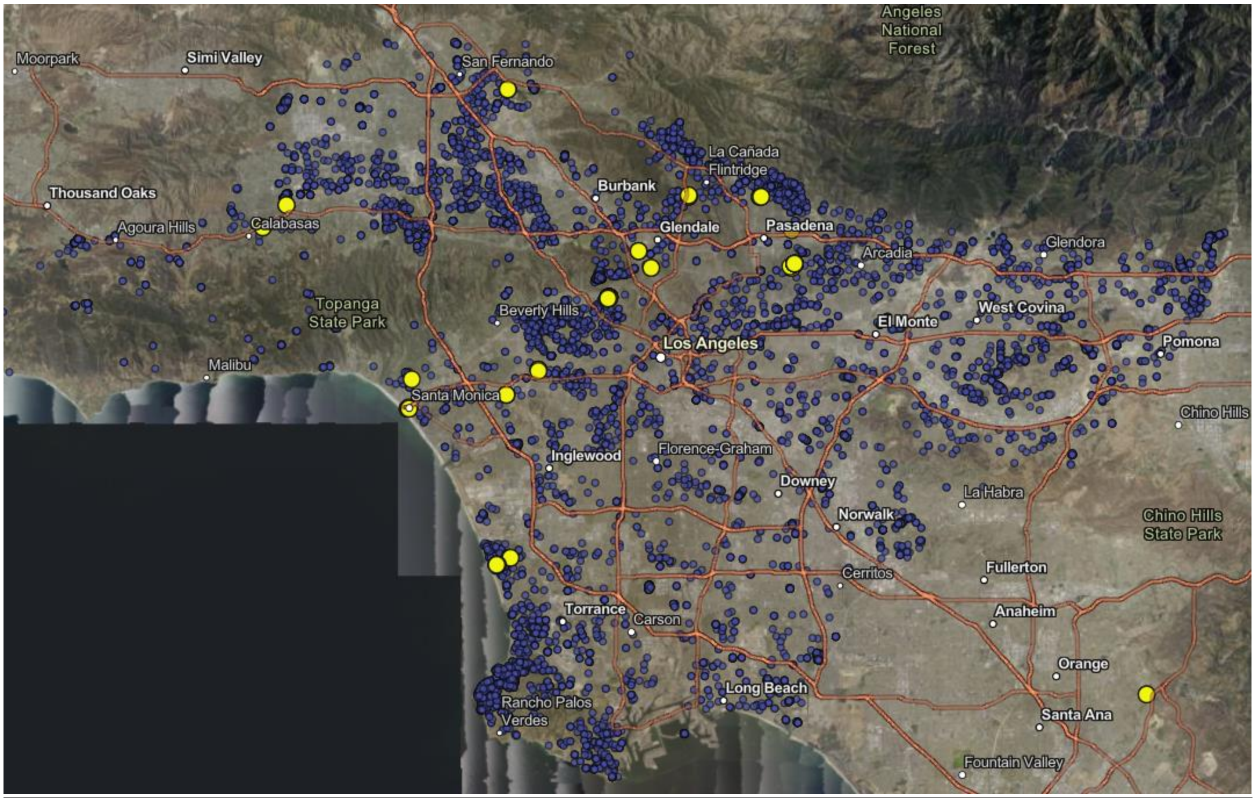


Figure 2: Distribution of olive trees in the greater Los Angeles area. Blue dots represent the distribution of all olive trees. Yellow dots indicate trees that were sampled for *Xf.* in September 2024.

Figure 3: Symptomatic olive trees in Manhattan Beach, CA (left) and San Marcos, CA (right). Note severe dieback throughout the canopy.

Figure 4: Leaf scorch on olive sample.


Figure 5: Potted olive trees ready for inoculation with *Xf.* strains

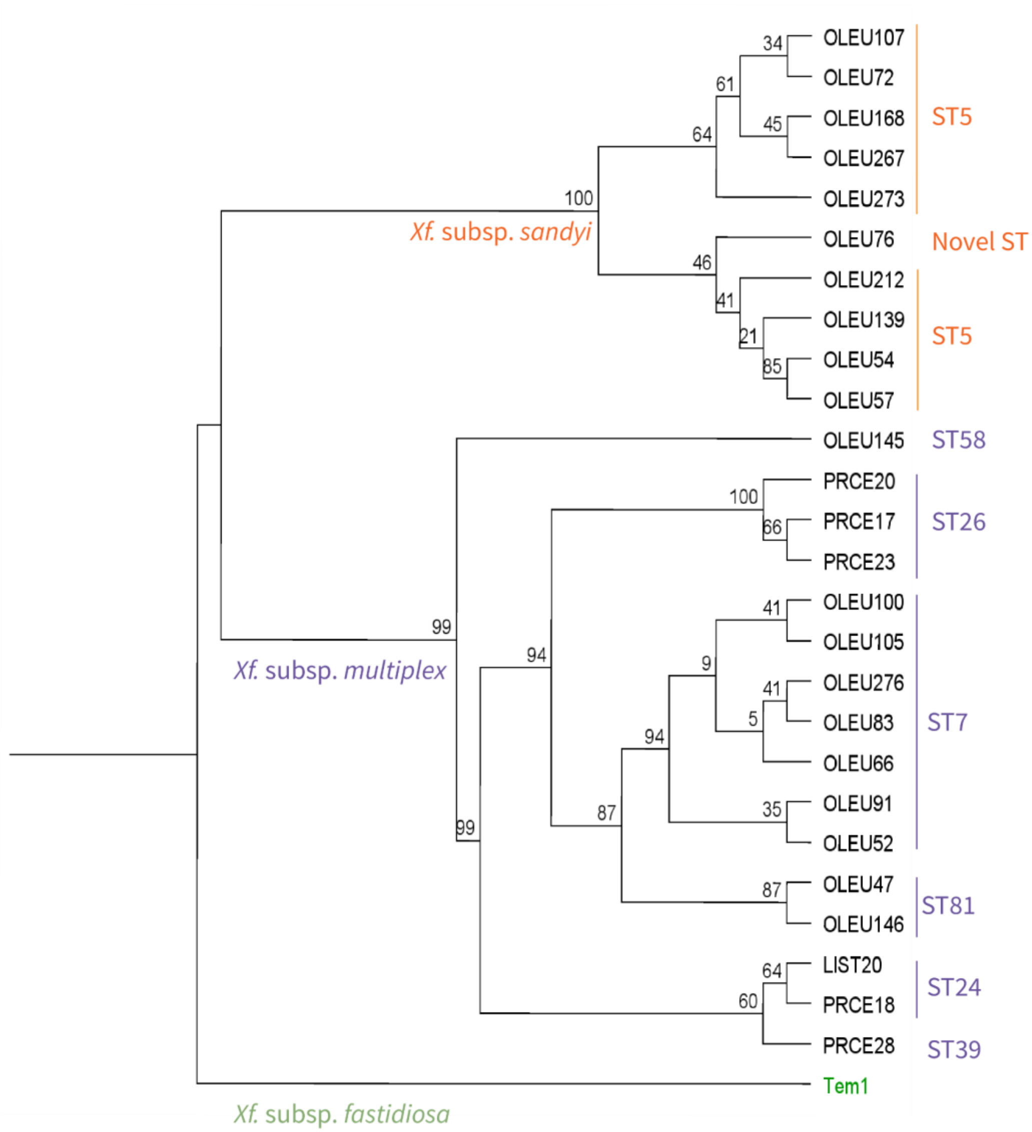


Figure 6: Phylogeny of a subset of *Xf.* positive samples with *Xf.* subsp. *fastidiosa* strain "Temecula 1" specified as outgroup. OLEU = Olive, PRCE = Purple leaf plum, LIST = Sweetgum. Please refer to Table 1 for more details about STs and their relationships to olives and the other hosts included here. Note that each ST is genetically distinct from another, and that a more thorough evaluation of this genetic diversity is ongoing, incorporating data from other regions of the US and the world. Tree assembled using RAxML program in Geneious Prime Ver. 2025.1.2.

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****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.

******INFORMATION ONLY******

FROM: RESEARCH SUBCOMMITTEE

SUBJECT: PRODUCT REGISTRATION UPDATE

BACKGROUND:

Product	Active Ingredient	Registrant	Status
Danitol 2.4 EC	Fenpropathrin	Valent	2ee is active and ready to use. Please see following page for more information.
Kasugamycin	Kasumin 2L	United Phosphorous, Inc.	Approval to submit Kasumin 2L on olives concurrently. It cannot be approved until they receive EPA registration. However, the submission is in progress.
Syllit	Dodine	United Phosphorous, Inc.	Currently at CDPR- on the most approved label it lists olives, the use is not registered in CA.
Ph-D	Poloyxin	United Phosphorous, Inc.	New stamped label was received earlier this month. It will begin the process of being updated on Agrian and Crop Data management Systems.

Section 18: OFFR

COC Staff has prepared a letter of support for a Section 18 Emergency Exemption request for the use of Arino Insecticide and Nematicide to help manage olive fruit fly pressure. This year, unusually high olive fruit fly populations combined with limited availability of GF-120 (active ingredient: spinosad) have put the industry at significant risk. Arino offers a viable alternative with strong efficacy, a novel mode of action, and a favorable fit for California olive production systems. The COC's letter emphasizes the urgency of the situation and the potential economic and agronomic impact if effective tools are not made available.

Resource for California Approved Labels:
https://www.agrian.com/labelcenter/results.cfm

RESTRICTED USE PESTICIDE
DUE TO TOXICITY TO FISH AND AQUATIC ORGANISMS.
For retail sale to and use only by Certified Applicators, or persons under their direct supervision, and only for those uses covered by the Certified Applicator's certification.

FIFRA Section 2(ee) Recommendation

THIS RECOMMENDATION IS ONLY FOR THE STATE OF CALIFORNIA

DANITOL 2.4 EC SPRAY

EPA Reg. No. 59639-35

DANITOL® 2.4 EC SPRAY FOR USE ON GLASSY-WINGED SHARPSHOOTER IN OLIVE

This FIFRA section 2(ee) recommendation expires on December 31, 2030.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

This recommendation is made as permitted under FIFRA Section 2(ee) and has not been submitted to or approved by the EPA. This 2(ee) recommendation contains directions for use which do not appear on the package label and must be in the possession of the user at the time of pesticide application. Follow all applicable directions, restrictions and precautions on the EPA registered label when using *Danitol* 2.4 EC Spray. Always read and follow all label directions when using any pesticide alone or in tank mix combinations. The most restrictive labeling applies when using a tank mix.

OLIVE		
Pest	***Danitol* 2.4 EC Spray Application Rates**	**Application Instructions**
Glassy-Winged Sharpshooter	10-2/3 – 16 fl oz/A (0.2 - 0.3 lb ai/A)	Apply as a ground application in a minimum of 100 gallons of water per acre or apply by air in a minimum of 25 gallons of water per acre. Make applications beginning when first pest activity is noticed and repeat as needed but not more often than every 14 days. Under severe pest pressure use the higher recommended rate.
• Do not apply within seven (7) days of harvest. • Do not exceed 2-2/3 pt (42-2/3 fl oz, 0.8 lb ai) total application of *Danitol* 2.4 EC Spray per acre per season.		

Refer to *Danitol* Insecticide label for additional insects controlled.

Registrant: Valent U.S.A. LLC
P.O. Box 5075
San Ramon, CA 94583

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TO: California Department of Pesticide Regulation
Morgan Thai
Pesticide Registration Branch

FROM: California Olive Committee

DATE: July 31, 2025

SUBJECT: Support for Section 18 Emergency Exemption for the Use of Arino Insecticide and Nematicide to Control Olive Fruit Fly in Olives in California

Dear Miss Thai:

On behalf of the California Table Olive Industry, the California Olive Committee, is writing to express our strong support for the Section 18 Emergency Exemption request for the use of Arino Insecticide and Nematicide to control olive fruit fly (*Bactrocera oleae*) in California table olives for the 2025 growing season.

California's table olive industry, which produces approximately 50,000 to 70,000 tons of fruit annually, is facing an acute pest emergency. The olive fruit fly continues to cause extensive damage throughout our major growing regions, including Glenn, Tehama, Butte, Colusa, Yolo, San Joaquin, Tulare, and Fresno Counties. This pest not only threatens yield but also the cosmetic quality of the fruit—critical for table olive marketability.

Due to recent supply constraints of GF-120 NF, the industry's primary bait formulation, and increasing evidence of pest resistance, growers are left with few effective and sustainable options. The remaining registered materials— Danitol 2.4 EC and Surround WP— pose significant limitations either due to resistance management concerns, broad-spectrum insecticidal effects, or inconsistent efficacy under high pest pressure.

Faced with limited alternatives and rising resistance, Arino is the strongest defense we have to protect a key California specialty crop. With a novel mode of action, proven field efficacy, and no detectable residues, it offers growers an environmentally responsible and IPM-compatible solution. The product has shown outstanding results in trials, reducing infestation levels and improving fruit quality outcomes.

Without access to Arino, the California table olive crop stands to suffer devastating losses—estimated up to 60% in heavily infested regions. Beyond economic loss, growers face increased production costs, labor inefficiencies, and jeopardized market access.

For these reasons, we respectfully urge the California Department of Pesticide Regulation to support and expedite the review of this Section 18 exemption request. The approval of Arino is critical to ensuring continued production of high-quality California olives, protection of our industry, and sustaining the long-term viability of our grower community.

Thank you for your time and consideration of this request. Should you need any additional information, please contact Mary McDonnell at mmcdonnell@calolive.org.

Sincerely,

Mary McDonnell

Mary McDonnell

Program Supervisor

California Olive Committee

******ACTION REQUIRED******

FROM: RESEARCH SUBCOMMITTEE

SUBJECT: DISCUSSION AND APPROVAL OF 2026 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 2025 Research Priorities.

2025 RESEARCH PROJECTS FOR THE CALIFORNIA OLIVE COMMITTEE

	Researcher	Project	Amount
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
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	$115,129.20
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
8	Nicholas Manoukis	New Prospects for the Control of Black Scale in California Olive Groves	$73,000
		TOTAL	**$314,114.2**

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

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California Olive Committee Research Priorities for 2025

- 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