CALIFORNIA
RIPE OLIVES
ENJOYED BY FAMILIES EVERYWHERE

CALIFORNIA OLIVE COMMITTEE

COMMITTEE MEETING

Wednesday, December 13, 2017
10:00 a.m.
Double Tree Hotel • Sonoma Room • Modesto, CA

CALIFORNIA OLIVE COMMITTEE

FULL COMMITTEE MEETING

Wednesday, December 13, 2017
10:00 a.m.
Double Tree Hotel • Sonoma Room • Modesto, CA

AGENDA

I. **CALL TO ORDER**
   - A. Roll Call
   - B. Approval of 11-30-17 Full Committee Minutes (action item)
   - C. Chairman's Comments

II. **MARKETING SUBCOMMITTEE**
   - A. Review 2017
   - B. Presentation of 2018 Plan & Budget
   - C. Approval of 2018 Plan & Budget (action item)
   - D. Delegation of Authority from the Committee to the Executive Director with oversight by the Chairman for inter-item transfers of the marketing budget (action item)

III. **INSPECTION SUBCOMMITTEE**
   - A. Review of 2017
   - B. Approval of 2018 Inspection Budget (action item)
   - C. Delegation of Authority from the Committee to the Executive Director with oversight by the Chairman for inter-item transfers of the inspection budget (action item)

IV. **EXECUTIVE SUBCOMMITTEE**
   - A. Review of 2017 Budget
   - B. Approval of 2018 Administrative Budget (action item)
   - C. Delegation of Authority from the Committee to the Executive Director with oversight by the Chairman for inter-item transfers of the administrative budget (action item)
   - E. Delegation of Authority from the Committee to the Executive Director with oversight by the Chairman to obtain legal counsel for employee personnel matters (action item)

V. RESEARCH SUBCOMMITTEE

A. Review 2017
B. Proposals of 2018 Projects
C. Approval of 2018 Research Budget (action item)
D. Delegation of Authority from the Committee to the Subcommittee to approve contingency fund (action item)
E. Delegation of Authority from the Committee to the Executive Director with the oversight by the Chairman for inter-item transfers of the research budget (action item)

VI. REVIEW OF FISCAL 2017 BUDGET

A. Approval 2018 Fiscal Budget (action item)
B. Approval 2018 Assessment Rate (action item)

VII. OTHER BUSINESS

VIII. ADJOURNMENT

CALIFORNIA OLIVE COMMITTEE

June 1, 2017 – May 31, 2019

PRODUCERS

DISTRICT #1 (Counties of Alpine, Tuolumne, Stanislaus, Santa Clara, Santa Cruz all counties north thereof)

Members	Alternates
Pablo Nerey	Carolina Burreson
Ed Curiel	Michael Silveira
Edward Garcia	Chris Henderson

DISTRICT #2 (Counties of Mono, Mariposa, Merced, San Benito, Monterey, and all counties south thereof)

Members	Alternates
Mark Hendrixson	Julia Inestroza
Mark Heuer	Bert Quezada
Rick Benson	Joan Whelan-Vanderhorst
Pat V. Ricchiuti	Galen Pfeiffer
Vito DeLeonardis	John Patterson

HANDLERS

Members	Alternates
Doug Reifsteck	Sergio Mendez
Tim T. Carter	Colleen Sparda
Cody McCoy	Jacob Peters
Julia Tinsley	Phil Quigley
Janet Edwards	John Pieretti
Felix Musco	Benjamin Hall
Bill McFarland	Tracy Wood
Dennis Burreson	Scott Hamilton

CALIFORNIA RIPE OLIVES
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CALIFORNIA OLIVE COMMITTEE
Full Committee Meeting Minutes
Thursday, November 30, 2017
Double Tree Hotel – Modesto, CA

I. CALL TO ORDER

A meeting of the Full Committee was called to order by Mike SILVEIRA at 9:02 a.m., and the following members were present:

Members	**Affiliation:**
Mike SILVEIRA	GROWER
Doug REIFSTECK*	BELL CARTER
Rick BENSON*	GROWER
Tim CARTER*	BELL CARTER
Ben HALL	BELL CARTER
Jacob PETERS	BELL CARTER
Edward GARCIA*	GROWER
Felix MUSCO	MUSCO
Julia TINSLEY*	BELL CARTER
Bill MCFARLAND*	MUSCO
Bert QUEZADA*	GROWER
Colleen SPARDA	BELL-CARTER
Janet EDWARDS	MUSCO
Carolina BURRESON*	GROWER
Dennis BURRESON*	MUSCO
Galen PFEIFFER	GROWER
Mark HENDRIXSON	GROWER
Pat V. RICCHIUTI*	GROWER
Vito DELEONARDIS*	GROWER
Mark HEUER	GROWER
Julia INESTROZA*	GROWER
John PEIRETTI	MUSCO
Cody MCCOY*	BELL CARTER
Others Present:	
Alexander OTT	COC
Liza RAMON	COC
Peter SOMMERS	USDA

*Denotes voting members for the Committee

With the appropriate number of members in attendance and the seating of an alternate member, a quorum was established.

MOVED by Pat V. RICCHIUTI, duly seconded by Vito DELEONARDIS, and unanimously carried THAT the minutes of the 6-20-17 Full Committee meeting be approved. (Motion 11-30-17 #1)

II. INSTALLATION OF 2017-2019 COMMITTEE TERM

Every two years the California Olive Committee (COC) holds elections for its representation. Committee members are elected and nominated by their peers to serve the Industry in a two year term. The Committee must elect following officers Chairman, Vice Chairman, and Secretary/Treasurer.

MOVED by Pat V. RICCHIUTI, duly seconded by Dennis BURRESON, and unanimously carried THAT Mike Silveira be nominated as chairman, AND THAT the Committee close the nominations and cast a unanimous ballot for Mike Silveira as Chairman. (Motion 11-30-17 #2)

MOVED by Doug REIFSTECK, duly seconded by Vito DELEONARDIS, and unanimously carried THAT Dennis Burreson be nominated as Vice Chairman, AND THAT the Committee close the nomination and cast a unanimous ballot for Dennis Burreson as Vice Chairman. (Motion 11-30-17 #3)

MOVED by Felix MUSCO, duly seconded by Dennis BURRESON, and unanimously carried THAT Doug Reifsteck be nominated as Secretary/Treasurer, AND THAT the Committee close the nomination and cast a unanimous ballot for Doug Reifsteck as Secretary/Treasurer. (Motion 11-30-2017 #4)

MOVED BY Pat V. RICCHIUTI, duly seconded by Bill MCCFARLAND, and unanimously carried THAT the Chairman be empowered to assign subcommittees. (Motion 11-30-17 #5)

III. COC MEMBER ORIENTATION

USDA Representative, SOMMERS, gave a presentation on the oversight of the Marketing Order and the requirements of the Committee under USDA.

VIII. ADJOURNMENT

Chairman Mike Silveira adjourned the meeting at 9:29 a.m.

December 1, 2017 Liza Ramon

Date: December 1, 2017 — Liza Ramon, California Olive Committee

SUMMARY OF MOTIONS FOR NOVEMBER 30, 2017

Motion 11-30-17 #1 **APPROVED**

MOVED by Pat V. RICCHIUTI, duly seconded by Vito DELEONARDIS, and unanimously carried THAT the minutes of the 6-20-17 Full Committee meeting be approved.

Motion 11-30-17 #2 **APPROVED**

MOVED by Pat V. RICCHIUTI, duly seconded by Dennis BURRESON, and unanimously carried THAT Mike Silveira be nominated as chairman, AND THAT the Committee close the nominations and cast a unanimous ballot for Mike Silveira as Chairman.

Motion 11-30-17 #3 **APPROVED**

MOVED by Doug REIFSTECK, duly seconded by Vito DELEONARDIS, and unanimously carried THAT Dennis Burreson be nominated as Vice Chairman, AND THAT the Committee close the nomination and cast a unanimous ballot for Dennis Burreson as Vice Chairman.

Motion 11-30-17 #4 **APPROVED**

MOVED by Felix MUSCO, duly seconded by Dennis BURRESON, and unanimously carried THAT Doug Reifsteck be nominated as Secretary/Treasurer, AND THAT the Committee close the nomination and cast a unanimous ballot for Doug Reifsteck as Secretary/Treasurer.

Motion 11-30-17 #5 **APPROVED**

MOVED BY Pat V. RICCHIUTI, duly seconded by Bill MCCFARLAND, and unanimously carried THAT the Chairman be empowered to assign subcommittees.

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

FROM: MARKETING SUBCOMMITTEE

SUBJECT: 2018 BUDGET

RECOMMENDATION: THAT the Committee adopt the Marketing Budget for the 2018 FY.

BACKGROUND: Each year, the Marketing Subcommittee approves a marketing plan with a contracted agency. Last year, the Committee contracted with Fleishman-Hillard (FH) to implement a marketing program and requested FH to propose a plan for 2018. FH developed a plan with a budget of $750,000 for the 2017 fiscal year. This year, FH is planning a marketing budget of $770,000.

Additionally, the Committee needs to approve travel for staff, and growers to various marketing events, association fees, partnerships and international program research. These items total of $58,500 making the total marketing budget $828,500.

1) Education and Partnerships - $58,500
    a. Alliance for Food and Farming
    b. CA Grown
    c. Partnerships
    d. Travel
    e. Olive Day
    f. Crisis Communication

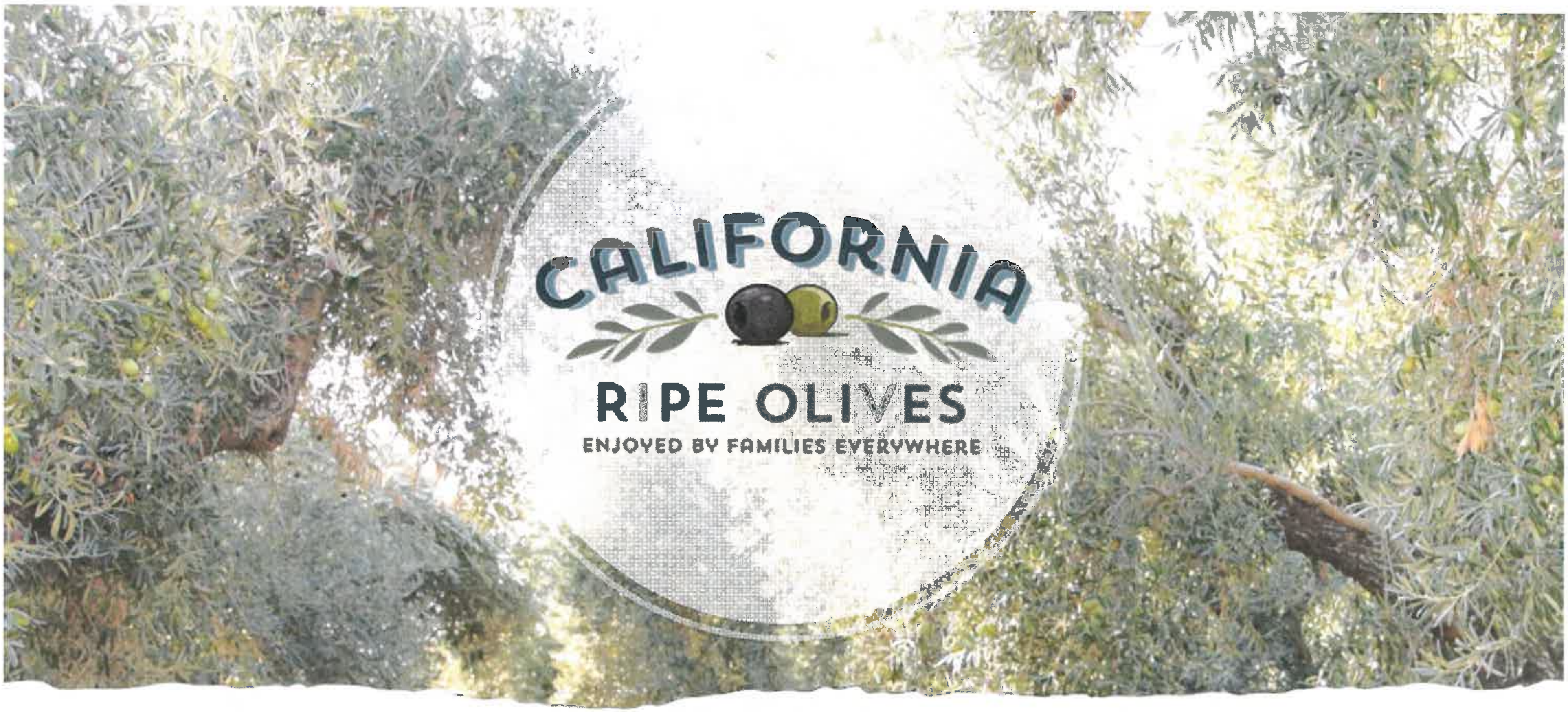
In addition, the Committee must approve the following:

1) Budget for the 2018 season; and
2) The Committee grant authority to the Executive Director and Chairman for inter-item transfers of the Marketing Budget.

Lastly, Fleishman-Hillard has two additional items that may be considered for the 2018 Marketing Program. These items include:

* NYC activation (IACP and media blitz)	$ 85,000
* Influencer activation (CA blossom and harvest tour)	$115,000
TOTAL	$200,000

FISCAL IMPACT: The Subcommittee approved $828,500. Discussion will be on the $200,000 for two additional projects. If approved the total will be $1,028,500 2018 FY.



CALIFORNIA RIPE OLIVES:

2017 PROGRAM HIGHLIGHTS AND 2018 RECOMMENDATIONS

Presented By: FleishmanHillard | November 30, 2017

2017 PROGRAM HIGHLIGHTS

CALIFORNIA RIPE OLIVES

2017 RECIPE FOR SUCCESS

Fresh new look....

CALIFORNIA

RIPE OLIVES

ENJOYED BY FAMILIES EVERYWHERE

2017 RECIPE FOR SUCCESS

Fresh new look….

Growers as the heart & soul…

2017 RECIPE FOR SUCCESS

Fresh new look....

Growers as the heart & soul...

New, best-of-the-best national media partner...

2017 RECIPE FOR SUCCESS

Fresh new look....

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New, best-of-the-best national media partner...

Social media influencers activated...

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Extensive media coverage...

2017 RECIPE FOR SUCCESS

Fresh new look....

Growers as the heart & soul...

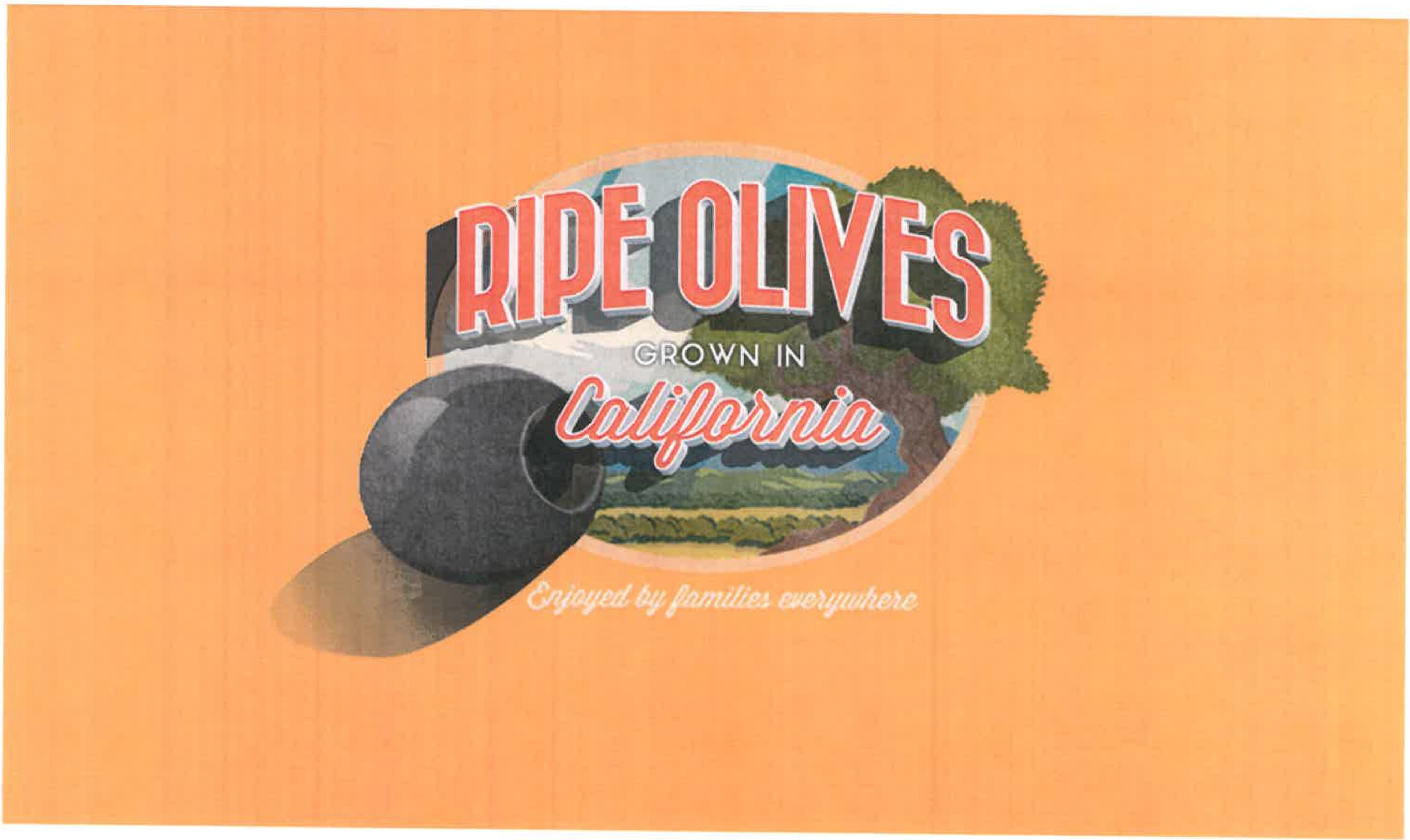
New, best-of-the-best national media partner...

Social media influencers activated...

Extensive media coverage...

Expanded retail advertising reach...

TRANSFORMING THE CALIFORNIA RIPE OLIVES LOOK & FEEL...



TRANSFORMING THE CALIFORNIA RIPE OLIVES LOOK & FEEL…

CALIFORNIA

RIPE OLIVES

ENJOYED BY FAMILIES EVERYWHERE

CALIFORNIA RIPE OLIVE GROWERS AT THE HEART OF IT ALL...

SIMPLY RECIPES = SIMPLY AMAZING!

#1 driver of CalOlive.org site traffic!

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4 new recipes; 2 new videos

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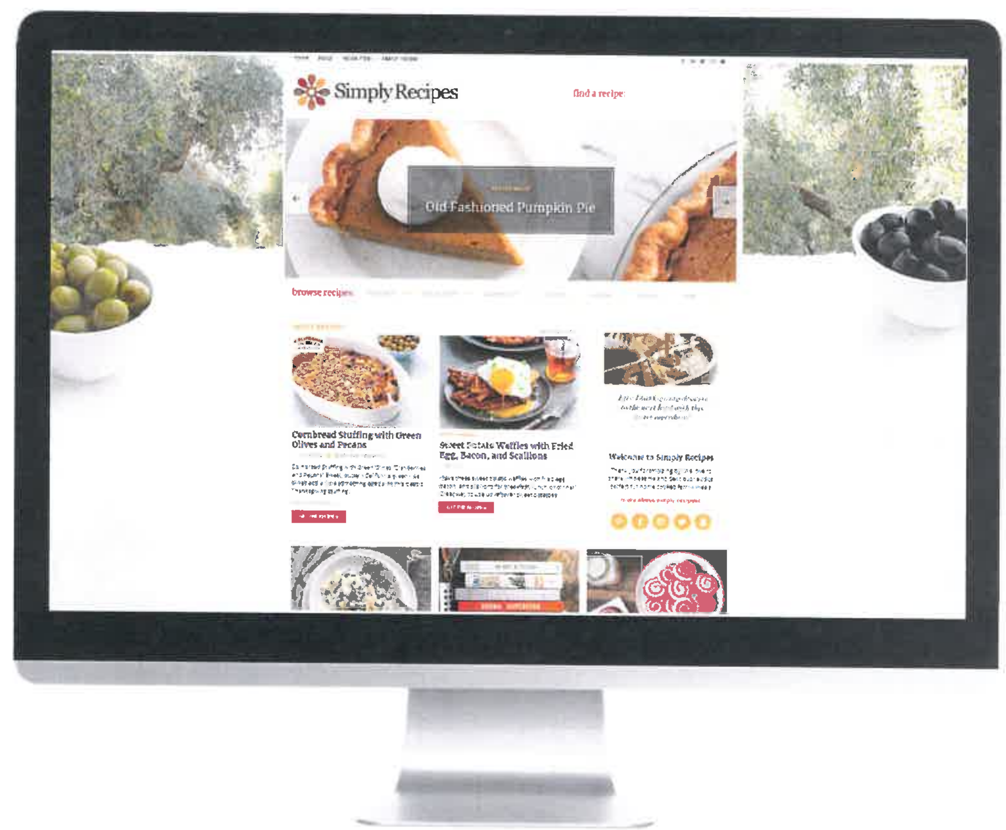
5+ million single-day viewers via the Thanksgiving Eve site take-over



SIMPLY RECIPES = SIMPLY AMAZING!

#1 driver of CalOlive.org site traffic!

4 new recipes; 2 new videos

15 existing recipes integrated to the site – including growers' favorites

9.2 million single-day viewers via the Thanksgiving Eve site take-over
(2.5 million guaranteed!)

39.5 million Simply Recipes social impressions to-date

MAXIMIZING THE PARTNERSHIP & AMPLIFYING THE CALIFORNIA RIPE OLIVE STORY

In May, we took Simply Recipes' founder, Elise Bauer, on the road

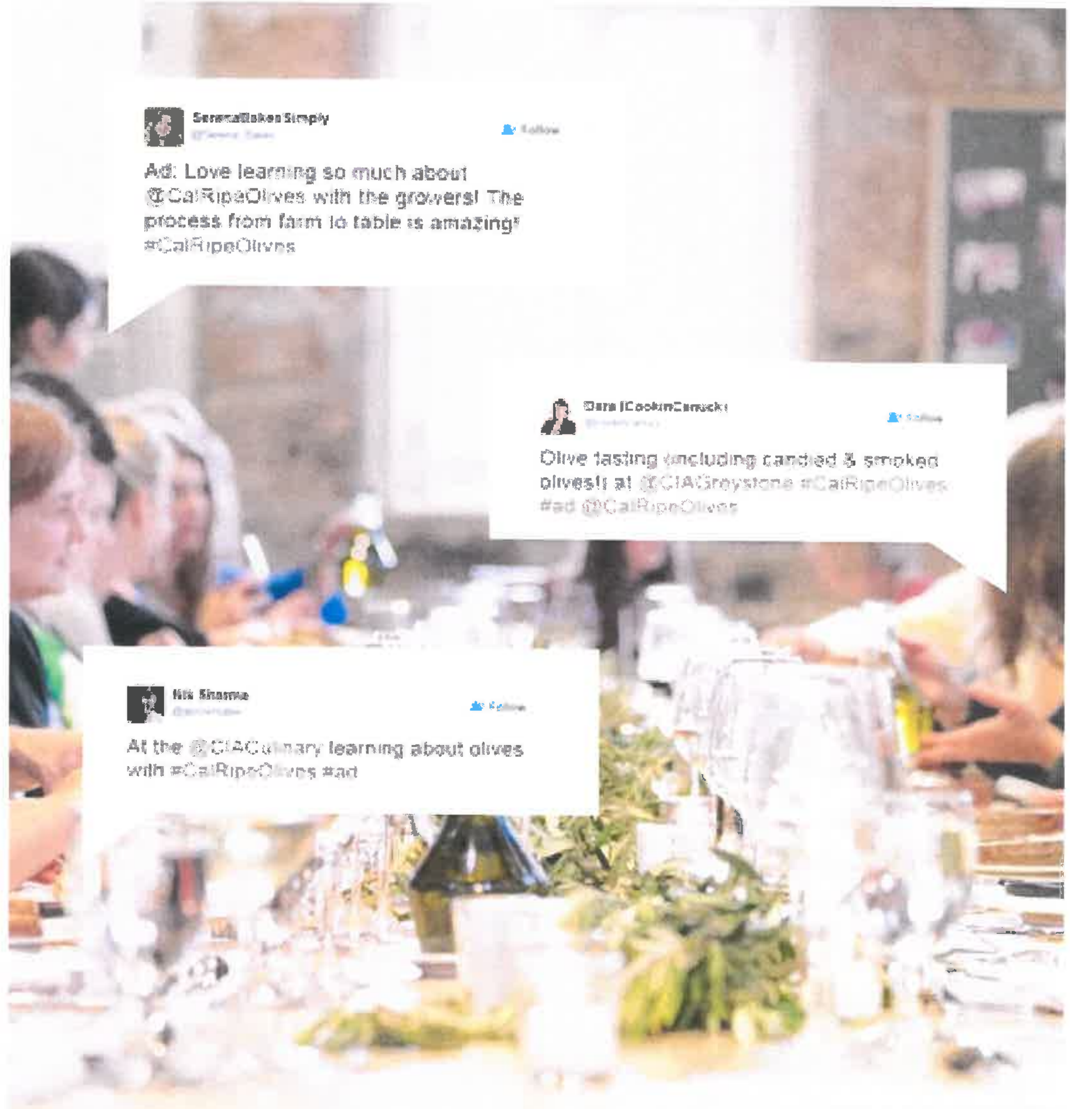
Custom event at the Culinary Institute of America in St. Helena for social media influencers

- Custom-created California Ripe Olives menu by Elise
- Flavor exploration and grower/canner Q&A panel
- Hands-on cooking with California Ripe Olives

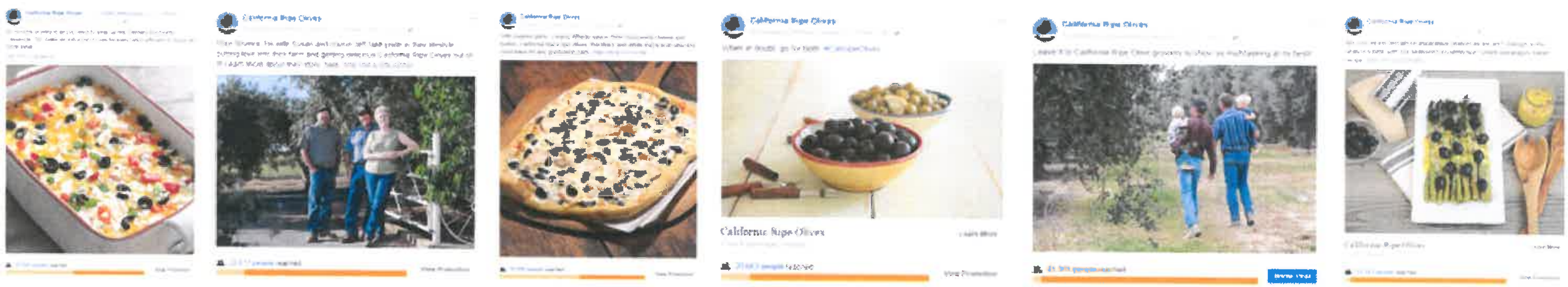
16 influencers

90+ social posts

All content now on CalOlives.org



CREATING CALIFORNIA RIPE OLIVES CONVERSATION & CONTENT...



25K Facebook fans • This time last year, **14.7K** • Up **68%** in one year! • **1.3 million** social impressions

Grower-related content is the top performer: 10% average engagement rate

SHOWCASING CALIFORNIA RIPE OLIVES IN THE NEWS

Print, broadcast and on-line integration all year long from coast-to-coast

Featuring Simply Recipes content and grower recipes

More than 500 million impressions!


Think Outside the Lunchbox

Deliciously Different

ELEVATING "CALIFORNIA" VIA RETAIL TRADE ADVERTISING

Highlighted CA Grown branding and product preference survey stat

Integrated grower content

5 outlets; 1.2 million combined impressions

Similar investment for double the reach (2016 vs. 2017)

THE YEAR IN NUMBERS

Activity	Actual Impressions/Reach
Simply Recipes Partnership	46.2 million
Influencer Activation	7.4 million
Media Engagement	501.6 million
Social Media	1.3 million
Trade Advertising	1 million
Total	**557.7 million**

IN COMPARISON: 2016 & 2017

2016 total impressions/reach	2017 total impressions/reach
303.9 million	557.7 million

2018 PROGRAM RECOMMENDATIONS

CALIFORNIA RIPE OLIVES

WHAT WE HEARD

- Positive feedback on the new California Ripe Olives branding
- Simply Recipes and Elise Bauer are a good fit for California Ripe Olives
- Explore opportunities for radio integration, specifically iHeart Radio

OUR POINT OF VIEW

- Grower content works! Grower profiles and videos drive social media engagement…in person engagement is even better.
- Simply Recipes was a major success. Let's evolve for year II.
- We have expanded opportunities this year due to a well-timed, well-located culinary conference.

SIMPLY RECIPES REFRESHER

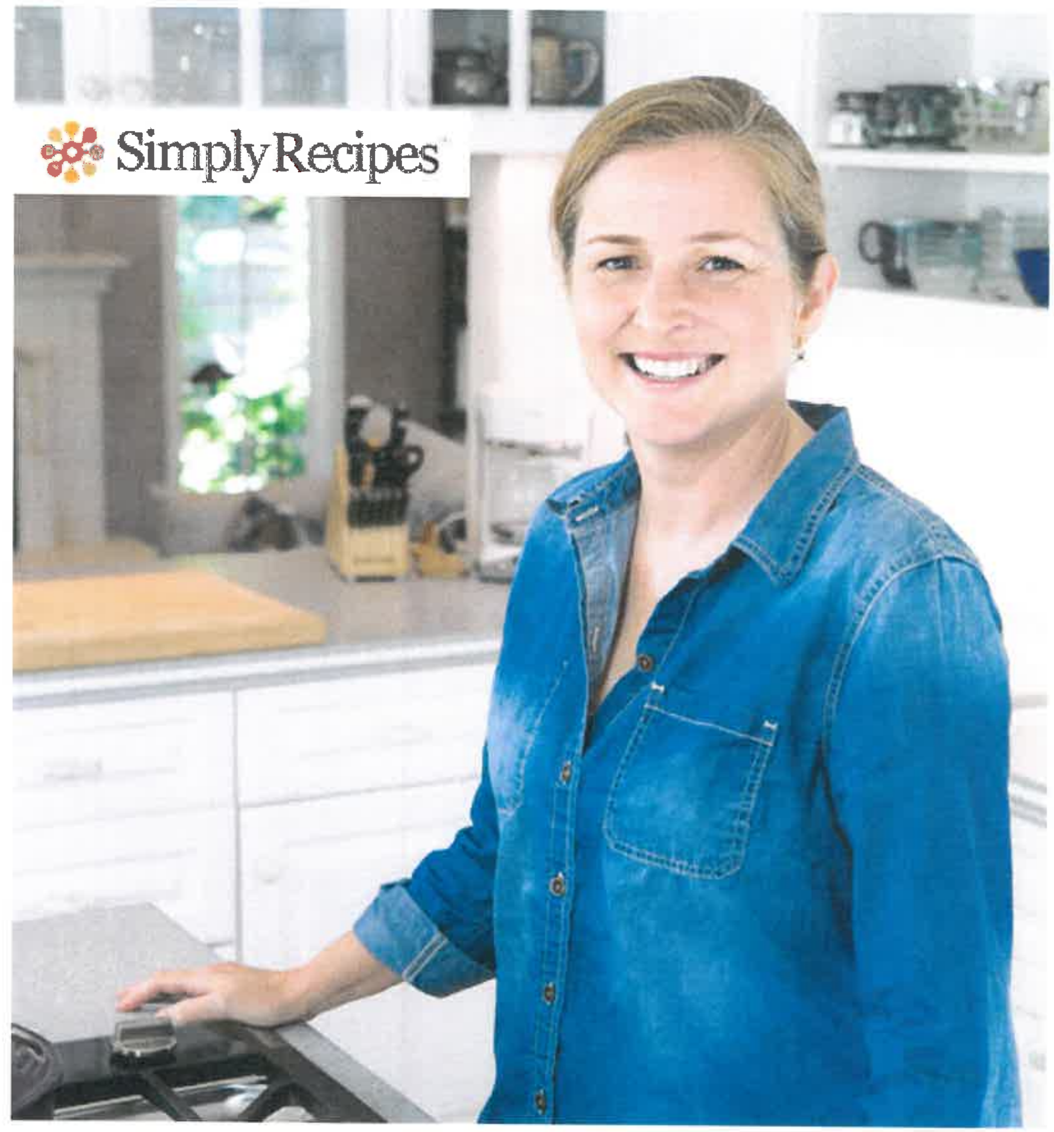
#1 food site for women, age 25-49

Star power of Simply Recipes founder, Elise Bauer

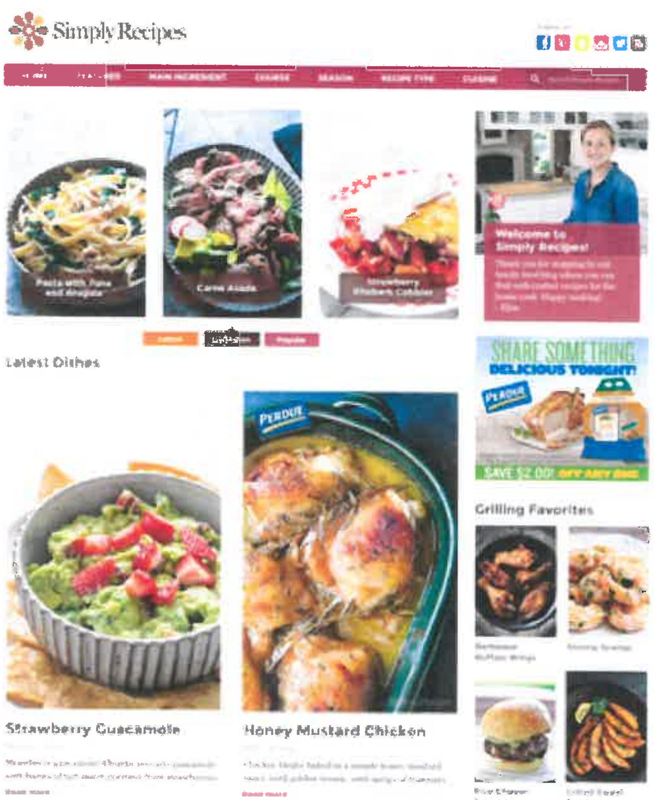
On-trend, high quality content

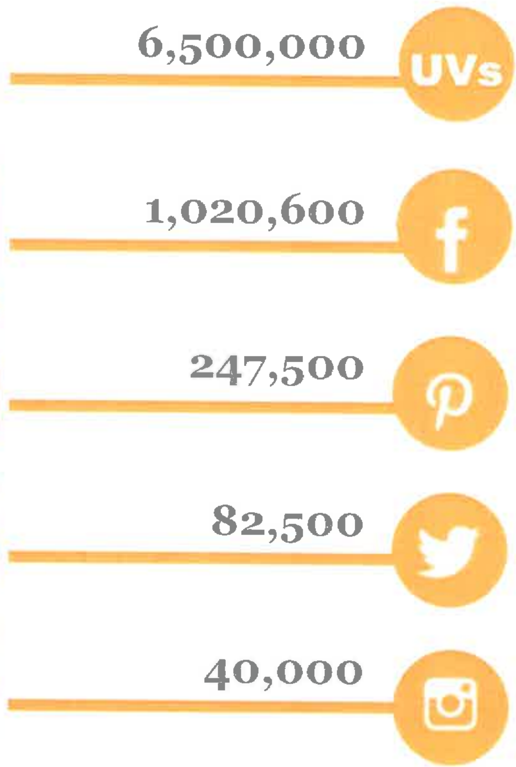
#1 driver to CalOlive.org

Expansive social media reach



SIMPLY RECIPES LOVES SOCIAL MEDIA... AND SO DOES MOM





- Women visit #1 Pinterest and #2 Facebook for meal inspiration i.e., recipe ideas and discovery
- Recipes (61%) are the most heavily shared type of content
- 78% say they visit food brand's social pages to find recipes and tips

(MediaPost)

BUILDING ON SIMPLY RECIPES SUCCESS IN THE YEAR AHEAD

First-ever Simply Recipes and California Ripe Olives recipe contest

- Promote via Instagram; drive to Simply Recipes for entry
- Contest to generate content for our social media platforms and for launch of our own Instagram channel!

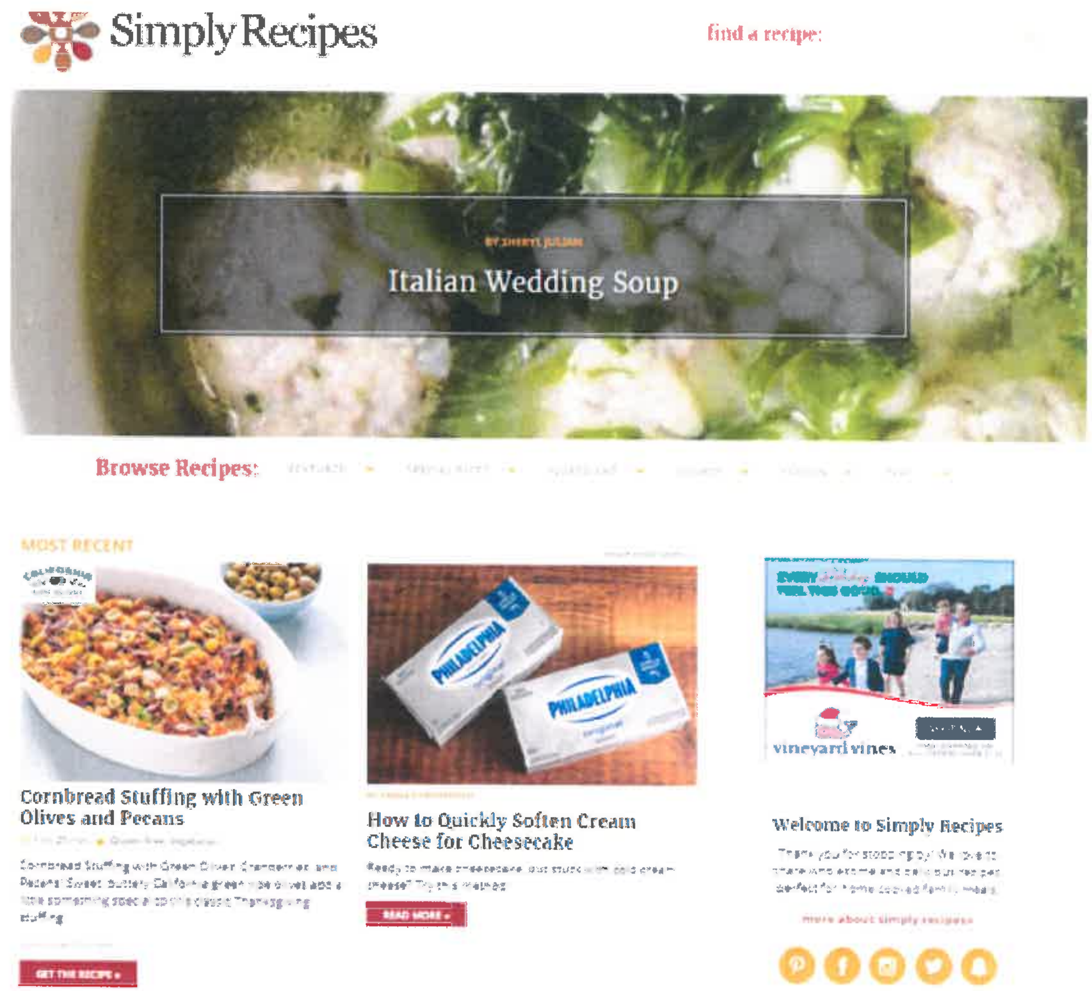
Super Bowl site take-over

- 2nd largest food holiday of the year (Yahoo Finance)

3 custom recipe posts; 3 custom recipe videos

Year-round grower-themed banner ad integration

Event appearance with Elise



CALIFORNIA RIPE OLIVES TAKE ON THE BIG APPLE!

Program Enhancement

International Association of Culinary Professionals Conference (IACP) in NYC

Major culinary conference attracting print, radio, television and social media influencers

California Ripe Olives cooking demonstration

- 1-hour demonstration by Simply Recipes

NYC Chef Showcase Lunch presenting sponsor

- Exclusive invitation-only event for 12-15 top food bloggers; post-event content generation

Tasting Table at Expo Lunch

- California Ripe Olives featured in meal stations developed by six of the city's top chefs

MAKING THE MOST OF OUR TIME IN THE CITY THAT NEVER SLEEPS...

Program Enhancement

Celebrity Page TV segment
(1.5 minutes) featuring
California Ripe Olives

- Airs in 200 markets for 3 million impressions

Media deliveries with
California Ripe Olives grower(s)

- Deskside visits to top media outlets, i.e. Food52.com, Saveur, The DailyMeal.com, with beautiful box of smoked olives/candied olives/etc.

IN THE GROVES & ON THE GROUND WITH SOCIAL MEDIA INFLUENCERS

Program Enhancement

Engage social influencers via custom content-generation experiences featuring
California Ripe Olive growers

- Spring blossom tour and fall harvest tour

6-7 influencers per tour – activities to include:

- Custom California Ripe Olive welcome dinner
- Grove tour led by local grower
- California Ripe Olive lunch and grower/canner panel

Extend the reach via traditional media relations: farm-to-fork ROP, video mat release and iHeartRadio audio news release

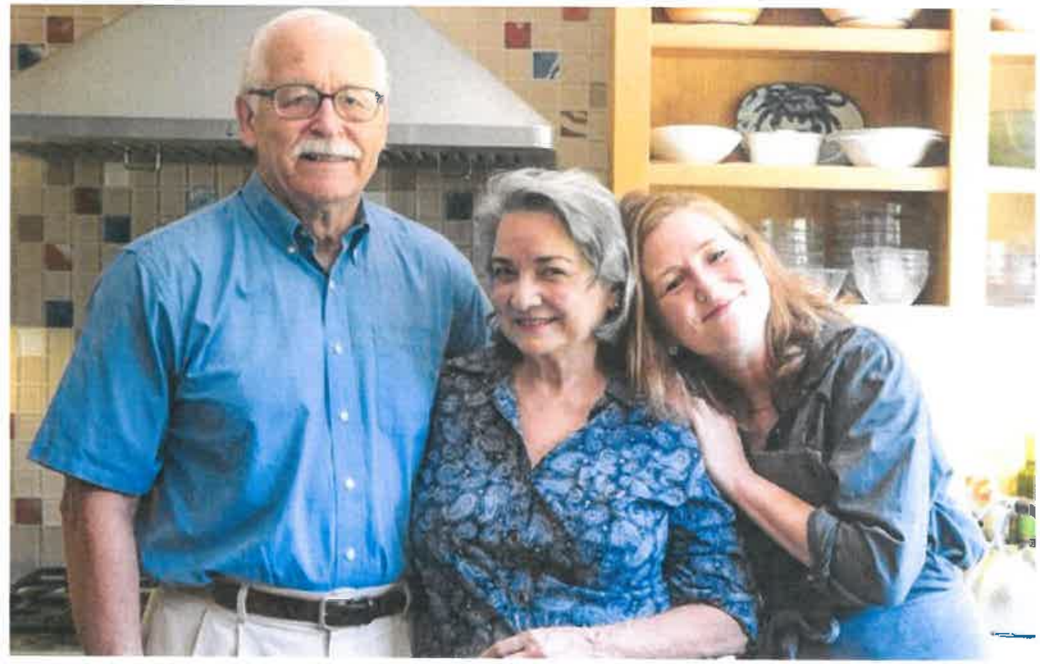
MARKING A MILESTONE WITH FREDA'S STORY

2018 marks the 120th anniversary of Freda Ehmann's purchase of her California olive property

Mini-documentary video (~3 – 4 minutes) about Freda, narrated and hosted by Simply Recipes founder, Elise Bauer, a food pioneer herself

Visit to Freda's property, capture content from family members and growers to underscore the **unique California origin story**

Leverage via social media, the media partnership and retail trade advertising



CAPTURING MORE VOICES & IMAGES TO SHARE THE CALIFORNIA RIPE OLIVE STORY

Continue building grower asset library with two new videos plus additional photos and grower recipes

New and existing grower content integrated into:

- Blossom and harvest tours
- IACP
- Traditional media outreach
- California Ripe Olives website and social media properties

SHARING CALIFORNIA RIPE OLIVES CONTENT AROUND THE WORLD

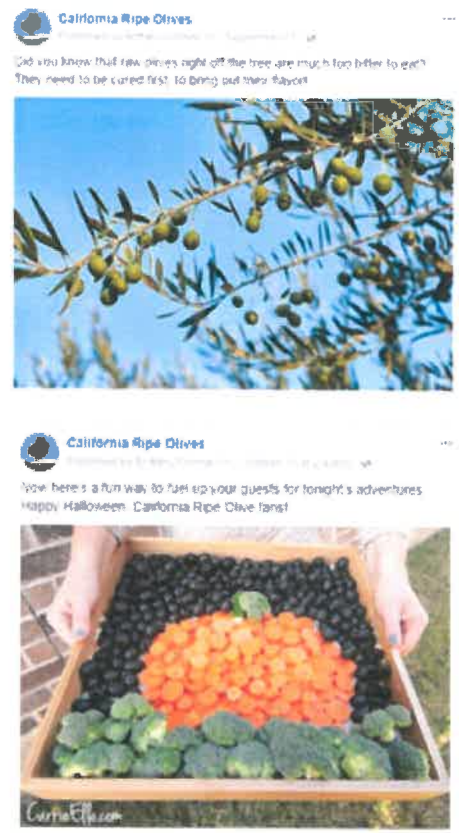
Development of 10-15 new California Ripe Olive recipes, photos and toolkits for use in international markets, including India and Japan

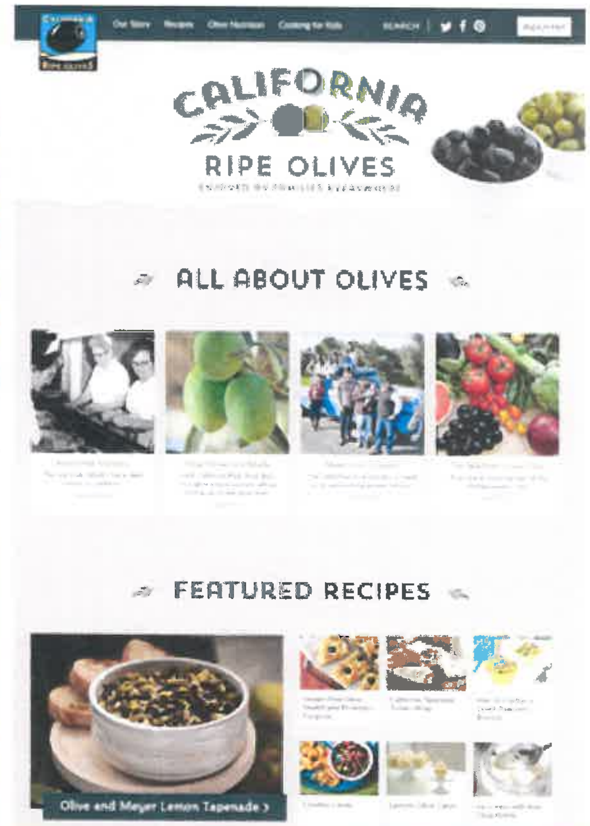
Input session and ongoing collaboration with international market reps for cultural appropriateness and translation support

CONTINUING SOCIAL ENGAGEMENT; LAUNCHING NEW PLATFORM

Editorial calendar development, community management and amplification via promoted posts:

- Simply Recipes videos and recipe amplification
- Continued integration of grower content – profiles, videos, photos and recipes
- California Ripe Olive origin story and Freda Ehmann mini-documentary
- Food art video series created around major holidays, events and seasons
- Website maintenance and ongoing refresh
- Instagram launch





Why Instagram?

- 700 million active users
- 58% of users are women
- 83% of users are 18-49
- Key platform for food and recipe sharing

(MarketingProfs)

EXTENDING THE RETAIL ADVERTISING PRESENCE VIA DIGITAL

Continue advertising in key retail outlets

Focus on digital format

Consistent creative: new branding,
CA Grown preference, grower content plus incorporating the new Freda Ehmann mini-documentary

CALIFORNIA CA GROWN

Grocery Headquarters · The Shelby Report · Progressive Grocer · SmartBrief · FMI Food Marketing Institute · SN

KEEPING THE INDUSTRY INFORMED & READY TO RESPOND IN A CRISIS

Continue to keep the industry informed of new California Ripe Olives marketing activities

- Mid-year newsletter
- Grower e-newsletter
- California ag trade media relations
- Crisis plan refresh and grower message training

TIMELINE & BUDGET

CALIFORNIA RIPE OLIVES

TIMELINE

Year-Round Programming

Simply Recipes	Media outreach	Content development	Ongoing social media engagement and outreach	Grower communications	Crisis plan refresh and grower message training

Key Pulse Points and Events

Q1

- Simply Recipes Super Bowl site take-over
- Simply Recipes recipe contest launch
- IACP & NYC media blitz
- Mini-documentary
- Instagram launch

Q2

- Blossom tour
- Grower content capture
- Retail advertising

Q3

- Harvest tour
- Retail advertising

Q4

- Retail advertising

Q1	Q2	Q3	Q4

BUDGET

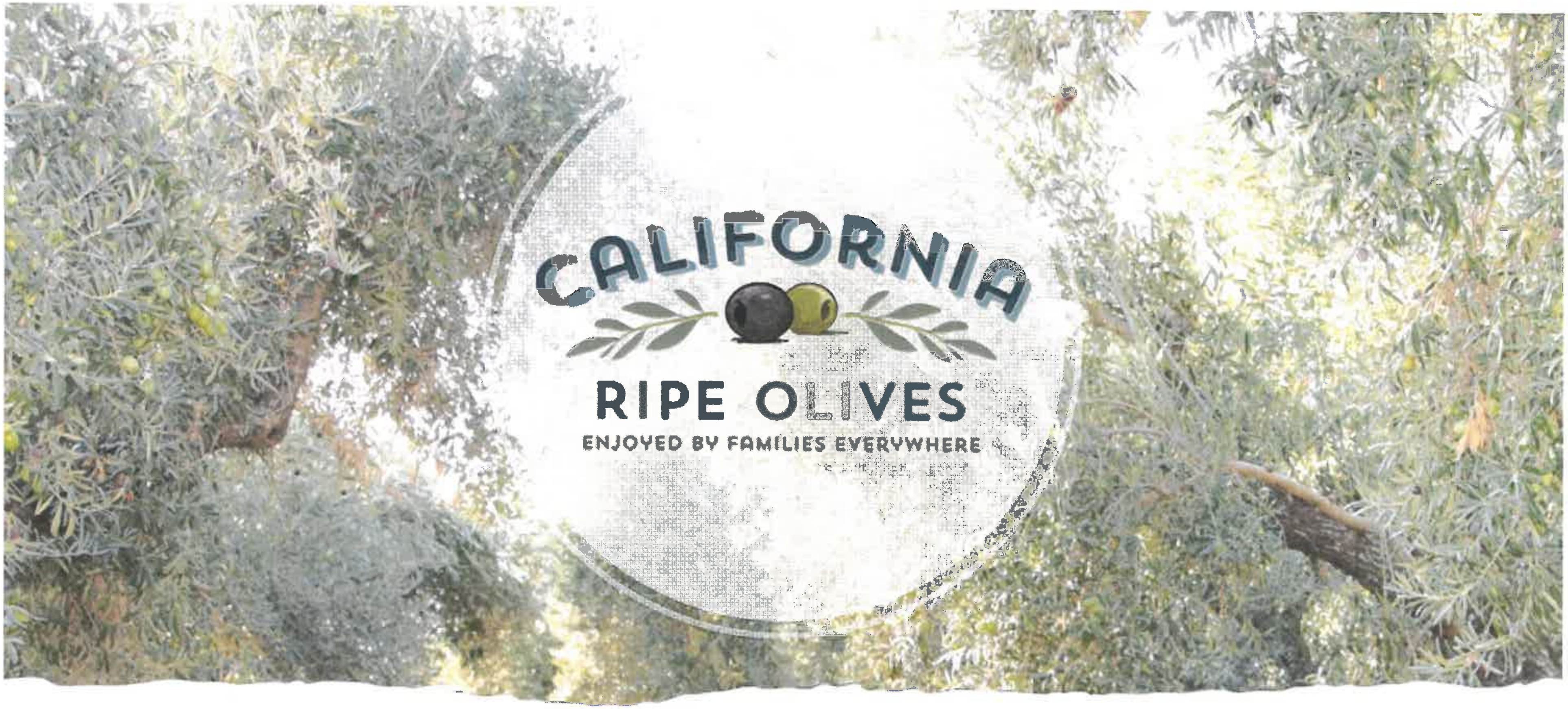
Core Program	
Media partner (Simply Recipes partnership and consumer contest)	$180,000
Media engagement (ROP, video mat release and iHeart Radio audio news release)	$90,000
Asset development (grower videos, food art photography, Freda mini-documentary and international recipes)	$155,000
Social media (FB, IG launch, Twitter/Pinterest maintenance)	$120,000
Website (maintenance and content updates)	$65,000
Retail (digital trade advertising)	$85,000
Industry communications (newsletters)	$25,000
Crisis plan update and message training	$25,000
Account management	$25,000
Core Program Total	**$770,000**

Program Enhancement	
NYC activation (IACP and media blitz)	$85,000*
Influencer activation (CA blossom and harvest tour)	$115,000
Program Enhancement Total	**$200,000**

**Note: By removing the broadcast media outreach while in New York City, we reduced the NYC activation budget from $100K to $85K – as reflected here. As discussed at the meeting, we would prioritize the NYC activation as the top program enhancement activity.*

2018 ANTICIPATED RESULTS

Increase impressions from **557.7 million** to **595 million** (print, radio, digital and social)
Expand Facebook presence by **20%** achieving **30K+** fans
Create more than **100 new pieces** of digital/social content
Launch new social media platform; achieve **2,000** year-one followers
Garner direct social media engagement with **25** national, social media influencers
Conduct briefings with up to **10** national media via NYC media blitz; generate additional exposure among IACP attendees
Expand retail advertising reach from **1.2 million** to **1.5 million** impressions



THANK YOU!

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

FROM: INSPECTION SUBCOMMITTEE

SUBJECT: 2018 BUDGET

RECOMMENDATION: THAT the Committee adopt the Inspection Budget for the 2018 FY.

BACKGROUND: Last year, the Committee did not allocate dollars for inspection as electronic reporting and optical sizing projects were carried over from previous years. With the systems in place, the industry is seeing success in both the reporting and optical sizing. Adjustments and maintenance will be needed for the program to maintain the integrity of the system and to ensure the technology keeps up with software and other items.

For the 2018 FY, the following items are expenditures for the Inspection program.

1. Travel - $5,000
2. ORES Maintenance - $42,000
3. Optical Sizer (misc. as needed) - $30,000

Staff has put together a history of previous Inspection Committee Budgets.

FISCAL YEAR	*2018 (Proposed)*	*2017*	*2016*	*2015*	*2014*	*2013*	*2012*	*2011*	*2010*
INSPECT	$77,000	$98,000	$102,000	$132,000	$0	$105,000	$50,000	$75,000	$50,000
%Differ	-27.2%	-3.9%	-29.4%	100.0%	-100.0%	110.0%	-50.0%	50.0%	-

The Sub-Committee must decide:

1) Approval of the 2018 Inspection Budget; and
2) Grant authority to the Executive Director with oversight by Chairman for inter-item transfers of the Inspection Budget.

FISCAL IMPACT: $80,000 for FY 2018 (Savings of $21,000 from previous year).

*******FOR YOUR INFORMATION*******

FROM: INSPECTION SUBCOMMITTEE

SUBJECT: ELECTRONIC REPORTING- OERS

BACKGROUND: In 2014, the Committee launched the Olive Electronic Reporting System (OERS). In 2015, the system was refined as the COC added additional features to aide with congestion at the scale house. These included: bin tag print outs, a new entry application, and improvements for the users of the system. In addition to the OERS system, the COC and the industry continue to capitalize on technology in an effort to provide real value by implementing usage of the Multiscan I5 Optical Sizing machines. The optical sizer cuts down on labor, processors' time, and provides a higher degree of accuracy while also decreasing subjectivity in the grading process. Going into year four of this technology's usage, we have continued confidence with the system, its functionality, and stabilization. In June of 2016, the COC was able to suspend the incoming inspection requirements in the marketing order. In turn, we were able to contract directly with CDFA by using current standards to inspect incoming fruit.

In 2017, we made number of enhancements such as: direct printing capabilities, upgraded the Weight Master app to include the COC 3 data entry, grading, inspection, view, and batching screens. This was done to increase security and performance compare to the web application. Also, we added bin tracking and accumulations capabilities.

Based on the circumstances we have faced in the previous year, we are recommending the following enhancements:

- Move database and web servers to Microsoft Cloud Azure server for optimum security and performance (highly recommended)
- Enhancements and optimization: COC 3 Web and Client Applications
- Digital inventory reports from each canner
- Multi-scan integration to the COC Application
- Increased support and database maintenance.

We are proposing the following budget for 2018:

Cloud set up and migration	$ 5,000
Optical sizer integration	6,000
Digital inventory reports	5,000
Enhancements	6,500
Support and Travel	9,500
Miscellaneous	10,000
Total	$42,000

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

FROM: EXECUTIVE SUBCOMMITTEE

SUBJECT: 2018 BUDGET

RECOMMENDATION: THAT the Committee adopt the General Administration 2018 FY Budget and the following actions outlined 1 – 3.

BACKGROUND: The following is the General Administration Budget for the California Olive Committee. Exports are separated

Staff has put together a history of previous Executive Committee Budgets.

FISCAL YEAR	2018 (Proposed)	2017	2016	2015	2014	2013	2012	2011	2010
ADMIN	$401,200	$392,100[1]	$399,800	$393,500[2]	$333,800	$333,500	$415,900[3]	$324,923	$359,549
%Change	2.3%	-1.9%	1.6%	17.9%	.09%	-19.8%	28.0%*	-9.6%	24.6%
EXPORTS	$191,000	$121,000	$85,000	$72,000	$0	$0	$0	$0	$0
%Change	57.8%	42.3%	18.1%	100%	-	-	-	-	-
MAP/EMP	$250,000	$236,000							
%Change	5.9%								

The Sub-Committee must decide:

1) Approval of the 2018 Fiscal Budget
2) Recommend to the Committee to delegate authority from the Committee to the Executive Director with oversight by the Chairman, for Inner-Item transfer fund Authority
3) Recommend to the Committee to approve the use of legal counsel should one be needed with approval from the USDA.

FISCAL IMPACT: $513,100 for FY 2017

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[1] $121,000 of the total budget is dedicated to the export category, and the remaining $392,100 is for general administrative costs. General admin. decreased from $399,800 in 2016 FY to $392,100 this year, whereas exports increased from $85,000 to $121,000.

[2] The Committee approved dollars for crisis communication and legal activities coupled with $72,000 for industry studies. These studies were for additional research on specific items. Legal and crisis communication will be rolled over to next year for a reserve to be created going forward.

[3] The original approved Executive Sub-Committee budget for 2012 was $335,900. However, in order to begin electronic reporting, USDA required the Committee to approve $80,000 not used in research for the 2012 FY and reallocate to the Executive Sub-Committee, otherwise the project would have to be placed on hold. The mid-year correction increased the Executive Sub-Committee budget by $80,000 to total $415,900.

GENERAL ADMINISTRATION BUDGET	Budget 2016	Budget 2017	Budget 2018	Diff.
Salaries	$ 118,000	$ 110,000	$ 118,000	$ 8,000
Attorney/crisis communication	$ 25,000	$ 25,000	$ 25,000	$ -
Audit Fee	$ 8,500	$ 8,500	$ 8,500	$ -
Bookkeeper	$ 5,000	$ 8,000	$ 8,000	$ -
Accounting Service	$ 1,800	$ 1,900	$ 2,000	$ 100
Vacation & Sick Leave Expense	$ 5,000	$ 5,000	$ 5,000	$ -
FICA & Medicare Expense	$ 10,000	$ 10,000	$ 11,000	$ 1,000
Health Insurance	$ 28,000	$ 25,000	$ 25,000	$ -
Disability Insurance	$ 3,000	$ 2,500	$ 2,500	$ -
Pension Plan Contribution	$ 4,500	$ 4,000	$ 4,000	$ -
Storage	$ 1,100	$ 1,300	$ 1,300	$ -
Telephone	$ 5,500	$ 5,500	$ 5,500	$ -
Travel Committee	$ 20,000	$ 20,000	$ 20,000	$ -
Travel Office	$ 15,000	$ 15,000	$ 15,000	$ -
Travel Insurance	$ 1,800	$ 1,800	$ 1,800	$ -
General Insurance	$ 6,900	$ 6,900	$ 6,900	$ -
Insurance-members/management	$ 10,000	$ 11,000	$ 11,000	$ -
Postage	$ 7,000	$ 7,000	$ 7,000	$ -
Office supplies	$ 4,700	$ 4,700	$ 4,700	$ -
Maintenance	$ 1,000	$ 1,000	$ 1,000	$ -
Printing - Admin	$ 11,500	$ 11,500	$ 11,500	$ -
Equipment, Software,Furniture	$ 4,000	$ 4,000	$ 4,000	$ -
Crop Estimate	$ 6,500	$ 6,500	$ 6,500	$ -
Misc. Admin Expense	$ 2,000	$ 2,000	$ 2,000	$ -
Education Training	$ 4,000	$ 4,000	$ 4,000	$ -
Crisis Communication	$ -	$ -	$ -	$ -
California Apple Commission	$ 90,000	$ 90,000	$ 90,000	$ -
Exports/Industry Studies	$ 85,000	$ 121,000	$ -	$ (121,000)
TOTAL	$ 484,800	$ 513,100	$ 401,200	$ (111,900)

TOTAL FOR G&A = $392,100
Total for Exports = $121,000

			Budget 2017	Budget 2018	Diff.
EXPORTS:					
	Asia Logestica		$ 10,000	$ 15,000	$ 5,000
	Industry Relations	**TOTAL FOR**	$ 15,000	$ 15,000	$ -
	BCI	**MAP &**	$ 45,000	$ 45,000	$ -
	Misc.	**TASC DOLLARS**	$ 5,000	$ 5,000	$ -
	FAS/USADEC	**FOR MATCH**	$ 3,000	$ 3,000	$ -
	Japan		$ 10,000	$ 20,000	$ 10,000
	India		$ 12,000	$ 10,000	$ (2,000)
	China		$ 15,000	$ 15,000	$ -
	Canada		$ 3,000	$ 3,000	$ -
	PMA		$ -	$ 5,000	$ 5,000
	Fruit Logestica		$ 10,000	$ 15,000	$ 5,000
	Mexico		$ 3,000	$ 5,000	$ 2,000
	Management		$ -	$ 35,000	$ 35,000
TOTAL			$ 121,000	$ 191,000	$ 70,000
MAP DOLLARS					
	JAPAN		$100,000	$100,000	
TOTAL			$100,000	$100,000	
EMP					
	India		$68,000	$65,000	
	China		$68,000	$65,000	
	Mexico			$0	
	Canada			$0	
TOTAL			$136,000	$130,000	
TOTAL MAP/EMP/TASC			$236,000	$ 230,000	

2017 Research Projects

Updated 12/4/2017

Researcher	Project	Amount	Finalized MOU	Paid thus far	% Paid	No Cost Extension
Ferguson & Ficthner	Investigating Anti-Oxidant to Decrease the Leaf Abscission with Ethephon Applications	$ 39,996.00	1/30/17revised 3/7/2017	$ 7,999.20	20%	12/31/2018
Wang	Investigation of chemical and biological formation of styrene in black ripe table olives	$ 51,350.00	2/17/2017	$29,450.00	57%	6/30/2018
Wang	Comprehensive nutritional analysis of California green and black ripe table olives	$ 46,350.00	2/17/2017	$9,450.00	20%	
Preece & Ferguson	Propagating Dwarfing Olive Rootstocks and Establishing a Long Term Orchard	$ 35,442.00	3/1/2017	$ 35,442.00	100%	
Adaskaveg	Epidemiology and management of olive knot caused by Pseudomonas savastanoi pv. Savastanoi	$ 18,900.00	1/30/2017	$11,340.00	60%	
Lovatt & Fichtner	Managing Alternate Bearing in olive with PGRs and Pruning	$ 23,845.00	2/17/2017	$14,307.00	60%	6/30/2018
Rosecrance & Kruegar	Canopy Management, Tree Hedging and topping to Optimize Yield	$ 31,075.00	1/17/2017	$18,645.00	60%	3/1/2018
Lightle	Prelimiary field study to identify new olive fly control materials	$ 19,647.00	4/7/2017	$11,788.20	60%	3/31/2018
	Contingency	$ 100,000.00		$12,000.00	12%	
Ernie Simpson	Northern Fly Trapping	$ 6,500.00	2/15/2017	$ 6,500.00	100%	
Jim Stewart	Southern Fly Trapping	$ 6,333.33	2/17/2017	$5,541.69	88%	
	Total	**$ 379,438.33**			0%	

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

FROM: RESEARCH SUBCOMMITTEE

SUBJECT: 2018 RESEARCH PROJECT

RECOMMENDATION: THAT the Subcommittee approve research project for 2018.

BACKGROUND: Each year the Research Subcommittee approves various research projects funded by the Committee. The Subcommittee must which proposed projects to recommend to the Committee for funding. A budget of $312,777 is purposed based on the submitted projects.

2018 RESEARCH PROPOSALS FOR THE CALIFORNIA OLIVE COMMITTEE

TOPIC	LEADERS	AMOUNT
A new fruit removal head for an olive harvesting system	Reza Ehsani	$45,741
Canopy management, tree hedging and topping to optimize yield	Rich Rosecrance	$31,075
Managing Alternate Bearing in Olive with PGRs and Pruning	Carol Lovatt Elizabeth Fichtner	$20,698
Evaluation of Several Promising Additives for Reducing Acrylamide in Black Ripe Table Olives	Selina Wang	$53,280
Differentiation of olive cultivars using DNA and NMR-based fingerprinting methods	Selina Wang	$67,433
Southern San Joaquin Valley Olive Fruit Fly Monitoring Project	Jim Stewart	$6,400
Sacramento Valley Olive Fruit Monitoring Project	Ernie Simpson	$6,500
Epidemiology and management of olive knot caused by *Pseudomonas savastanoi* pv.*savastanoi*	J. E. Adaskaveg	$16,650
Contingency Fund		$50,000
Total		$297,777
*Sensory Research (research and key message development)		$65,000
*Management of foliar diseases of olive (Contingency Fund)	J. E. Adaskaveg	$15,000*

The Committee must decide:

1) Research Budget
2) Recommend to the Committee to delegate authority to the Subcommittee to approve projects for contingency fund.
3) Recommend to the Committee to delegate authority from the Committee to the Executive Director with oversight by the Chairman, of the research budget.

FISCAL IMPACT: The Subcommittee approved $297,777. Discussion will be on the $80,000 for two additional projects. If approved the total will be $362,777 2018 FY.

CALIFORNIA OLIVE COMMITTEE

PROJECT PLAN/RESEARCH GRANT PROPOSAL

Workgroup/Department: School of Engineering – Mechanical Engineering

Project Year: 2018 Anticipated Period of Performance: 03/01/2018 – 02/28/2019

Project Title: A New Fruit Removal Head for an Olive Harvesting System

Project Leaders: Reza Ehsani (Professor, University of California, Merced, 5200 N. Lake Road, Merced, CA 95343, 209-228-3613, rehsani@ucmerced.edu)

Cooperators: Louise Ferguson (CE Pomologist, Department of Plant Sciences, UC Davis, Email: lferguson@ucdavis.edu, Phone: (559) 737 3061)

Commodity: Olive
Relevant AES/CE Project No.:

Year Initiated: 2018
Anticipated Duration of Project: 2 years (only one year proposed here)

Problems and Significance:
Production acreage of table olives, California's signature crop, has significantly decreased in recent years due to the high cost of production and small margin of profit. Harvesting is a major cost of production for table olives. Currently, the majority of table olives are hand-harvested. Although some growers are using trunk shakers with some success, this method has not been widely utilized because older trees that have larger trunks cannot be harvested by trunk shakers. Also, growers are hesitant to remove and replace high yield producing older trees with younger trees. Mechanical harvesting, using contact canopy shakers, is the most promising method for harvesting table olives. Scientists at UC Davis have developed a prototype of a canopy shaker that has been tested and has shown some level of success. The UC Davis-designed canopy shaker is very similar to the canopy shaker used in harvesting process oranges in Florida. This type of shaker is relatively heavy and cannot accommodate the shape of the tree very easily, plus research at the University of Florida has shown that fixed shaking frequency is not the best choice for maximum fruit removal and a better fruit removal can be achieved if a range of frequencies be used. In spite of all past efforts, there is still a need for a cost-effective and efficient harvesting system to match the needs of existing table olive trees.

Progress to Date:
Mechanical harvesting of olives was initiated in the US in 1940s. The main goal of this method was to develop a cost-effective technique to harvest olive fruit for both table and oil extraction purposes (Sola-Guirado *et al.*, 2014). Among all proposed methods, mechanical shaking has been the most successful approach for fruit removal. Different types of shakers such as a trunk shaker, branch shaker and canopy contact shaker were developed (Jimenez-Jimenez *et al.*, 2015 and

Famiani *et al.*, 2014). To increase the efficiency of using these shakers, previous research studies suggested high density hedgerow orchards with limited tree height. Trunk shakers had lower fruit removal efficiency due to the damping effect of branches (Castro-Garcia *et al.*, 2014 and Fergusen *et al.*, 2014). Beside the lower efficiency, damage to the bark of the trunk and branches cause lower yield in the future, and increase the risk of infestation and disease in the trees (Jimenez-Jimenez *et al.*, 2015). For other types of shakers, especially contact canopy shakers, damage to the branches and leaves and also final fruit quality issues such as cuts and flesh injury should be taken in to consideration (Fergusen *et al.*, 2010). All these damages reduce the market acceptability, especially of green processed table olives. To solve the issues with mechanical harvesting of traditional orchards, Fergusen *et al.*, 2010 suggested to consider modifications in both canopy size of traditional trees and mechanical harvesters simultaneously. In this project, we are proposing a new canopy shaker configuration with an articulated frame to improve the canopy adaptability and reduce the shaking intensity and damage to both tree and fruits for conventional orchards. This will be a smart shaker head and will be equipped with sensors to self-adjust its shaking frequency and tine position to reduced tree damage.

Objectives:

The ultimate goal of this project is to reduce the harvesting cost for table olives. The specific goal is to develop a cost-effective fruit removal system for existing conventional olive trees with higher harvest efficiency and better fruit removal percentage while reducing damage to the fruit and tree branches. This is a two-stage project, the first stage includes developing a new fruit removal mechanism and installing it on a test platform and conducting field trials to evaluate its performance. If successful, then we will propose the second stage in which we will compare the new designed fruit removal head with the current shaking mechanism developed by UC Davis researchers for conventional olive trees.

Experimental Procedures:

To achieve the objectives of the proposed project, the following tasks should be done. Tasks for each objective are listed below individually.

Task 1- Review the literature to find the issues with introduced harvesters and visiting the orchards with conventional trees to determine the specific requirements of a proper fruit removal head.
Task 2- Design and build the head in the shop and install the head on a test platform.
Task 3- Conduct both stationary and dynamic tests to make sure all mechanical components work properly and field evaluation to verify the head functionality. The field evaluations consist of percentage of fruit removal, evaluation of damage to the tree branches and leaves and visual evaluation of damage to the fruit.
Task 4- Write a final report for the first year of the project and summarize the results of machine evaluations.

Anticipated Outcomes:

It is anticipated that the newly designed harvesting head is cost-effective and lighter than the previous design and will cause less damage to the fruit making it more suitable to be used on the existing table olive trees.

Select References:

Castro-Garcia, S., Castillo-Ruiz, F. J., Jimenez-Jimenez, F., Gil-Ribes, J. A., & Blanco-Roldan, G. L. (2015). Suitability of Spanish 'Manzanilla'table olive orchards for trunk shaker harvesting. Biosystems Engineering, 129, 388-395.

Famiani, F., Farinelli, D., Rollo, S., Camposeo, S., Di Vaio, C., & Inglese, P. (2014). Evaluation of different mechanical fruit harvesting systems and oil quality in very large size olive trees. Spanish Journal of Agricultural Research, 12(4), 960-972.

Ferguson, L., Rosa, U. A., Castro-Garcia, S., Lee, S. M., Guinard, J. X., Burns, J. & Glozer, K. (2010). Mechanical harvesting of California table and oil olives. Advances in Horticultural Science, 53-63.

Ferguson, L., Burns, J., Miles, J., Guinard, J. X., Rosa, U., Castro-Garcia, S. & Vossen P. M. Developing Mechanical Harvesting for California Black Ripe Processed Table Olives: 2006-2014.

Jimenez-Jimenez, F., Blanco-Roldana, G.L., CastilloRuiza, F. J., Castro-Garcia, S., Sola-Guiradoa, R., Gil-Ribesa, J.A. (2015). Table Olives Mechanical Harvesting with Trunk Shakers. Chemical Engineering, 44.

Sola-Guirado, R. R., Castro-García, S., Blanco-Roldán, G. L., Jiménez-Jiménez, F., Castillo-Ruiz, F. J., & Gil-Ribes, J. A. (2014). Traditional olive tree response to oil olive harvesting technologies. Biosystems Engineering, 118, 186-193.

BUDGET REQUEST: Reza Ehsani

Budget Year: 2018 Funding Source: COC

Labor:		**(Line 1) $26,916 +$1,292**
Salary – 2 Graduate Student Researcher, 100% for 3 months of summer 2018, $4,489 per month		$26,916
Benefits – 4.8%		$1,292
Subtotal 1	**Line 1 subtotal**	**$28,208**
Supplies, Equipment:	**(Line 2)**	**$10,000**
Supplies: (hauling the mechanical harvester to the field ($1,500), renting a platform for installing the harvesting head for two weeks ($2000) raw materials for fabrication ($1,500), hydraulic components, hosing and hydraulic motors, hydraulic valves ($3,000), consumable shop and welding supplies, supplies for field data collection supplies ($2,000)	$10,000	
Equipment: N/A	$0	
Individual contractors: N/A	$0	
Subtotal 2	**Line 2 subtotal**	**$10,000**
Travel:	**(Line 3)**	**$380+$2,620**
Vehicle Use: (Renting a truck for two weeks for field trials $380 ($190.00/week)		$380
Meeting attendance: (*attending COC meeting ($320)* attending a professional meeting for one person Registration + airplane ticket and accommodation $2,300)		$2,620
Subtotal 3	**Line 3 subtotal**	**$3,000**
Subcontracts: N/A	***(Line 4)***	**$0+$0**
Collaborator A: N/A		**$0**
Collaborator B: N/A		**$0**
Subtotal 4	**Line 4 subtotal**	**$0**
Total of lines 1 through 3 above	**(Line 5)**	**$41,208**
UCD/ANR/UCR Overhead @ 11% IDC	**Line 6**	**0.11 * Line $41,208**
Total to primary PI (Line 7)		**Line 4 $0 + Line 6 $4,533**
TOTAL BUDGET REQUEST		**$45,741**

PRIMARY PI SIGNATURE PAGE: UNIVERSITY OF CALIFORNIA

Reza J Ehsani ______ _10/31/2017____
Originator's Signature Date

Mark Matteson ______ 10/31/17
Department Chair/County Director Date

Caroline Lutz ______ 11/01/2017
Liaison Officer Date

CALIFORNIA OLIVE COMMITTEE

PROJECT PLAN/RESEARCH GRANT PROPOSAL

Workgroup/Department: Olive / Plant Sciences College of Agriculture, CSU Chico

Project Year 2018 Anticipated Duration of Project: 4 years

Project Title: Canopy management, tree hedging and topping to optimize yield

Project Leaders:

Rich Rosecrance, Professor, California State University, Chico. College of Agriculture, 400 West First Street, Chico, CA 95929-0310: rrosecrance@csuchico.edu

William H. Krueger: Glenn County Farm Advisor (Emeritus): whkrueger@ucanr.edu

Louise Ferguson, Extension Specialist, Department of Plant Sciences, 2037 Wickson Hall, Mail Stop II, UC Davis, 1 Shields Ave., Davis CA 95616, (530) 752-0507 [Office], (559) 737-3061 [Cell] LFerguson@ucdavis.edu

Daniele Lightle: Glenn County Farm Advisor: DLightle@ucanr.edu

Cooperating Ranches and People:

Erik Nielsen Enterprises Inc. 4453 Co Rd O, Orland, CA 95963

Dennis Burreson, Musco Olives, 17950 Via Nicolo, Tracy, California 95377

Commodity: Olive Relevant AES/CE Project No.

Year Initiated: 2016 Current Funding Request: **31,075.00**

Problems and Significance:

Mechanical Hedging

Mechanical hedging and topping can be important tool in improving harvest efficiencies by affecting return bloom, helping to maintain trees in their allotted space and reducing hand pruning costs. Typically, hedging and topping result in smaller and more compact trees. Smaller trees will facilitate hand harvest by obviating the need for tall, cumbersome ladders and likely increasing the number of bins harvested per hour. Picking crews have repeatedly commented that they prefer to harvest from mechanically hedged and topped trees than from traditionally pruned trees (Louise Ferguson, personal communication). In oil olive orchards, mechanical hedging has resulted in increased harvest efficiency and reduced alternate bearing (Charlie

Garcia, California Olive Ranch, personal communication). However, timing of mechanical hedging is critical for optimal yields. Hedging too late in the season may not provide enough time for new shoots to grow and flower buds to initiate. Earlier work that we conducted on 'Arbequina' oil olives indicated that shoot growth that occurred after early July did not produce flowers the following year. Whether 'Manzanillo' olives will behave the same is unknown. Hedging too early in the season can cause extensive vegetative growth at the expense of fruit growth. Thus, finding 'the sweet spot' for the timing of mechanical hedging is important to maximize and help regulate yields.

Mechanical Topping

Unlike hedging, mechanical topping does not reliably produce a crop on shoots that grow in response to the topping. Our trials have demonstrated that topping produced vigorous growth with limited fruit and resulted in two problems: 1) The limited fruit in the upper canopy ripened sooner than the rest of the crop, producing overripe fruit that decreased grade and value by 25%, and 2) Vigorous vegetative growth that can shade fruitwood and decrease yields, even when the tree is topped every other year. The solution appears to be to top the tree annually with a gabled cut to eliminate this overly vigorous growth and overripe fruit.

Optimizing Tree Light Interception at different tree heights, and latitudes

A program that evaluates light interception at different tree heights, row spacings, and latitudes has been developed by David Connor in Spain. This program was developed to help determine optimal tree spacing and height to maximize light interception at different latitudes. This program will assist us in our hedging and topping treatment to increase light interception and yield.

Fruit Nutrient Removal Calculator

Significant quantities of nitrogen, phosphorus and potassium are removed by harvested portions of fruit crops. Thus, the nutrient removal rate is an important consideration for making fertilizer recommendations. Inadequate fertilization and/or nutrient imbalance can prevent growers from achieving desired fruit yields and quality. Recently, we developed a macro- and micro-nutrient removal calculator for 'Arbequina' oil olives (Figure 1). Oil olives, however, are smaller and have a greater pit to flesh ratio than 'Manzanilla' table olives, which influence fruit nutrient content. An online fruit nutrient removal calculator needs to be developed for table olives.

Progress to Date:

Nickels Soil Lab

We harvested the trial at Nickels Soil Lab in Arbuckle with a mechanical harvester on October 13, 2017. Cumulative yields (2016 and 2017) indicated that yields were reduced by almost 3 tons per acre in the 10-foot topping treatment compared with trees topped at 13 feet and the no topping treatments, 5.8, 8.6, and 8.6 tons per acre, respectively. The 10-foot topping treatment, however, reduced hand pruning cost by almost $500 per acre compared with the 13-foot and no topping treatments, likely the result of a more compact tree. Currently we are analyzing light levels and fruit size along a transect from the base to the top of the tree. In the unhedged treatment, preliminary data indicate that fruits located between 1 and 1.5 m from the ground were significantly smaller that fruit higher up in the canopy. No difference in fruit size along the transect was found in the 10-foot topping treatment. This likely resulted in the greater percentages of large fruit in the 10-foot vs the 13-foot and hand pruned treatments. We will be evaluating how topping affect pruning costs, return bloom, and yields in 2018

Nielsen Trial

Trees hedged in 2016 still had reduced canopies in late 2017 compared with a non-hedged control. Severe hedging in 2016 increased shoot growth and decreased reproduction in 2017 compared with a non-hedged control. Severe hedging (removal ~ 30% of the canopy) in 2016 significantly reduced flower intensity and fruit set and increased shoot growth in 2017. In contrast, flower intensity and fruit set levels were similar among the moderately hedged and non-hedged treatments. As in 2016, yield-ranking data in 2017 indicated that severe hedging reduced yields, likely a result of carbohydrates being diverted to shoot growth rather than to fruits. It will be interesting to see how 2016 hedging treatments affects yields in 2018.

Burrison Trial

In Spring 2017, we initiated a new trial on 8-year old olive trees at Heath Burrison's orchard (Figure 2). The trial was set up as a factorial design with four hedging dates and two canopy sides (east or west; the orchard is planted in a north-south direction) and replicated 5 times. The 10-tree plots were hedged on March 8, April 5, May 8, and June 8, 2017. Trees tend to grow slightly more on west-facing canopies and on canopies facing east. Thus, we want to evaluate the effect of canopy orientation on yield and canopy growth. Shoot growth from trees hedged in March and April was significantly greater than growth from trees hedged in May and June and the non-hedged control. Yields will be collected in the near future.

Olive Nutrient Removal Calculator

At fruit maturity, fruit samples were collected from eight orchards up and down the state. Fruits dried, grown, and analyzed for maco- and mico-nutrients at Dellavalle Labs, Fresno, California. We will use these data and data collected in 2018 to develop a nutrient removal calculator.

Objectives:

We propose to:

1. Investigate the effects of timing of mechanical hedging on return bloom, yield on mature trees. The objective is to determine the optimal timing of hedging for hedgerow plantings for generating a 5-ton or more per acre annual average crop.

2. Compare the effects of a mechanical pruning program that incorporates annual topping at two different tree heights to controlling the tree height. All of the treatments would receive an every other row middle hedging. The objective is to determine the optimal hedgerow height for generating a 5-ton per acre annual average crop that can be produced with mechanical pruning. This data could then be used to evaluate the program for determining optimum tree height for hedgerow plantings.
3. Compare results from hedging and topping trials with the a MatLab program which predicts optimal tree size and spacing to maximize light interception.
4. Develop a web-based fruit nutrient removal calculator for 'Manzanillo' table olives

Experimental Procedures:

Experiment 1: Mechanical Hedging (Erik Nielsen's and Heath Burreson's orchard)

Hypothesis: optimal timing or mechanical hedging will not decrease yield and will facilitate mechanical harvesting.

Overall Objective: to determine the optimal timing of mechanical hedging for table olive productivity and fruit quality.

2017 Objectives:

- **I.** Hedge Trees Monthly
- **II.** Evaluate effect of pruning treatments on shoot growth, and return bloom and quality: perfect versus imperfect flowers.
- **III.** Evaluate effect of pruning treatments on yield and fruit quality.
- **IV.** Determine optimal timing of hedging treatment to facilitate high quality fruit production and return bloom.

Materials and methods:

Experimental Design:
Randomized complete block of four replications.

- Treatments: Evaluate timing by hedging the south side of the tree at monthly intervals starting in April and ending in August. Twelve trees from 4 tree rows will be hedged each month.
    - Hedging will aim to remove about 50 percent of the new growth
    - middle 10 trees of each treatment will be the data trees

- Data Collection:
- 100 fruiting and 100 non-fruiting branches will be tagged after hedging treatment
- Shoot growth will be measured at the end of the seasons
- At bloom the following season, flowering intensity (inflorescences per branch) will be determined from the tagged branches
- Following bloom, fruit set will be determined

- Measure fruit removal and yields following mechanical trunk shaking in the hedged trees.

- Data Analysis:
  - The following relationships will be evaluated statistically for the trial:
    - Effect of time of hedging on shoot growth in both fruiting and non-fruiting shoots.
    - Effect of time of hedging on flowering the next year from fruiting and non-fruiting shoots
    - Effect of time of hedging on fruit set the next year from fruiting and non-fruiting shoots
    - Evaluate the effects of the treatments of fruit removal and yields following mechanical trunk shaking.

Experiment 2: Mechanical Topping

Materials and Methods:
Experimental Plot: Nickels Estate - 2 acre 'Manzanillo' orchard established in 2002.

Hypothesis: mechanically topping hedgerow olive orchards will not decrease yield and will reduce hand harvesting costs by producing shorter statured trees.

Overall Objective: to determine the optimal row height for table olive productivity and fruit quality at a 12 X 18' orchard spacing (202 trees/acre) and develop the formulas for applying this information to different latitudes and orchard spacing.

2017 Objectives:

V. Apply two different tree height pruning treatments and compare to controlling tree height with hand pruning
VI. Install sunlight exposure monitoring cameras
VII. Evaluate effect of pruning treatments on bloom quality: perfect versus imperfect.
VIII. Evaluate effect of pruning treatments on yield and fruit quality in upper and lower canopy at harvest.
IX. Correlate hours of sunlight exposure with fruit yield and quality.

Materials and methods:

Experimental Design:
Randomized complete block of four replications: map attached

- Treatments: three pruning treatments of three, 10 tree rows
  - topped at 10 and 13 feet in February 2017 and compared to pruning to lateral branches at 13 feet using thinning cuts
  - middle row of each treatment will be the data row
  - alternate row side hedging treatments will be applied

- Data Collection:

- Five photosynthetically active radiation (PAR) monitors will be positioned on a 20' pole and installed along a transect from the trunk to the top of the tree. Measurements will be taken every 5 minutes and compared with the full sun measurement. Fruit size at each position will be determined.
- A late-season mid-day light interception measurement will be done to determine the percentage of light each treatment is intercepting.
- Trees will be harvested and fruit quality will be assessed from samples taken from the upper and lower tree canopy.
- Yields will be compared with the MatLab program that predicts optimal tree size and spacing to maximize light interception.

- Data Analysis:
    - The following relationships will be evaluated statistically for the east and west sides, within the three pruning treatments:
        - Effect of pruning treatment on ratio of perfect to imperfect flowers
        - Effect of pruning treatment on total yield and fruit quality; size and color
        - Correlation of each of the above parameters with total hours of light exposure through the season from bud swelling through harvest.

Olive Nutrient Removal Calculator

At fruit maturity, fruit samples will be collected from eight orchards up and down the state. Fruits will be dried, grown, and analyzed for maco- and mico-nutrients. We will use these data to develop a nutrient removal calculator. Growers will input their olive yield and this web-based tool will determine the amount of macro- and micro-nutrients removed in the harvested crop, similar to what is shown in Figure 1.

Anticipated Outcomes:

Hedging and Topping Treatments

The goal of these experiments are to determine the most effective timing of canopy hedging and topping height to ensure return bloom, maximize yields, and minimize excessive vegetative growth. We anticipate that hedging and topping treatments can producer similar yields to hand-pruned trees with lower labor costs. We also anticipate the hedging and topping will significantly reduce alternate bearing.

Light Measurements in topped, hedged, and control trees

The goal of these experiments are to determine how canopy management with mechanical topping and hedging affects total hours of canopy light exposure and therefore flower production, fruit yield and quality. The ultimate goal is to demonstrate how to calculate the optimal tree height for moderate density orchards at different latitudes.

Olive Nutrient Removal Calculator

The 'Manzanillo' nutrient removal calculator will estimate nutrient removal of macro- and micro-nutrients. Removal data for the 'Manzanillo' will be incorporated into the calculator found at http://www.csuchico.edu/~rrosecrance/Model/OliveCalculator/OliveCalculator.html

BUDGET REQUEST –

Budget Year: 2018-2019 Funding Source: COC

Personnel:		
Rich Rosecrance, California State University, Chico, professor.		6,000.00
data collection and entry, harvest support. (~87 hrs @ $69/hr)		
Student (summer and fall; 375 hours at $12/hr)		4,500.00
Fringe @ 11.01%		1,156.05
Independent Contractor - Bill Krueger: Glenn County Farm Advisor (emeritus):		6,000.00
Technical Support - data collection and entry, harvest support.		
	Sub 1	**17,656.05**
Equipment Supplies & Expenses:		
Light measurement, timelapse cameras, field scale equipment		3,600.00
	Sub 2	**3,600.00**
Pruning and Harvesting Costs: (based on previous year's cost)		
Hand pruning, brush shredding: Nickels Estate		1,500.00
Mechanical harvest (ENE Inc.) at Nickels Estate:		1,500.00
Hand harvest at Nickels Estate (post mechanical harvest)		1,000.00
Nutrient Analyses (18 samples x $56/sample)		1,000.00
Miscellaneous harvest supplies: water, gloves, tarps, buckets		1,000.00
	Sub 3	**6,000.00**
Experimental Travel Costs:		
Travel support for plot set-up, data collection, harvesting. (8 months X 4 RT/month @ 120 miles/trip X .55/mile)		2,338.95
	Sub 4	**2,338.95**
Facilities and Admin @ 5%		**1,480.00**
TOTAL BUDGET		**31,075.00**

Scope of Work

Dr. Richard Rosecrance:
Responsible for overall coordination of the project, applying pruning treatments, executing harvest trials, developing fruit nutrient calculator, data collection and analysis and writing final report.

Bill Krueger, Louise Ferguson, and Dani Lightle: Responsible for assisting in the mechanical pruning treatment in Orland and Nickels trial and co-coordinator of harvesting the trials.

External Contractors: contracts to be secured after funding.

Pruning Contract at Nickels Soils Laboratory: Colusa, California
Hillary Nielsen Porter
ENE Inc.
4453 County Road O
Orland CA 95963
ENE@EneInc.com
Office: 800-844-9409
FAX: 530-865-4845

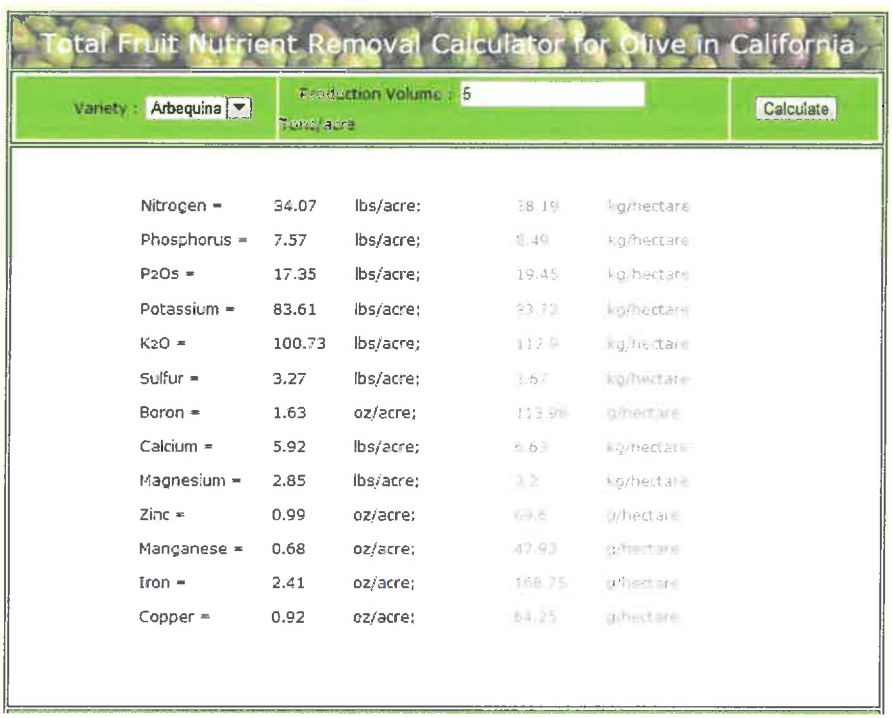

Figure 1. Nutrient removal calculator for 'Arequina', 'Arbosana', and 'Koroneiki' olive oil cultivars. Data will be collected to include 'Manzanillo' in the fruit nutrient removal calculator.

Figure 2. Hedging timing trial located at Heath Burreson's orchard, Orland, California. Trees hedged at the following times: Yellow = 8-Mar, Red = 5-Apr, Blue = 8-May, Orange = 8-Jun, and White = No Hedge Control. Experiment is set up as a factorial design with 5 hedging timings and 2 hedging positions (east and west) with 5 replicates.

PRIMARY PI SIGNATURE PAGE: UNIVERSITY OF CALIFORNIA

______________________ Originator's Signature	__________ Date
______________________ Department Chair/County Director	__________ Date
______________________ Liaison Officer	__________ Date

CALIFORNIA OLIVE COMMITTEE

PROJECT PLAN/RESEARCH GRANT PROPOSAL

Workgroup/Department: Olive Workgoup/Department of Botany & Plant Sciences, UCRiverside

Project Year: 2018 Anticipated Period of Performance: 2 crop years to assess treatment effects on cumulative yield of alternate bearing olive trees

Project Title: Managing Alternate Bearing in Olive with PGRs and Pruning

Project Leaders: Elizabeth Fichtner and Carol Lovatt

EF-Farm Advisor, Orchard Systems, Cooperative Extension, 4437 S. Laspina St., Tulare, CA 93274; Phone: 559-684-3310; Fax: 559-685-3319; Email: ejfichtner@ucanr.edu

CL-Professor of Plant Physiology, Emeritus & Professor in the Graduate Division, Botany and Plant Sciences-072, UCRiverside, CA 92521-0124; Phone: 951-827-4663; Fax: 951-827-4437; Email: carol.lovatt@ucr.edu

Cooperators: Kurt Schmidt, Lindcove Research and Education Center, 22963 Carson Avenue, Exeter, CA 93221; Phone: 559-592-2408, ext. 153; Email: krschmidt@ucanr.edu

Commodity: Olive Relevant AES/CE Project No.: 4556-H

Year Initiated: 2018 Anticipated Duration of Project: 2 crop years

Problems and Significance: Alternate bearing (AB), production of a heavy "on-crop" (high yield, ON-trees) followed by a light "off-crop" (low yield, OFF-trees), occurs in perennial fruit and nut crops, as well as forest species (where it is called "masting"). For tree crops, alternating high and low yields cause significant economic problems. In ON-years, trees produce a large number of small size fruit with reduced commercial value. In OFF-years, trees produce large fruit, but in some cases a significant proportion of the fruit are too large and have reduced economic value, further exacerbating the problem that there are too few fruit in OFF-crop years to provide growers with a good income. For olive, the ON-crop takes longer to mature, attain size and accumulate oil. The delayed harvest further reduces floral intensity the following spring. It is important to note that the lack 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 operation, manufacture of value-added products, marketing, and consumer prices, which jeopardizes the stability and sustainability of tree-crop commodity-based industries.

The severity of alternate bearing in the olive industry in Tulare County is illustrated in Table 1. Since the major factor initiating AB is an extreme climate event (high or low temperature, etc.) that ultimately reduces yield and initiates AB, there is a reoccurring need for a management strategy to mitigate the severity of AB.

Progress to Date: a) *Understanding the mechanisms that perpetuate AB in olive.* Our research identified four mechanisms by which the ON-crop of olive fruit reduces return bloom, and thus yield, the following year and perpetuates AB in 'Manzanillo' olive trees (Fichtner et al., 2017). The ON-crop causes the following, with the OFF-crop having the inverse effect. (1) The setting ON-crop of developing olive fruit inhibits summer vegetative shoot growth as first reported by Sibbett (2000) and confirmed by our research. This reduces the number of nodes that can produce floral buds at spring bloom the following year. In addition, our COC-funded research also documented that spring vegetative shoot growth is reduced when trees produce an ON-bloom, reducing the number of inflorescences contributed by the spring vegetative shoots to bloom the year following the ON-crop (Fichtner and Lovatt, 2016). (2) Despite being harvested 4 to 6 months before spring bud break, the ON-crop of olive fruit inhibits spring bud break, which also reduces inflorescence number. (3) From fruit set to harvest, the ON-crop of fruit causes abscission of floral buds, with the greatest abscission occurring in September, a mechanism we identified in our COC-funded research that was previously only known to function in AB pistachio trees (Chao, 2014; Fichtner et al., 2017). (4) The ON-crop of 'Manzanillo' olive fruit inhibits floral development by inhibiting transcription of key genes necessary for flower formation (Chao, 2014; Fichtner et al., 2017). Our COC-funded research results also documented that the ON-crop of fruit reduces the number of inflorescences contributed to return bloom by bearing shoots (shoots that set fruit) to a greater degree than non-bearing shoots (shoots that did not set fruit). Bearing shoots are negatively impacted by both the fruit set on the shoot (localized effect of fruit) and all the fruit on the tree (whole tree crop load effect), whereas non-bearing shoots on ON-crop trees are influenced only by crop load. As a result, non-bearing shoots are the major source of inflorescences at spring bloom following the ON-crop year. Thus, increasing the number of non-bearing shoots on ON-crop trees by fruit thinning (before pit hardening) is essential for reducing the negative impact of the four mechanisms that reduce flowering and perpetuate AB. Moreover, fruit thinning should improve the efficacy of PGR treatments that increase vegetative shoot growth and spring bud break on non-bearing shoots to increase floral intensity and yield in the year following the production of the ON-crop. This project also utilizes what we have learned about the timing and efficacy of PGR treatments that we have tested as branch injections and whole and half tree sprays.

b) *Progress in the use of PGRs to mitigate AB in olive.* For 'Manzanillo' olive, injection of 6-benzyladenine (6-BA) or adenosine (ADO) (alone or combined with tri-iodobenzoic acid [TIBA]) into scaffold branches of ON-crop 'Manzanillo' olive trees in July significantly increased summer vegetative shoot growth for non-bearing shoots of ON-crop trees to a value equal to that of non-bearing shoots of OFF-crop control trees and significantly greater than that of bearing shoots of ON-crop control trees ($P < 0.0001$) (Table 2) (Fichtner et al., 2017). However, only ADO (alone or combined with TIBA) significantly increased summer vegetative shoot growth on bearing shoots of ON-crop olive trees to a value equal to that of non-bearing shoots of OFF-crop control trees ($P < 0.0001$). For 'Manzanillo' olive, combining ADO with TIBA provided no benefit over using ADO alone to increase summer vegetative shoot growth. Injecting these same compounds into the scaffold branches of a second set of ON-crop 'Manzanillo' olive trees in February demonstrated that both 6-BA and ADO had a positive effect on spring bud break and floral intensity at return bloom (Fichtner et al., 2017). As a result, 6-BA and ADO increased the number of inflorescences produced by non-bearing shoots of ON-crop trees to values significantly greater than those of non-bearing shoots on both OFF- and ON-crop control trees at return bloom ($P < 0.0001$) (Table 2). Supplying TIBA with ADO reduced the benefit of ADO alone. All three treatments increased inflorescence number at return bloom for bearing shoots of ON-crop 'Manzanillo' olive trees relative to bearing shoots of ON-crop control trees, but not to the level of non-bearing shoots of either ON- or OFF-crop trees ($P < 0.0001$) (Table 2), confirming the need to increase the number of non-bearing shoots on ON-crop trees.

c) *Progress with PGR strategies and increasing the number of non-bearing shoots on ON-crop 'Manzanillo' olive trees obtained from our most recent COC-funded research.* ON-crop trees receiving a summer application of 6-BA last year (July 2016) to increase summer vegetative shoot growth were treated with 6-BA again in February 2017 to increase spring bud break and floral intensity at bloom. We continued to test AVG applied at 30% bloom to trees going into an OFF-bloom. Neither treatment increased yield to values greater than control trees going into an OFF-bloom; all produced OFF-crops that were significantly lower than control trees going into an ON-bloom and producing an ON-crop ($P < 0.0001$). In year 2 (2017) of our current COC-funded project, based on the results presented above supporting the need to increase the number of non-bearing shoots on ON-crop trees and the large number of ON-crop trees present in our research orchard, as proposed we tested the efficacy of the PGR naphthaleneacetic acid (ALCO® Olive Stop™; AMVAC Corp.) applied at full bloom at the manufacture's suggested rate to just one side of ON-crop 'Manzanillo' olive trees to reduce bloom and fruit set in the ON-crop year in order to increase spring and summer vegetative shoot growth in the current year and spring bud break, floral intensity and yield on that side of the tree the following year so that it would not produce an OFF-crop. By chemically thinning only half of the tree, the impact of over-thinning on yield when a heat wave occurs is reduced. During the last week of June, we pruned (mechanically hedged) one side of a second set of ON-crop trees to compare the efficacy of chemical fruit thinning versus mechanical pruning on yield and fruit size of the current year's harvest and of next year's return yield following the ON-crop. For fruit removal by pruning, pruning was delayed to the end of June to enable growers to evaluate the crop set by their trees or the efficacy of NAA, if it was applied at bloom, in order to make an informed decision to prune or not, and how severely to prune. Removing fruit by pruning at this time is sufficiently early to promote summer vegetative shoot growth and to have a positive effect on floral bud retention and floral gene expression and spring bud break. Moreover, mechanical hedging is typically a less expensive method of pruning. All trees were topped during the first week of July 2017. In this strategy, the side of the tree that was not treated with NAA or not pruned is the source of the current year's crop, with an increase in average fruit size anticipated relative to fruit of untreated ON-crop control trees. However, the untreated side will produce an OFF-bloom and an OFF-crop the following year, although some increase in return bloom and yield is anticipated on this side of the tree due to the reduction in total fruit number per tree (crop load) on the treated side of the tree. The proposed strategy directs the grower to treat the other side of the tree the following year with NAA or pruning, based in the intensity of the bloom or crop set by June. Thus, each year, alternating sides of the tree would be treated with NAA or pruned. In our research, NAA and mechanical pruning (hedging) reduced yield equally, 28% and 23%, respectively, resulting in yields that were significantly lower than the yield of ON-crop control trees, but significantly greater than the yield of OFF-crop control trees by more than 2-fold ($P < 0.0001$). In addition, the results confirmed that removing fruit on one side of the tree significantly increased average fruit size for the whole tree. NAA and pruning increased fruit size by 20% and 15% compared to ON-crop control trees, respectively, but the fruit were still 10% and 15% smaller than fruit of OFF-crop control trees, respectively ($P < 0.0001$). The average size of fruit on OFF-crop trees was extra large (82 fruit/lb), for ON-crop trees, medium (111 fruit/lb) and for the NAA and pruned trees, large (93 fruit/lb). In a second orchard, we tested two concentrations of the new proprietary material (1-aminocyclopropane-1-carboxylic acid, ACC, a precursor of ethylene biosynthesis) from Valent BioSciences, the action of which might be less sensitive to high temperature, possibly reducing the potential for over-thinning in a heat wave. The treatment was also applied to only one half of the tree. The two concentrations of the proprietary fruit-thinning PGR ACC reduced yield 36% and 31% compared to ON-crop control trees, but the effects were not statistically significant do the low number of replications possible in this small set of trees. The ACC treatments did not increase average fruit size per tree numerically or statistically. For all fruit thinning treatments, return yield data for next year is critical for determining the capacity of the treatments to even out yield in an AB orchard and establish the degree of thinning that is required. Imposing the treatments on alternate sides of the trees annually and collecting yield data over multiple years is essential to determine if good yields can be maintained and AB mitigated.

Two additional items of information. First, Dr. Fichtner observed during the collection of fruit samples for fruit size determination that the number of black and partially colored fruit was possibly treatment related. We evaluated this possibility using the fruit samples we collected for each data tree. She was correct. There was a strong inverse relationship between the proportion of black and partially black fruit per tree and total yield per tree ($r = -0.60$; $P < 0.0001$), with OFF-crop control trees having the largest proportion of black fruit (31%) per tree ($P < 0.0003$) with another 15% partially colored fruit and the fewest green fruit (54%) ($P < 0.0003$). Conversely, the proportion of fruit that remained green through harvest increased in parallel with total yield per tree ($r = 0.60$; $P < 0.0001$) with the majority (90%) of the fruit remaining green on ON-crop control trees and a statistically equal proportion remaining green on NAA (81%) and pruned trees (75%) ($P < 0.0003$). A greater proportion of green fruit might be another benefit from evening out AB. Second, just prior to harvest we tested our ability to evaluate the effectiveness of the fruit-thinning treatments. The treated sides of the trees were rated on a scale from 0 (no crop present, 100% crop reduction), 1 (25% of crop present; 75% crop reduction) to 4 (100% of crop present; 0% crop reduction). The correlation between the crop load rating for each tree and the harvested yield per tree was positive and strong ($r = 0.71$; $P = <0.0001$). The next step is to test the rating system in June for use as a tool to facilitate the grower's decisions related to pruning.

Objectives: The overall goals of the proposed research are three-fold: (1) to even out AB so there is a good crop annually by switching crop production from one side of the tree to the other side of the tree annually; (2) to sustain even production so growers have a stable and good income annually; and (3) to provide growers with means mitigate AB when it reoccurs. These goals will be achieved by meeting the following objectives. Objective 1: To reduce crop load (total number of fruit per tree) by removing flowers and/or fruit starting in an ON-crop year by applying a PGR thinning agent at bloom and/or by pruning (hedging) before pit hardening (June) to one side of the tree only for either treatment to create more non-bearing shoots during the ON-crop year that flower and produce crop the next year. Thereafter, flowers or fruit are removed on alternating sides of the tree annually by either using a chemical thinning agent at bloom or by pruning (hedging) at bloom or in June (before pit hardening). This strategy is designed to achieve yields that are significantly greater than OFF-crop yields but less than ON-crop yields annually (at the present time, we estimate a 30% reduction of the ON-crop yield is necessary to eliminate the OFF-crop year). Objective 2: To compare the efficacy of NAA versus ACC to reduce bloom reliably from year to year to even out alternate bearing. Objective 3: To compare the efficacy of using PGRs to thin flowers versus pruning (hedging) to remove fruit in June (before pit hardening). Objective 4. To determine the effectiveness and added value (cost-benefit) of applying 6-BA to trees that have had the ON-crop removed on one side of the tree to increase summer vegetative shoot growth during the ON-crop year and stimulate bud break the spring following the ON-crop

Experimental Procedures: The experiment includes six treatments in a randomized complete block design with 15 individual trees (replications) per treatment. The treatments are: (1) ON-crop (untreated) control trees; (2) OFF-crop (untreated) control trees; (3) ON-crop trees treated with NAA at full bloom in 2017 on one side of the tree and now treated on the other side of the tree with NAA at full bloom in 2018 and the alternate side in 2019; (4) ON-crop trees pruned in June 2017 (before pit hardening) and now pruned on the other side of the tree in June 2018, with the alternate side pruned in 2019; (5) ON-crop trees treated with ACC at full bloom in 2018 and the alternate side in 2019; and (6) On-crop trees pruned (hedged) in June 2018 and treated with 6-BA in July 2018 to stimulate summer vegetative shoot growth and 6-BA in February 2019 to stimulate spring bud break in order to test the efficacy of the PGR treatment on trees that now have an increased number of non-bearing shoots; the alternate side will be pruned in 2019 and the 6-BA treatments applied as described. The amount of summer vegetative shoot growth will be compared for treatment 6 (pruned plus 6-BA) versus treatment 4 (pruned only). Treatment effects on floral intensity, crop load and summer vegetative shoot growth will be determined for all data trees. Treatment effects on final yield and average fruit size, fruit size distribution (pack out) and the proportion of black versus green fruit will be determined at harvest. This experiment needs to run for a minimum of two years in order to evaluate cumulative yield over at least one complete AB ON/OFF cycle.

Anticipated Outcomes:

- We will gain insight into the capacity of NAA and ACC applied at full bloom to thin flowers uniformly each spring and maintain a uniform yield for successive years.
- We will have data on the impact of different degrees of fruit thinning on only half of the tree on total yield, which will enable us to estimate the impact that over-thinning due to a heat wave would have on final yield, i.e., we will have some indication of the risk associated with the application of chemical thinning agents to only half of the tree.
- We will learn whether the application of NAA or ACC supports better summer vegetative shoot growth and return bloom and return yield than June pruning (hedging).
- We will learn whether delaying pruning (hedging) to June to give growers the opportunity to evaluate their potential crop load to make a decision to prune or not to prune or how severely to prune is efficacious or has negative consequences.
- Specifically, we will learn whether pruning in June is effective or too late for stimulating summer vegetative shoot growth to increase return bloom and yield.
- Through these comparisons, potential benefits can be verified, e.g., fruit removal in June before pit hardening increases floral bud retention and flowering, or potential problems can be identified, e.g., June pruning causes loss of carbohydrates resulting in poor shoot growth, small fruit size or too much shoot growth, leading to competition and small fruit size (potential problems not encountered thus far with June pruning).
- Documentation of whether or not foliar application of 6-BA to pruned trees during the summer stimulates vegetative shoot growth and increases return bloom and return yield better than pruning alone, i.e., a cost-benefit analysis of using 6-BA with pruning.
- Data to support or refute (1) that reducing crop load on one side of the tree starting in the ON-crop year using PGRs thinning agents or pruning (hedging) increases yield in the following OFF-crop year sufficiently to even out AB and provide growers with a good annual income the following year and (2) that reducing crop load on alternate sides of the tree each year will sustain good yields and grower income annually.
- The data will document whether removing fruit on one-side of the tree increases return bloom and yield the other side of the tree, the untreated side, the following year as well, due to the reduction in crop load on the treated side of the tree.

- The harvest data will quantify the effect that removing fruit on one side of the tree has on average fruit size, fruit size distribution (pack out), proportion of black versus green fruit, and crop value.
- We anticipate a positive outcome indicating that strategy proposed above can successfully mitigate alternate bearing each time it is initiated by an adverse climate event, or other event, that results in an OFF-crop followed by an ON-crop.

<u>Select References</u>:

Agricultural Commission/Sealer. 2016. Tulare County Annual Crop and Livestock Reports for 2009, 2010, 2011, 2012, 2013 and 2014. (agcomm.co.tulare.ca.us/default/index.cfm/standards-and-quarantine/crop-reports1/).

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

Fichtner, EJ and CJ Lovatt. 2016. Alternate bearing in olive. Acta Hort. (in press)

Fichtner, EJ, Y-Y Chao, L Ferguson, JS Verreynne, L Tang and CJ Lovatt. 2017. Repeating cycles of ON and OFF yields in alternate bearing olive, pistachio and citrus trees — *Different mechanisms, common solutions*. Acta Hort. (in press)

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

Table 1. Olive production in Tulare County, California, 2008-2014.[z]

Year	Yield (kg/ha)	Value (US$/ha)	ABI[y] (0-1.0)
2008	4,057	685	
2009	897	186	0.6
2010	16,208	2400	0.9
2011	4,080	758	0.6
2012	7,958	1494	0.3
2013	10,491	1894	0.1
2014	341	664	0.9

[z]Adapted from Agricultural Commission/Sealer (2016).
[y]ABI = alternate bearing index = the absolute value of year 1 yield minus year 2 yield divided by the sum of year 1 yield + year 2 yield. An ABI of 0, means no alternate bearing; an ABI of 1, means complete alternate bearing, crop one year and no crop the other year.

Table 2. Effects of 6-benzyladenine (BA), adenosine (Ado) and ADO plus tri-iodobenzoic acid (TIBA) injected into scaffolding branches of ON-crop trees in July on summer vegetative shoot growth or in February on the number of inflorescences at spring bloom for non-bearing and bearing shoots of ON-crop 'Manzanillo' olive trees.

Tree status	Shoot status	Year 1: Summer shoot growth (no. of node pairs/shoot)	Year 2: Inflorescences (no./shoot)
OFF	non-bearing	3.3 a[z]	15.4 b
ON	non-bearing	0.7 cd	13.3 b
+ 6-BA	non-bearing	2.6 ab	22.0 a
+ Ado	non-bearing	3.5 a	22.2 a
+ Ado + TIBA	non-bearing	3.6 a	15.8 b
ON	bearing	0.6 d	0.8 d
+ 6-BA	bearing	1.9 bc	4.1 c
+ Ado	bearing	2.6 ab	5.1 c
+ Ado + TIBA	bearing	2.4 ab	4.9 c
P-value		< 0.0001	< 0.0001

[z]Means in a vertical column followed by different letters are significantly different at specified *P*-values by Fisher's LSD Test.

BUDGET REQUEST: (Carol J. Lovatt)

Budget Year: 2018 Funding Source: COC

Labor: **(Line 1) $4309**

Salary: T Khuong @ $4,879/mo x 30% = $1,464; Lab Asst. 1 @ $16.47/hr x 70 hr = $1,152 $A $2,616

Benefits: TK= $1,464 x 1.1351% = $ 1,662; Lab Asst. 1 = $1,152 x 2.65% = $31 $B $1,693

Subtotal 1 **Line 1 subtotal: $4,309**

Supplies, Equipment: **(Line 2) $6446**

Supplies: *(be specific. Examples include tape, tags, buckets, traps, safety, chemicals, etc)* $C $0

Equipment: *(be specific. Examples include balances, meters, devices, etc)* $D $0

Individual contractors: Recharge to Lindcove REC – use of olive orchard, irrigation, weeding, pruning, pest control, application of PGRs = $4,068 (based on 50% @ the old recharge rate of $16.26/h and 50% @ the new recharge rate effective July 1, 2018, of $30/h. Harvest @ $2,500 (estimated to be less than last year due reduced crop load per tree due to fruit thinning and pruning on a majority of the trees) $E $6,446

Subtotal 2 **Line 2 subtotal $10,755**

Travel: **(Line 3) $2,487**

Vehicle Use: 5 roundtrips to Exeter (520 mi x 5 = 2,600 mi x $0.6014/mi = $1,564; UCR vehicle Rental 10 days x $47.268/day = $473; $90/day per diem (Lindcove REC trailer, plus meals) for 1 person x 5 trips (1.5 days each) = $450 $F $2,487

Meeting attendance: *(be specific. anticipated travel to meetings such as COC meetings, professional society meetings)* $G $0

Subtotal 3 **Line 3 subtotal $13,242**

Subcontracts: Elizabeth Fichtner **(Line 4) $6,000**

Collaborator A: Elizabeth Fichtner $H $6,000

Subtotal 4 **Line 4 subtotal $19,242**

UC R Total **(Line 5) $13,242**

UCR Overhead on $13,242 @ 11% IDC **(Line 6) $1456.62**

(Total to primary PI – Carol Lovatt) **(Line 7) $14,698.62**

TOTAL BUDGET REQUEST **Line 4+Line 7 $20,698.62**

PRIMARY PI SIGNATURE PAGE: UNIVERSITY OF CALIFORNIA

Carey Lovatt	10/27/2017
Originator's Signature	Date
Patricia Springs	10/27/2017
Department Chair/County Director	Date
Liaison Officer	Date

SUBCONTRACT BUDGET REQUEST: (*Elizabeth Fichtner*)

Budget Year: 2018

Funding Source: COC

Labor:	**(Line 1)**	**$4855.61**
Salary *(Junior Specialist, Narges Mahvelati, at 7% FTE)*		$3495.76
Benefits *(38.9%)*		$1359.85
Sub 1		**$4855.61**
Supplies, Equipment:	**(Line 2)**	**$200.00**
Supplies: *(be specific. general field supplies (flagging tape, pruners, buckets, gloves. etc)*		$200
Sub 2		**$5055.61**
Travel:	**(Line 3)**	**$349.80**
Vehicle Use: (*Mileage from Tulare, CA to/from Modesto for COC meetings; 280 miles round trip @ $0.535/mile. Request partial funds ($200) toward attendance of Pomology Conference in Davis in March 2018.This is approximately 1/3 of the cost of attending the meeting; other costs would be contributed by walnut and pistachio accounts to share costs across main commodities that I serve.*		*$349.80*
Sub 3	**(Line 4)**	**$5405.41**
UCD/ANR/UCR Overhead @ 11%	**(Line 5)**	**$594.59**
Sub 4 (Total Subcontract)	**(Line 6)**	**$6000.00**

(Add Line 6 to primary PI budget in subcontract section 'H' and 'I')

SUBCONTRACT SIGNATURE PAGE: UNIVERSITY OF CALIFORNIA

Originator's Signature	Date
Department Chair/County Director	Date
Liaison Officer	Date

CALIFORNIA OLIVE COMMITTEE

PROJECT PLAN/RESEARCH GRANT PROPOSAL

Workgroup/Department: Food Science and Technology

Project Year: 2018-2019 Anticipated Duration of Project: March 2018 – July 2019

Project Title: Evaluation of Several Promising Additives for Reducing Acrylamide in Black Ripe Table Olives

Project Leader:
Dr. Selina Wang
University of California, Davis
Olive Center
Food Science & Tech
Phone: 530-219-1267
E-mail: scwang@ucdavis.edu

Commodity: olives

Year Initiated: 2017 Anticipated Duration of Project: March 2018 – July 2019

Problem and its Significance:

Acrylamide has been identified as a probable carcinogen by the National Toxicology Program and the International Agency for Research on Cancer. High levels of acrylamide have been found in black ripe table olives by researchers (Table 1). In a survey conducted by the US Food and Drug Administration (FDA), high amounts of acrylamide were found in black ripe table olives in US market (375-1925 μg/kg). Casado and Montaño screened 11 black ripe table olives obtained in Spain and found the levels of the acrylamide ranged from 176 to 1,578 μg/kg of olive pulp. Similarly, in our lab, we also found 288-1,192 μg/kg acrylamide in seven Spanish black ripe table olives samples.

Research Group	Acrylamide level (μg/kg)
US Food and Drug Administration	375-1,925
Casado and Montaño	176-1,578
UC Davis Olive Center Laboratory	288– 1,192

Table 1. Acrylamide levels found in recent research in black ripe table olives.

Seeking a quick and cost-effective solution to reducing acrylamide in black-ripe processing, the UC Davis Olive Center and California table olive processors in 2014 evaluated sodium bisulfate ($NaHSO_3$) -- Casado had found that addition of 25 mM $NaHSO_3$ reduced acrylamide by 37% without any impact on sensory qualities. Unfortunately, the Casado method proved ineffective when deployed at an industrial scale – in fact, we found that the amount of $NaHSO_3$ (0, 10, and 25 mM) actually increased the amount of acrylamide in black ripe table olives at 15 and 30 min sterilization times at 240°F. Moreover, since sulfites are allergens, the addition of $NaHSO_3$ may limit commercial applications for canned olives. We looked into other options.

In 2015, UC Davis Olive Center and California table olive processors evaluated how different sterilization conditions can affect the acrylamide levels in canned black ripe table olives. We concluded that lowering the sterilization temperature and shortening the sterilization time could reduce the formation of acrylamide, while continuing to achieve appropriate process bacterial lethality. However, this may not be desirable as it has the potential of slows down production significantly.

In 2017, we designed a model system to test out various additives (amino acids: L-cysteine and glycine; flavone/phenols: luteolin, naringenin, apple skin polyphenolics, grape seed and grape skin extracts) and their ability to reduce acrylamide levels at different ranges of pH (5-9) and temperature (110-130°C). We found that two amino acids showed promising results and are likely to work in an industrial scale.

We propose the use of natural additives to reduce or completely remove acrylamide in black ripe table olives. We will work with the processors to obtain controlled (no additives) and experimental samples (with various additives at different concentrations). The pH and acrylamide concentrations of these samples will be analyzed at UC Davis.

Objectives:

The objective of this proposal is to determine compounds such as amino acids and phenols can be added during processing to reduce substantially the acrylamide levels in canned black ripe table olives.

Experimental Procedures:

We will work with the processors and provide them with the additives at different concentrations so that they can be added to the brine before sterilization or other steps during processing. A control from the standard procedure without any additives will be used to establish a comparison. It has been suggested in literature that acrylamide in ripe table olives can decrease after 6 months of storage time in the presence of acrylamide-reducing additives. Therefore, we will be measuring acrylamide concentration 1, 3, 6 months and 12 months after canning.

The pH and acrylamide concentration in olives and in brine will be determined at UC Davis. Black ripe table olives (20 g) will be shaken off the brine and crushed in the mortar with a pestle. Then 2 g of sample will be placed in a centrifuge tube and spiked with 0.5 μg d_3-acrylamide as internal standard. Water (4 mL) will then be added to the centrifuge tube. After 10 min of shaking, hexane (1 mL) will then be added, followed by another shaking for 10 min. The samples will be then centrifuged at 8,000 rpm for 10 min to separate the aqueous and hexane layers. The separated aqueous layer (lower layer) will be vacuum filtered using a 125 mL Buchner funnel. Then nitrogen will be blown on top of the filtrate to completely evaporate the hexane.

A Sep-Pak C_{18} cartridge will be activated by methanol (2 mL) followed by water (2 mL). All of the filtrate (about 4 mL) will then be loaded on the cartridge and passed through the cartridge without vacuum (about 1.5 mL/min). The filtrate will be collected and evaporated to less than 1 mL and water to which water will be added to make up to exactly 1 mL. Acrylamide determination will be performed by LC-MS/MS.

The quantification of acrylamide and d_3-acrylamide will be performed on a Sciex API 2000 triple-quadruple MS system. The samples will be separated using a Hypersil-Keystone Hypercarb column (50×2.1 mm i.d., particle size 5μ). The mobile phase will be isocratic methanol/water (80:20, v/v) at 200 μL/min for a total run time of 5 min. The column will be operated at room temperature. The retention time of acrylamide and d_3-acrylamide is 1.56 min.

The mass spectrum data will be acquired with positive ion atmospheric pressure ionization (APCI) utilizing the multiple-reaction monitoring (MRM) mode. Transitions for acrylamide and d3-acrylamide were monitored at 72/55 and 75/58, respectively.

Anticipated Outcome:

All the samples processed will be tested for acrylamide levels. The results determine if the addition of amino acids, flavonoids and other polyphenolics affect the formation of acrylamide. With the knowledge obtained from this project, we will be able to make the recommendation on how to best modify the current commercial processing procedures to reduce the level of acrylamide in canned black ripe olives.

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BUDGET REQUEST (Selina Wang)

Budget year: 2018-2019

Personnel (salaries and benefits): $27,500

- Graduate student GSR- 50%@$55,000

Supplies (instrumental and chemical supplies): $20,000

Travel: $500

- Sample collections and meetings with the processors

Subtotal: $48,000

University overhead 11%: $5,280

TOTAL BUDGET REQUEST: $53,280

CALIFORNIA OLIVE COMMITTEE

PROJECT PLAN/RESEARCH GRANT PROPOSAL

Workgroup/Department: Food Science and Technology

Project Year: 2018-2019 Anticipated Duration of Project: March 2018 – July 2019

Project Title: Differentiation of olive cultivars using DNA and NMR-based fingerprinting methods

Project Leader:

Dr. Selina Wang

University of California, Davis
Olive Center
Food Science & Tech
Phone: 530-219-1267
E-mail: scwang@ucdavis.edu

Cooperator:
Dr. Emmanuel Hatzakis (Ohio State University)

Commodity: olives

Year Initiated: 2018 Anticipated Duration of Project: March 2018 – July 2019

Problem and Its Significance:

According to the Food and Agriculture Organization (FAO) germplasm database, over 1000 cultivars of olives exist worldwide. Cultivar significantly influences the physical appearance and oil content of the fruit, as well as chemical parameters like phenolic content, fatty acid profile and volatile profile.[1,2,3] As there are price, quality and sensory differences between olives of different cultivars, it is important for California producers to be able to determine which cultivar they are receiving from importers. Morphological characterization and sensory evaluation are the simplest methods for differentiation.[3,4] However, these techniques are unreliable for California-style olives, as processing can change the shape, texture, color and sensory characteristics of the fruit. An accurate and sensitive method to determine the cultivar of processed olives would greatly benefit the California table olive industry.

Genetic markers can be used to differentiate between cultivars of olives. Previous studies have successfully used techniques that characterize variations in DNA among cultivars for cultivar identification and fingerprinting. One popular technique involves the use of single nucleotide polymorphisms (SNPs), or variations in individual nucleotides that occur at specific positions in a DNA sequence. SNPs are abundant in the genome, stably inherited, and conducive to analysis with next generation high-throughput sequencing methods.[5,6] Capitalizing on previous research that has defined cultivar-specific SNPs, we will develop a SNP array designed to detect genetic differences between olives. We will develop an extraction method to salvage DNA from canned, processed olives and use our SNP array for cultivar identification. The challenge we will need to overcome to use this method is ensuring that enough SNPs are included in our array to identify cultivar in the face of DNA degradation, which is likely to occur during California-style olive processing. This project has both scientific novelty and practical implications; it will establish genomic database of processed ripe table olives for the first time as well as provide a useful tool for the California food industry to identify the cultivar of imported products.

Nuclear magnetic resonance (NMR)-based metabolomic analysis has also emerged as a very promising technique for differentiating food products by cultivar and/or geographical origin. Previous studies have used NMR (^{1}H, ^{13}C, ^{31}P)to classify olive oils based on geographical origin.[7–9] A metabolomics fingerprinting approach is used, meaning that resonances are not necessarily assigned to specific compounds. Instead, the full spectra are analyzed using multivariate statistical analysis and samples are clustered based on geographical origin. A sufficient number of samples with known origins are analyzed in order to build a model, which can then be used to predict the geographical origin of an unknown sample. This same approach can be modified to differentiate between cultivars of processed table olives. The composition of olive fruit is more complex than olive oil, meaning that a higher amount of interferences may be present in the spectra. We will test different extraction methods and NMR analyses to determine which method generates the most informative NMR spectra with the greatest sensitivity and resolution. After optimizing extraction and instrument conditions, canned olives of known cultivars will be analyzed and a model for identifying the cultivar of unknown table olives will be developed and validated.

Fatty acid profile (FAP) analysis is a third common method for classifying olives and olive oils based on cultivar. [10,11] The premise is that each cultivar has a distinct ratio of individual fatty acids. Previous studies have successfully used FAP to discriminate between cultivars of California-style olives.[12,13] However, only three common cultivars— Manzanilla, Hojiblanca and Gordal— were analyzed. Results from our previous COC project suggest that FAP can potentially be used to differentiate Mission, Sevillano and Barouni cultivars as well. We will analyze the fatty acid profile of all cultivars relevant to the California industry and, similar to NMR analyses, FAP data will be clustered using multivariate statistics to build a model for identifying unknown samples.

Our *hypothesis* is that olive fruits from different cultivars have distinct metabolic profiles, detectable via NMR spectroscopy, DNA fingerprinting and fatty acid profiles. Integration of

DNA, NMR and FAP analysis will create more robust tools for olive fruit authentication compared to models that rely on individual methods.

Objectives:

To develop DNA and NMR-based fingerprinting methods and fatty acid profiles for differentiating cultivars of processed olives. Color-coded loading plots will be generated from supervised multivariate statistical analysis methods to indicate the significance of specific metabolites in different cultivars and regions.

Experimental Procedures:

Samples: Canned olives of known cultivars (*e.g.* Manzanilla, Hojiblanca, Sevillano, Gordal, Barouni, Mission) will be provided by processors. We will obtain fresh plant material for these cultivars from the USDA National Clonal Germplasm Repository at UC Davis.

Lab supplies: Zymo ZR Plant/Seed DNA MicroPrep kit, ethanol, gloves, pipette tips, PCR supplies for SNP isolation and DNA amplification, Fluidigm EP1 System Genotyping, 5 mm sample tubes, standards, deuterated solvents and instrumental time.

DNA: We will conduct a literature search to identify 192 candidate biallelic SNPs that are variable between cultivars. We will validate these SNPs using DNA extracted from fresh olive fruits. We will design DNA primer sequences that will target these SNPs. Genotyping of DNA will be performed at the UC Davis DNA Technologies Core using the Fluidigm EP1 system. After validation, we will test the performance of these SNPs on identifying cultivar of origin from DNA extracted from canned fruits. If an insufficient quantity of DNA is extracted from canned fruits, we will use a PCR amplification step to amplify the region containing the SNP prior to genotyping. We will aim to produce a 48-SNP panel that can be used as a tool to reliably identify cultivar for industry.

NMR: Method development will be performed by our collaborator Dr. Emmanuel Hatzakis at the Ohio State University (OSU). Polar and nonpolar fractions will be isolated from olive fruit and analyzed using different NMR liquid spectroscopy methods including ^{1}H NMR and ^{13}C NMR analysis. The NMR experiments will be performed in the NMR facility at the OSU using a 700 MHz instrument equipped with a 5mm TXO cryoprobe. Data pre-processing will be performed using AMIX software and principle component analysis (PCA) and partial least squares discriminant analysis (PLS-DA) will be applied to the data using SIMCA-P software. Conditions that provide the most sensitive differentiation will be optimized. We will use the developed method to analyze 30 samples of canned olives from each cultivar and a model will be constructed by PLS-DA. Finally, we will analyze 30 samples of various known cultivars in order to test the prediction ability of the model.

FAP: FAP will be determined following the IOC official method (COI/T.20/Doc. no. 24-2001). Oil will be extracted from fruit using hexane. Methanol/HCl will be used to convert fatty acids into fatty acid methyl esters (FAMEs), which can be analyzed by gas chromatography-flame ionization detection (GC-FID). We will analyze the FAP of 30 samples from each cultivar and, using PLS-DA, construct a model for identifying unknown samples. As with NMR analyses, we will analyze samples of various known cultivars to test the effectiveness of the model.

Anticipated Outcomes:

All the samples will be analyzed by DNA, NMR and fatty acid profiles; the data will be compared to the known cultivars. A genomic and metabolic database of processed ripe table olives will be established for the first time and to be used as a tool for the California industry to identify the cultivar of imported products.

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BUDGET REQUEST (Selina Wang)

Budget year: 2018-2019

Personnel (salaries and benefits): $41,250

- Graduate student GSR- 50%@$55,000
- Graduate student GSR- 25%@$55,000

Supplies (instrumental and chemical supplies): $19,000

Travel: $500

- Sample collections and meetings with the processors

Subtotal: $60,750

University overhead 11%: $6,683

TOTAL BUDGET REQUEST: $67,433

PROJECT PLAN/RESEARCH GRANT PROPOSAL

Project year: 2018 Anticipated Duration of the project: April –November 2018

Project Leader: Jim Stewart Location: Tulare County
Mailing Address: PO Box 1095, Exeter CA 93221
Phone: (559) 730-6243 FAX: (559) 592-4105 E-mail: jsagipmc@verizon.net

Project Title: Southern San Joaquin Valley Olive Fruit Fly Monitoring Project

Cooperating personnel: Bert Quezada, Doug Bigham, Laura Doskocil

Keywords: Olive Fruit Fly, Monitoring, Traps,
Commodity: Olive

PROBLEM AND ITS SIGNIFICANCE:

The monitoring of Olive Fruit Fly (OLFF) in commercial olive groves in the Southern San Joaquin Valley started in 2001. OLFF is potentially the most significant insect pest in commercial Olive.

OBJECTIVES:

The objective of this project would be to continue the monitoring program of adult OLFF in commercial olive groves in the Southern San Joaquin Valley. Detection and seasonal monitoring of OLFF and the accurate timing of control measures, primarily bait sprays, would be the goal of this project. Correlation of fly collections with fruit susceptibility to infestation would indicate to growers when initial bait treatments should be applied. In addition, monitoring would continue to give growers information on the general OLFF population. This information would specific for only the groves being monitored and would be available to growers to aid in making OLFF management decisions in their respective groves in the area being trapped.

PLANS AND PROCEEDURES:

Seven of the nine sites used in the years 2013 to 2017 in commercial olive groves will be set up with traps in April of 2017. One of sites in Strathmore was moved to a nearby grove in 2016 and the South Exeter location will be relocated to a site across the street in 2018. The locations will be Ivanhoe, Woodlake, Exeter, South Exeter, Tonyville, West Lindsay, Strathmore, Porterville and Terra Bella. In addition, a site in the city of Visalia would also be monitored. All of these sites are in Tulare County where a high percentage of the commercial olives are located in the Southern San Joaquin Valley. Many of the sites have been monitored starting in 2001. All traps will be in place by the first week of April and the program will end the last week of October. Two yellow panel traps with ammonium carbonate bait and male pheromone will be used per site. Traps will be serviced and OLFF counted weekly. Reports detailing the number of OLFF found at each location will be submitted to the California Olive Committee and interested parties within 24 hours on a weekly basis during the project.

BUDGET REQUEST

Budget year: April 1, 2018-December 1, 2018

Funding Source: California Olive Committee
Crop Protection Service, Inc.
Ag IPM Consultants, Inc.

Salaries and benefits:		$15,600.00
Supplies:		
Traps, bait and pheromone		1,200.00
Travel:		
Mileage to trap sites		2,400.00
Equipment:		0.00
	TOTAL	$19,200.00

Funding would be split equally between the above listed funding sources.

Total funding from the California Olive Committee would be: $6,400.00

James R. Stewart
Project leader
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Ern's Pest Control

Project Plan/ Research Grant Proposal

Project Year: 2018

Project Leader: Ernie Simpson
Mailing Address: 320 County Road 15 Orland, California 95963
Phone: 530-865-9829 Cell: 530-518-4685
E-mail: ernsimp17@sbcglobal.net

Cooperator: Dani Lightle, Orchards Advisor, UC Cooperative Extension, Orland

Commodity: Olive

Problem and its Significance:

Since the detection of Olive Fruit Fly in California in 1998, it has been a concern to olive growers in commercial orchards; preventative sprays are necessary. Trapping to monitor the Olive Fruit Fly populations in individual orchards is recommended. This will allow growers and PCA's to follow trends to their orchards and help evaluate spray program efficacy. Having an idea of area-wide population trends will help growers and PCA's interpret the results from their orchards.

Objectives:

1: Provide timely information to area growers regarding area-wide olive fruit fly population trends.
2: Continue to develop a historical perspective of olive fruit fly populations for the area.

Plans and Procedures:

Starting in early April plastic McPhail traps using Torula yeast tablets dissolved in water as the bait will be placed in one tree at 12 sites (6 in Glenn County and 6 in Tehama County). The same sites that have been used in previous years will be monitored again to allow for comparison of current years trap catches to previous years. Earlier work in Glenn and Butte Counties has shown that the plastic McPhail traps catch more flies than the commonly used yellow panel trap. Traps will be checked and flies counted weekly. The results and field observations will be posted on the Sacramento Valley Orchards website (www.sacvalleyorchards.com) and reported via email to the COC for further distribution. Trapping results will be reported as male and female flies for individual traps and combined by site. Trapping and reporting will be continued through December or until trap catches decline for the year.

Budget Request

Budget Year: 2018

Funding Source: California Olive Committee
Salaries____$4735
Supplies and Expenses: Trapping Supplies________________________$ 365
Travel 2545 mi. ____$1800
This may vary due to fuel prices

Total____$6500

Originator's Signature______________________________________

Ernie Simpson

AES/CE MAR 84

Workgroup: Olive
Department: Plant Pathology/UCR

University of California
Division of Agricultural Sciences
PROJECT PLAN/RESEARCH GRANT PROPOSAL

Project Year: 2018 Anticipated Duration of Project: 2nd of 3 years

Principal Investigators: J. E. Adaskaveg

Cooperating: D. Thompson, H. Förster, and K. Nguyen

Project Title: Epidemiology and management of olive knot caused by *Pseudomonas savastanoi* pv. *savastanoi*

Keywords: Bactericides, copper enhancing compounds, antimicrobial natural products, biological controls

JUSTIFICATION/ BACKGROUND

Olive knot caused by the bacterium *Pseudomonas savastanoi* pv. *savastanoi* (*Psv*) is a serious disease of olives (*Olea europaea*) worldwide (8). The pathogen enters through wounds causing outgrowths (knots, tumors, galls) on branches and infrequently on leaves and fruit. Olive knot is one of the most economically important diseases of olives as infection may lead to tree defoliation, dieback, and reduced tree vigor, which ultimately lowers fruit yield and quality (6). *Psv* can survive epiphytically on olives but the main sources of inoculum are bacteria living within knots (7). Large quantities of bacterial ooze can be exuded upon wetting knots. This exudate is disseminated by rain, wind, insects, birds, as well as human activity. The opportunistic pathogen takes advantage of wounds caused by natural leaf abscission (4), frost, and hail, as well as cultural practices such as pruning and harvesting. These latter practices also lead to direct mechanical damage of the knots, exposing and spreading inoculum to healthy tissue. After entering its woody host, the pathogen actively induces knot formation through the production of indoleacetic acid (IAA) and cytokinins (2). In California, infections occur mostly during the rainy season (late fall, winter, and spring) but knots do not develop until new growth starts in the spring. Infections can occur at low temperatures (-5° C) and thus, wetness is the main limiting factor for the disease. None of the currently grown olive cultivars is resistant to the pathogen (5).

Control of olive knot is difficult, and growers rely on applications of copper-based bactericides as the only effective foliar treatment. Manual application of cresol- and xylenol-based compounds (Gallex) to knots can eliminate the knot pathogen but is unfeasible on a commercial scale. Copper has been extensively used in olive production for many years for the control of diseases such as peacock spot and olive knot. Reliance on a single active ingredient has led to our detection of copper resistance in *Psv* strains from a commercial olive orchard. The incidence of copper resistance is currently very low, accounting for only 2% of the total strains collected in different olive growing regions of California. When resistant strains were inoculated to Arbequina and Manzanillo olive wounds, application of copper provided reduced or no control as compared to inoculation with a sensitive strain. Copper-resistant strains caused less disease on leaf scars as compared to Cu-sensitive strains, but still resulted in a high incidence of disease over a range of inoculum concentrations. Therefore, there is a potential risk of copper resistance spreading with continued and sole use of copper. This necessitates the development of new bactericides or copper-activity-enhancing materials to overcome resistance. The latter strategy has proven to be effective for walnut blight management where copper resistance in *Xanthomonas arboricola* pv. *juglandis* is common and copper-mancozeb mixtures have provided exceptional control. Mancozeb can no longer be registered on new crops but other copper-enhancing alternatives can be evaluated. Salicylidene benzoylhydrazone (SBH) was recently discovered to display synergism when combined with copper against *Alternaria solani* causing early blight of tomatoes. We performed preliminary tests with a derivative of this molecule with promising results with several genera of phytopathogenic bacteria including *Psv*. Low concentrations of metallic copper combined with SBH were highly inhibitory in vitro against a copper-resistant *Psv* strain while copper or SBH by themselves at the same concentrations were not effective. Field trials in 2017 on managing olive knot, SBH-copper, however, did not improve performance of copper. Other derivatives of SBH will be supplied by Dow AgroSciences, and these will be tested in 2018.

Other potential bactericides have also been made available to us by agrochemical registrants in 2017. These include a nanoparticle zinc product called Zinkicide and experimental inhibitors of type III secretion systems in plant pathogenic bacteria. The latter compounds are novel in their mode of action. They act on the mechanism that delivers bacterial proteins into the host cells that are necessary for *Pseudomonas* species to cause disease. Currently, we are testing Zinkicide and three experimental type III secretion system inhibitors.

We have been instrumental in the development of the new agricultural antibiotic kasugamycin (commercial name Kasumin) for several bacterial diseases of agronomic crops in the United States. Kasugamycin has high activity against *Erwinia* (1) and *Pseudomonas* species and moderate activity against *Xanthomonas* species and other plant pathogenic bacteria. We found it to be the most promising new treatment for preventing olive knot in our extensive field studies, including in a commercial application to inoculated branches. Kasugamycin is currently federally registered on pome fruit crops, whereas use on olives was approved as an "A" priority by inter-regional project 4 (IR-4) for the 2015 season. Kasumin is still in the IR-4 program with the final report and submission to the EPA pending in 2018 with a possible 2019 registration. Kasugamycin would greatly complement current copper sprays and could be used in rotation or mixtures with copper. Oxytetracycline was also submitted to IR-4 and is in the field trial phase of the IR-4 program for establishing tolerances. We will conduct additional studies with oxytetracycline to potentially improve its efficacy by using registrant-recommended adjuvants. New antibiotic registrations, however, find little acceptance with regulatory agencies, and we are currently in discussion with EPA to develop a science-based approach on the use of antibiotics in plant agriculture.

In addition to developing conventional chemical compounds, research on alternative materials such as biopesticides and food additives may provide new modes of action for managing olive knot. Biopesticides such as Serenade contain the gram-positive bacterium *Bacillus subtilis* (strain QST 713) that produces various compounds that are antagonistic against a broad range of fungal and bacterial organisms. In our efficacy trials, Serenade and Serenade-copper mixtures, however, were not effective at recommended rates.

Several food additives that are considered 'generally recognized as safe' (GRAS) have antimicrobial properties. They are often naturally produced molecules of gram-positive *Streptomyces* species. Although these compounds are typically applied to food products as preservatives, they may have potential for controlling plant diseases when applied as a foliar treatment. Integration of these alternative materials with conventional treatments may improve disease control, reduce the risk of resistance development, and provide olive growers with more resources for managing olive knot. In 2017, we evaluated nisin, epsilon-poly-L-lysine, and lactic acid and all showed similar efficacy to copper in reducing olive knot on leaf scars, but not on lateral wounds. This information is still valuable because rotational programs could be developed with different modes of actions for different phases of the disease, i.e., leaf scars or lateral wounds occurring during leaf drop or harvest and pruning, respectively. These materials are registerable for conventional and possibly organic treatments.

RESEARCH OBJECTIVES

1) **Develop new bactericides and potential enhancers of copper activity against *Psv***
   a) In-vitro sensitivity of *Psv* to Zinkicide, Type III secretion system inhibitors, and copper mixtures with new SBH derivatives (using selected ratios).
   b) Efficacy of new bactericides in comparison with kasugamycin for the management of olive knot caused by copper-sensitive and -resistant strains of *Psv* in field studies.
      i) Zinkicide
      ii) Potential enhancers of copper activity - new SBH derivatives.
      iii) Type III secretion system inhibitors
      iv) Oxytetracycline formulations in combination with adjuvants recommended by the registrant.
2) **Evaluate several food additives and a sanitizer for the control of olive knot**
   a) Determine the efficacy of the GRAS food additives nisin, epsilon-poly-L-lysine, and the GRAS sanitizers lactic and citric acid in field studies for the management of olive knot.
3) **Continue to support the registration of the antibiotics kasugamycin and oxytetracycline -** UV blockers and stabilizers and EPA policy.

PLANS AND PROCEDURES

1) Develop new bactericides and potential enhancers of copper activity against *Psv*.

1a. To evaluate the in vitro toxicity of Zinkicide, the spiral gradient endpoint (SGE) method will be used where bacterial strains are exposed to a bactericide concentration gradient on a single agar plate. To evaluate new potential enhancers of copper activity against *Psv*, a dilution plate method will be combined with the SGE method. Agar media will be amended with fixed concentrations of copper. Subsequently, derivatives of SBH will be applied to the plates in radial concentration gradients using a spiral plater. Suspensions of *Psv* strains will be streaked radially onto the amended media. This will allow the determination of minimal inhibitory values for *Psv* at different ratios of copper and SBH derivatives. These data will then be used to calculate appropriate field rates.

1b,c. Zinkicide, copper-SBH mixtures, Type III secretion system inhibitors, and oxytetracycline will be tested in the field on Arbequina and Manzanillo olives at UC Davis. Plants will be wounded with lateral and leaf scar wounds. Lateral wounds on 1-2-year-old twigs will be made using a scalpel by removing the bark and exposing cambial tissue. Leaf scars will be made by pulling leaves off the same twigs. In addition, wounds from natural leaf drop will be used. Treatments will be sprayed onto wounds before inoculation with a suspension of copper-sensitive or -resistant *Psv* strains. SBH derivatives will be applied using rates based on the laboratory tests. Oxytetracycline will be used in combination with recommended adjuvants because it is especially vulnerable to UV-degradation. Treatments will be compared to Kasumin and copper by itself. The efficacy of treatments will be assessed as the percent incidence of knots forming on treated, inoculated wounds as compared to wounds that are treated with water and inoculated (i.e., controls).

2) Evaluate several food additives for the control of olive knot. Field tests will be conducted on Arbequina and Manzanillo olives to evaluate the efficacy of nisin, epsilon-poly-L-lysine, and lactic acid treatments against *Psv*. The same wounding, treatment application, inoculation, and evaluation procedures will be used as described above.

3) Continue to support the registration of the antibiotics kasugamycin and oxytetracycline. An inter-commodity and industry group will continue to work with the Minor Crop Farmer Alliance to recommend an EPA policy change towards the use of antibiotics in plant agriculture. Specifically, a new internal EPA Guidance Document (GD) for use of antibiotics in plant agriculture needs to be developed based on science. Historically, EPA GD 152 for registration of antibiotics in animal husbandry is used for all requests in agriculture. Additionally, we will continue to work with a USDA working group to address CODEX initiatives for establishing policies on all antibiotic use in agriculture including animal and plant uses.

Benefits to the industry

For management of olive knot, in addition to cultural methods, sanitation practices, and the labor-intensive Gallex, only copper materials and the natural product Regalia are currently available. We obtained improved performance of copper when applications were made within 24 h of wounding events (e.g., harvesting, pruning, hail storms, freezing) as compared to later applications, and with high labeled rates of copper. In our previous research we also showed that copper resistance is currently not widespread and is only found locally where copper has been used for many years. Because copper-resistant strains of Psv were found to be virulent and likely competitive, and because they were not genetically clonal, there is a risk of further spread of copper resistance. Therefore, alternatives are needed for a sustainable and effective management program. We initiated the registration of the new agricultural antibiotic kasugamycin that was registered in 2014 on pome fruit, and of oxytetracycline through the IR-4 program. Kasugamycin showed high activity against olive knot especially in mixtures with copper. Mancozeb as a mix partner with copper was considered by us and the industry, but EPA has denied any new registrations. In 2017, we evaluated new copper activity-enhancing compounds that, however, were not effective; therefore, new derivatives of SBH will be evaluated in 2018 in cooperation with a US registrant (Dow AgroSciences). Working with Brandt Corp., we will also test new bactericides such as Zinkicide, a nanoparticle zinc product. Other companies will provide Type III secretion system inhibitors and natural products (nisin, epsilon-poly-L-lysine, and the GRAS sanitizers lactic and citric acid) for evaluation against bacterial plant diseases. The registration of several materials for olive knot management will allow the implementation of anti-resistance strategies and will prevent over-use of any single mode of action bactericide. Still, integrated practices will be critical for the successful management of the disease. Any bactericide or biological treatment will be most effective when pathogen population levels are at a minimum and the host is less susceptible.

References

1. Adaskaveg, J.E., Förster, H., and Wade, M.L. 2011. Effectiveness of kasugamycin against *Erwinia amylovora* and its potential use for managing fire blight of pear. Plant Dis. 95:448-454.
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3. Edgecomb, D.W. and Manker, D. 2005. *Bacillus subtilis* strain QST 713, bacterial disease control in fruit, vegetable and ornamental production. Mitteilungen-Biologische Bundesanstalt für Land und Forstwirtschaft 408:167-169.
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6. Schroth, M.N., 1973. Quantitative assessment of the effect of the olive knot disease on olive yield and quality. Phytopathology 63:1064.
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Budget Request:

Funding Source: California Olive Commission and California Olive Oil Commission

Budget Request with UC indirect costs:

Budget Year: 2018 Funding Source*:	**OOC**	**COC**	**Total Budget**
Salaries and Benefits: Post-Docs/RAs	7,000	7,000	14,000
Lab/Field Ass't	1,000	1,000	2,000
Subtotal	8,000	8,000	16,000
Employees' Benefits**	4,500	4,500	9,000
Subtotal	12,500	12,500	25,000
Supplies and Expenses	0	0	0
University Land and Orchard charges	1,000	1,000	2,000
Operating Expenses/Equipment Travel	0	0	0
Travel	1,500	1,500	3,000
Direct Cost Totals Total	**$15,000**	**$15,000**	**$30,000**
Off Campus IDC @ 11%		1,650	1,650
Total Budget Requested	**$15,000**	**$16,650**	**$31,650**

Date: Oct. 31, 2017

Originator's Signature (PI)

Dept. Chair Date: Oct. 31, 2017

(Riverside Campus)

Liaison Officer Date:

AES/CE MAR 84

Workgroup: Olive
Department: Plant Pathology/ UCR

University of California
Division of Agricultural Sciences
PROJECT PLAN/RESEARCH GRANT PROPOSAL

Project Year: 2018 Anticipated Duration of Project: 1st year of 3 years

Principal Investigators: J. E. Adaskaveg

Cooperating: H. Förster, D. Thompson (UC Riverside)

Project Title: Management of foliar diseases of olive – A. Olive knot (see previous submission and B. Evaluation of new fungicides for control of olive leaf spot (Supplemental Proposal)

Keywords: Chemical and biological control

JUSTIFICATION/ BACKGROUND

Olive leaf spot or peacock spot, caused by the fungus *Fusicladium oleagineum* (syn. *Spilocea oleaginea, Venturia oleaginea*), is a sporadic disease of olive trees in California. In years with favorable environmental conditions, an orchard may lose 9 to 15% of its leaves and 10 to 20% of the fruiting twigs if the disease is not managed. Excessive leaf loss can also result in more olive knot because leaf scars are sites for bacterial infection. Symptoms most commonly develop on the leaf blade but are also found on petioles, fruit, and fruit peduncles (stems). At first, lesions are inconspicuous, superficial, sooty blotches. Later they become dark green to black circular spots containing mycelium and conidia (Fig. 1), and spots are surrounded by yellow halos. These lesions resemble the spot on the tail of a peacock, and hence the name peacock spot. With numerous lesions, the leaf becomes chlorotic and falls.

Leaves in the lower canopy are more severely affected where the humidity is higher, resulting in greater defoliation. Defoliated twigs often die later in the summer. Leaf infections occur on the upper surface and seldom penetrate beyond the epidermal layer. Once the leaf drops, however, the fungus colonizes the internal leaf tissues forming a dense mass of stromatic tissue. The sexual state of the pathogen has not been observed. Olive cultivars vary in their susceptibility. Mission is the most susceptible followed by Manzanillo and to a lesser extent Sevillano, but all cultivars are generally susceptible.

Leaf drop occurs mostly in late spring and summer. Infected leaves remaining on the tree start sporulating along the margins of lesions in the fall. Rainfall and wind-driven rain are the main dissemination methods; whereas wind alone is not effective in detaching and disseminating conidia. In California, lesions start forming in the fall and winter, but most disease develops in the spring. Rainfall is essential for infections to occur regardless of the season. Temperature is important but often is not limiting the development of the pathogen. High temperatures are more limiting to spore germination and mycelial growth than low temperatures. The optimum temperature for growth of the fungus is 21°C, but growth can occur at 6 to 28°C. The minimum duration of leaf wetness for spore germination is 48 h at 16°C, 24 h at 20°C, or 36 h at 24°C. The incubation period is 12 to 19 days over a temperature range of 10°C to 25°C.

Management of the disease can be mostly solved by elimination of the Mission variety, but this cannot be done realistically. Currently available chemicals for managing the disease are copper and lime sulfur. Bordeaux mixtures or fixed coppers are commonly used to prevent copper injury. Lime sulfur can also eradicate the fungus in leaf tissue. Other fungicides such as zineb are effective but no longer available. Timing of fungicide treatments in California include a postharvest application and an early spring application. Others, however, have indicated that spring treatments are less effective. Use of copper treatments at these time periods corresponds with olive knot management timings. With more regulations concerning the use of copper (new copper limits for agricultural uses) and lime sulfur, alternative fungicides are needed that are highly efficacious and persist for extended time periods to prevent infections over the winter and spring when rainfall results in infection periods.

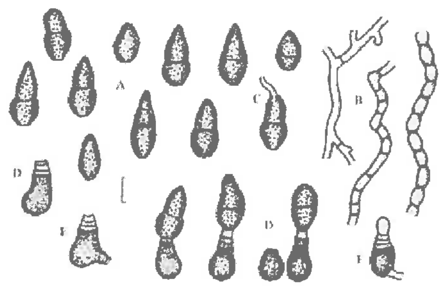

Fig. 1. *Fusicladium oleagineum.*
A - conidia. B - superficial septate hyphae, C - germinating conidium, D - conidiogenous cells with several conspicuous annellations, E - percurrently proliferating conidiogenous cell, F - conidiogenous cell arising from a hypha. Scale = 10 µm.

OBJECTIVES

1. Evaluate the performance of new and older fungicides in field trials.
   a) Dithicarbamates (ziram), chlorinated hydrocarbons (chlorothalonil), and phthalimides (captan) (FRAC Groups – M3, M4, M5), DMIs (FG 3), SDHIs (FG 7), QoIs (FG 11), dodine (FG U12), polyoxins (FG 19), or mixtures such as FG 3/11, FG 3/7, FG 7/11, and FG 3/19.
2. Evaluate application timing of selected treatments.
   a) Fall, spring, or fall and spring.
3. Evaluate new fungicides for their in vitro activity.
   a) Determine the in vitro activity of selected fungicides that are effective in field trials.

PLANS AND PROCEDURES

1. *Evaluate the performance of new and older fungicides in field trials.* In studies in a commercial olive orchard where the disease is known to occur and in an experimental orchard at UC Davis, fungicides including ziram (FG M3), captan (FG M4), chlorothalonil (FG M5), metconazole (FG 3), pydiflumetofen (FG 7), pyraclostrobin (FG 11), dodine (FG U12), polyoxin-D (FG 19), or mixtures such as FG 3/11, FG 3/7, FG 7/11, and FG 3/19 will be applied using an air-blast sprayer. There will be four replications for each treatment in a randomized complete block design. Disease incidence and severity will be evaluated in late spring. Data will be analyzed statistically using ANOVA procedures and mean separation procedures of SAS 9.4.

2. *Evaluate application timing of selected treatments.* In field studies, selected fungicides will be applied at different timings to compare fall vs. spring or fall + spring timings. There will be four replications for each treatment in a randomized complete block design for a factorial experiment. Disease incidence and severity will be evaluated in late spring. Data will be analyzed statistically using ANOVA procedures and mean separation procedures of SAS 9.4.

3. *Evaluate new fungicides for their in vitro activity.* Isolates of the pathogen will be obtained from several locations. To evaluate the in vitro toxicity of selected new fungicides with efficacy in field trials, the SGE method will be used. Agar media will be amended with fungicides in radial concentration gradients using a spiral plater. Suspensions of spores or mycelial strips will be placed radially onto the amended media. This will allow the determination of EC_{50} values for each fungicide and isolate using a computer program.

BENEFITS TO THE INDUSTRY

Little information is available on the management of peacock spot although the disease is widely distributed and causes sporadic losses in olive growing regions of California. Chemical management is currently based on the use of copper and lime sulfur, two materials that are increasingly being restricted by regulatory agencies at the state and federal levels. Thus, the evaluation of the efficacy and timing of new and older fungicides is needed to provide the industry with alternative treatments for peacock spot management. Due to the small acreage of olive production in California, registration of any new material will be limited to registrants that are willing to cooperate and to registration processes such as the IR-4 program that take several years to complete.

REFERENCES

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2. Ogawa, J. M., and English, H. 1991. Diseases of Temperate Zone Tree Fruit and Nut Crops. University of California, DANR, Publication No. 3345.

Budget Request: (Supplemental to the Olive Knot Proposal)

Budget Year: 2018

Funding Source: California Olive Commission

Salaries and Benefits:	Post-Docs/RAs		9,000
	Lab/Field Ass't		0
	Subtotal		9,000
	Employees' Benefits		5,000
		Subtotal	14,000
Supplies and Expenses			0
Equipment and University Land and Orchard charges			0
Operating Expenses/Equipment Travel (Davis Campus only)			0
Travel (include $500 for each Farm Advisor travel costs)			1,000
Department Account No. ________		**Total**	**15,000**

James E. Adaskaveg ______________________ Date: Dec. 5, 2018

Originator's Signature (PI)

Dept. Chair, Kathy Borkovich Katherine Borkovich ______________________ Date: Dec. 5, 2018
(Riverside Campus)

Liaison Officer ______________________ Date: ________

Project Year: 2018 *Anticipated Duration of Project: 2-3 years*
Principle Investigator: Debra Keenan, Research 2000
Project Title: Evaluation of new chemistries to control Olive Fruit Fly

Justification Background

The Olive Fruit Fly, *Bactrocera oleae*, has become a serious pest in olives. It was first seen in 1998 in Los Angeles. It quickly spread to the olive growing regions and has become a pest. The olive fruit fly causes a huge economic threat to the olive growers in the state. The larvae feed on the inside of the fruit. The larvae destroy the pulp and allow entry of secondary pests. The fruit rots and can cause the quality of the oil to degrade and cause the fruit to drop. Feeding damage can cause premature fruit drop and reduce fruit quality for both table olive and olive oil production. Large numbers of rotting fruit on the ground can create an unwelcome mess, especially in landscaped situations.

GF-120 NF Naturalyte Fruit Fly Bait, an organically acceptable product containing the biologically produced insecticide spinosad, recently has received registration for use on olives in California. GF-120 attracts olive fruit fly adults, which feed on the bait, and causes adult mortality. GF-120 is concentrated and needs to be diluted with water at 1:1.5 to 1:4 (GF-120 NF: water) before application. Follow label instructions for methods of dilution. GF-120 applications should commence when olive fruit fly adults are captured on the monitoring traps or at least 2 to 3 weeks before pit hardening. Repeat applications every 7 days until harvest when flies are captured on monitoring traps. GF-120 should be applied at a 2.5 to 7.5 ounce dilute spray per tree using a 1:1.5 dilution or at a 5 to 15 ounce dilute spray per tree using a 1:4 dilution with very large droplet size. Droplets should be 5 millimeters or more in size and uniformly dispersed around the tree. Other materials will be applied according to the label.

Data to Collect: Scout for adult flies that emerge from March to May and attack olives remaining on trees from the previous season. During early summer (June) as temperatures and day length increase and few mature fruit remain on trees, female flies do not lay eggs. Although few olives are present from the previous crop to host the egg laying, the adults remain active, and they may disperse to new locations such as citrus orchards or vineyards. By late June to the beginning of July as the new olive crop develops, females begin to lay eggs and are attracted to the fruit. Although eggs may be laid in small fruit, the larvae do not successfully develop until the ripening fruit grows to sufficient size. Eggs are laid just under the fruit's skin, often creating a dimple or brown spot. Will observe for the dimple or brown spot. The use of baited traps will be used to determine presence of the pest.

Research Objectives

1. Trap for the presence of the fruit fly. The most efficient trap for monitoring the olive fruit fly is the glass or plastic McPhail-type trap baited with torula yeast lures. Yellow sticky traps baited with sex-pheromone lures (attractive to male flies) and/or ammonium carbonate, ammonium bicarbonate food bait (attractive to both sexes) also are commonly used to monitor olive fruit fly populations, but these generally are less efficient than McPhail traps.
2. Apply materials to the olives for control of the olive fruit fly. Find new chemistries to control the pest. This will aid in resistance management.

Research 2000

Olive fruit fly control. Efficacy program to combat resistance.		
Protocol ID: Olive FF OC	Location:	Trial Year: 2018
Trial ID: OFF-OC	By: Debra Keenan	
Project ID:	Study Director: California Olive Committee	
	Sponsor Contact: Research 2000	

Trt	Treatment	Rate	Appl	Volume	Mix unit
1	Untreated				
2	GF120	1 fl oz/item	ABCDEF		
3	Danitol	16 fl oz/a	AB	100 GAL/AC	20 gallons
4	Harvanta	16 fl oz/a	ABCDEF	100 GAL/AC	20 gallons
5	Harvanta	24 fl oz/a	ABCDEF	100 GAL/AC	20 gallons
6	Assail	8 fl oz/a	ABCDEF	100 GAL/AC	20 gallons
7	number fmc	fl oz/a	ABCDEF	100 GAL/AC	20 gallons
8	number dupont	fl oz/a	ABCDEF	100 GAL/AC	20 gallons
9	number Syngenta	fl oz/a	ABCDEF	100 GAL/AC	20 gallons
10	Sivanto	14 fl oz/a	AB	100 GAL/AC	20 gallons
11	Lorsban	4 fl oz/a	ABCDEF	100 GAL/AC	20 gallons
12	GF120 Harvanta Asail Danitol	1 fl oz/item 16 fl oz/a 8 fl oz/a 16 fl oz/a	ACE B D F	 100 GAL/AC 100 GAL/AC 100 GAL/AC	 20 gallons 20 gallons 20 gallons
13	Biological				

3. Find alternatives to the current program. This will allow for resistance management and allow for the olive growers to have more tools to control the olive fruit fly.
4. Provide efficacy data to support registration of new products for the control of olive fruit fly.

Benefits to the industry.

Management of Olive Fruit Fly is very labor intensive. Currently growers do not have a lot of tools for the control of this pest. Researching new tools and new chemistries will help the growers. New tools will give them more ways to control this pest. The olive fruit fly poses a severe economic threat for the state's commercial olive growers. By finding new ways to control the pest industry may be able to register these products. New tools will allow for control of the pest and resistance management. The most effective strategy to combat insecticide resistance is to do everything possible to prevent it occurring in the first place. Crop specialists recommend Insect Resistant Management programs as one part of a larger IPM approach covering three basic components: monitoring pest complexes in the field for changes in population density, focusing on economic injury levels and integrating multiple control strategies.

Budget Request

Item	Total budget
Set up, spray, and evaluate the list of materials in the proposal – site 1 with crop purchase	$ 12,500.00
Set up, spray, and evaluate the list of materials in the proposal – site 2 with crop purchase	$ 12,500.00
Total	$ 25,000.00

The costs include the data to be compiled in a format that is acceptable to Department of Pesticide Regulation. Also will help determine which insecticides that should be targeted for registration.

This is the first of three years. In the following years the materials that are favorable in the screening will be looked at in greater depth.

Principle Investigator: Debra Keenan 12-8-2017

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

FROM: CALIFORNIA OLIVE COMMITTEE

SUBJECT: 2018 BUDGET

RECOMMENDATION: THAT the Committee adopt the 2018 FY Budget.

BACKGROUND: The following is the total 2018 FY Budget.

TOTAL 2018 BUDGET

BUDGETS	*MARKETING*	*RESEARCH*	*INSPECTION*	*EXECUTIVE*	*EXPORT*	*TOTAL*
2018	**$828,500**	**$297,777**	**$77,000**	**$401,200**	**$191,000**	**$1,795,477**
Extras to be discussed	***$1,028,500 49.9%**	****$362,777 17.5%**	**3.7%**	**19.4%**	**9.2%**	**$2,060,477**
% Budget	46.1%	16.5%	4.2%	22.3%	10.6%	100%

*Two additional items were requested to be brought before the board for discussion and approval. These items total $200,000
**$65,000 is being discussed for sensory tasting. If approved, total will be $362,000

HISTORIC BUDGET, TONNAGE, & ASSESSMENT COMPARISON

FISCAL YEAR	*2018 (Proposed)*	*2017*	*2016*	*2015*	*2014*	*2013*	*2012*	*2011*	*2010*
Previous	$1,795,477 $2,060,477	$1,752,366	$1,525,415	1,296,731	1,129,682	$1,289,198	$1,197,291	$2,203,909	$929,923
% Difference	2.4% 17.5%	14.9%	15%	12%	-12%	7%	-46%	107%	-39.97%
Tonnage	90,188	63,000	77,977	37,119	90,790	78,179	26,944	167,000	22,150
%Difference	50.7%	-19.2%	110.1%	-59.1%	16.1%	190.2%	-83.9%	6.54%	-54.8%
Assessment Rate		$26.00	$26.00	$26.00	$15.21	$21.16	$31.32	$16.61	$44.72
% Difference		0%	0%	41%	-39%	-52%	89%	-63%	56%

FISCAL IMPACT: $1,752,366.33 for FY 2017 with $23,063 for no-cost research extensions from 2016.