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Grower Profile

26 The Kimball Family
Santa Paula, CA

From the Grove

Volume 8, Number 1

President
Tom Bellamore
CA Avocado Commission

Editor
Tim Linden
Champ Publishing
925.258.0892
tim.linden@ymail.com

Ad Sales
Tom Fielding
626.437.4619
tomfielding1@mac.com

Design/Layout
Heather Gray
User Friendly, Ink.
userfriendlyink@gmail.com

April Aymami
Industry Affairs Director
949.754.0738
aaymami@avocado.org



www.californiaavocadogrowers.com

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FROM THE GROVE is published quarterly by California Avocado Commission; 12 Mauchly, Suite L; Irvine, CA 92618. POSTMASTER: Send address changes to California Avocado Commission; 12 Mauchly, Suite L; Irvine, CA 92618.

The articles, opinions and advertisements presented in this magazine are designed to offer information and provoke thought. Inclusion in this publication does not presume an endorsement or recommendation by the California Avocado Commission for any particular product or cultural practice.

A New Board, A Better Strategy



Tom Bellamore

Several months ago, the California Avocado Commission's (CAC) board of directors met for two days in Ventura County to discuss the future of the California avocado industry. It was a leaner, younger board — down from 29 members to 19, because of changes to Commission law, with the next generation well represented. The diversity of ideas that emerged was indicative of the new board composition.

The central questions before the board were: *Where can CAC focus to make the biggest difference five years out, and beyond?* and *What can be done to reinforce and strengthen the premium positioning of California avocados?* If these sound familiar, it's because we routinely take stock of the pathway we are on with the aim of making improvements based on key learnings, and premium positioning has been the industry's strategic mantra for some time now.

After a day of churning through the details about those internal and external forces impacting our industry, and an evening of reflection, the board arrived at a point of clarity with respect to a new strategic platform. Six strategic priorities were identified:

- Quality improvement
- Adding dimension to the brand and our targets
- Pursuing domestic and global

- premium market opportunities
- Improving industry alignment
- Strengthening partnerships on issues
- Becoming more effective at production research and knowledge transfer

Each of these priorities could be the basis for a magazine column or perhaps an entire issue of *From the Grove*. Instead, I'll give a few examples of how the conversation went with the hope they will be illustrative.

Quality improvement may be the toughest priority to achieve, for one simple reason: everyone in the supply chain likes to point to the next guy as being the bigger culprit behind compromised quality. Growers know what to do to produce a quality crop, and for the most part, they do it. But not always. Still, we are quick to point out that the consumer's attempt to select a just-right, ripe avocado at retail by squeezing the fruit may undo all the care that went into those avocados prior to going on display. Nonetheless, there is room for improvement at every step in the post-harvest chain, and if we redouble our efforts to address the weak links, our chance of delivering on our quality promise to the consumer increases. Premium, after all, connotes high quality. An example of a breakthrough idea

related to the quality priority may be reexamination of the release dates for GEM avocados and possibly other varieties.

The next two marketing-centric priorities entail taking what we have done to successfully position our fruit as a premium product and doing it better. There is still much to be learned about the buying habits of millennials and Gen Z consumers and understanding what makes them tick. In-depth research on our premium target can help us craft and deliver our messages in a more meaningful way. Adding "dimension" to our brand means identifying the product or brand attributes that our target consumers respond to and leveraging those as points of differentiation from other avocado origins. In the breakthrough idea category is the barcode initiative that someday may replace the weary, price-lookup-code (or PLU) relied upon by retail cashiers. As you may know, the PLU classifies avocados by size and type, but not by origin. Imagine how much better the retail scan data we purchase would be if we could definitively distinguish a California avocado from a Mexican avocado when a sale is made! It's hard to believe we are not there yet.

The goal, of course, is to find customers with a willingness to pay for Cal-



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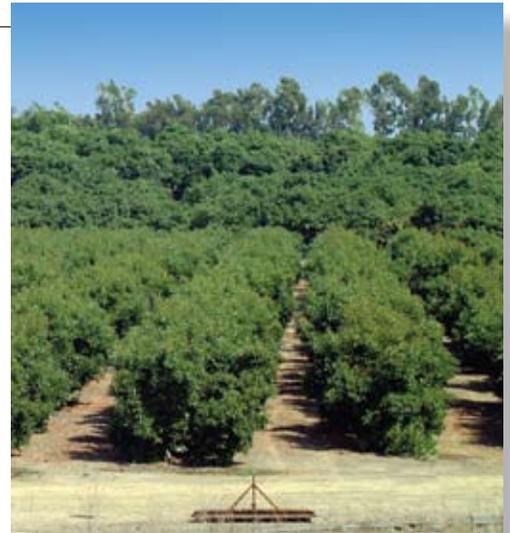
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CaliforniaAvocadoGrowers.com/Commission/your-representatives

ifornia and quality, and have every sale ring up the value our fruit deserves.

With an ever-crowded U.S. market, sometimes the best place to hunt for that premium customer is abroad. This year, the Commission is conducting a limited, test-marketing effort in Japan and South Korea. Some export markets favor smaller size fruit, serving as a relief valve for 60s and 70s that might otherwise put downward price pressure on the U.S. market. Going forward, we need to look to these outlets more consistently, and the board discussed pursuing U.S. Department of Agriculture (USDA) grant funding for export market development more aggressively. An example of a breakthrough idea related to the two marketing priorities would be investigating and tying into the e-commerce food delivery trend, which is slow in taking off in the U.S. but is spinning heads in some Asia markets.

"Improving industry alignment" is code for everyone rowing in the same direction — packers and growers alike. One way to make progress on this priority is enhancing the quality and availability of information. An initiative is underway at CAC to improve our California crop forecasting through more frequent communication with the industry's packers and a revamping of our acreage inventory program. If other suppliers to the U.S. market could be relied upon to do the same thing, growers and packers would be more fully informed about the ebb and flow of fruit in any given season, and better equipped to make sound marketing decisions.

The final two strategic priorities acknowledge the importance of supporting the marketing effort through advocacy, issues management and production research. CAC has a long history of engaging in partnerships on issues, and the issues confronting the industry have not diminished. We need to keep working on the toughest



problems — water, pests, labor, regulation — and we also need to forge relationships that increase our chances of securing outside funding for marketing. Greater involvement in the USDA's Market Access Program and Technical Assistance for Specialty Crops Program is one such example.

On the production research front, there are multiple opportunities for progress and change. The board heard ideas from members of the production research committee about accelerating the rootstock program through semi-commercial field testing and privatization, and CAC's Research Program Director Dr. Tim Spann stepped forward with some innovative ideas for sharing industry best practices at home and abroad.

Each strategic priority identified by the board will become the focus of intensive planning by Commission staff and the marketing agencies that help us carry out our mission. Ultimately, objectives and strategies are built out, and action steps — in the form of the annual business plan — make their way back to the board for approval, funding and evaluation. As you think about the next five years and what lies ahead for you as a grower, know that your board and staff are immersed in developing strategies to deliver the highest value possible for California avocado growers. 🥑

Good Communications Can Rectify Problems & Disputes



Rick Shade

It is time once again to put fingers to the keyboard and create my commentary for the latest edition of *From the Grove*. We are in the height of the California season, about halfway through both the calendar and the volume. The biggest challenge for me seems to be predicting and writing about things that haven't happened, but will be history by the time this column is actually read. One thing is for sure: spray season has started here in Santa Barbara County; the helicopters are flying and the normal hue and cry has started, though we have a new voice added to the din.

With the legalization of cannabis, many of the cut flower greenhouses in our area have been converted to cannabis production. Many of those greenhouses sit among avocado orchards. Now that the crop is legal, the authorities are testing cannabis for pesticide residue down to one part per billion. The problem is that there are no pesticides registered for use on cannabis. If any residues are found, the crop must be destroyed. Given this scenario, the cannabis growers don't want helicopters anywhere near the greenhouses. We have formed a group of avocado growers, cannabis growers and pesticide applicators to come up with a solution to

the problem.

As a licensed pest control advisor, pesticide residues are a continuous concern for me. I was very interested to read an article on the topic in the *Progressive Crop Consultant* magazine. The article cited statistics from the California Department of Pesticide Regulation from 2016, the most recent year available. A total of 3,585 produce samples were tested for pesticide residues — 24 percent of those produce samples were grown in California. The great news is that 96 percent of all produce tested either had no pesticide residue detected or residues within the legal tolerances. The greatest majority of produce with illegal residues was imported from off-shore producers, though bok choy from the United States also was an offender. The good news here is that tree fruits from the United States in general, and avocados in particular, did not have pesticide residue issues.

The message I am trying to convey is really about communication. In this day and age it is imperative to keep open lines of communication with your neighbors, even your fellow farmers. Good lines of communication will help avoid problems and disputes down the road. We also should be communicating as good stewards of our crops. When

talking to our off-farm friends and neighbors, take advantage of the opportunity to communicate the good news about the lack of pesticide residues, even in conventionally-grown crops, on what we grow here in California.

We have just finished California Avocado Month on the West Coast. Jan DeLyser and her team have had some wonderful promotions up and down the coast. Truly innovative food hall events were held in Los Angeles and Portland, celebrating our California avocados. My favorite ways to eat avocados are with a little salt or a little lime juice. I am truly amazed, and my palate surprised, every time I attend an event that showcases new and creative uses of our fruit. The flavor combinations and exceptional presentations are truly stunning, showcasing our fruit beautifully.

Those are the avocado topics that come to my mind at this point in time. As usual I will leave you with a thought, this one from Thomas Jefferson. This quote should ring true with every farmer reading this column. "When facing a long day of work, be sure to choose the tool with the smoothest handle." As someone who started his career in the business by hoeing weeds I can say truer words were never spoken. 🍷



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By *Ken Melban*
Vice President of Industry Affairs

Sustainability, Produce Safety Rule & International Markets

Sustainability

Sustainability is becoming a more common topic surrounding the production and distribution of products and is increasingly important to retailers and consumers of fresh produce. A few retailers are asking for specific information concerning the sustainability of California avocados.

As reported previously, the California Avocado Commission (CAC) has begun work to help the California avocado industry identify current practices that are part of a sustainability profile. There are three primary areas of a sustainability profile: social, environmental and economic. In short, sustainability focuses on treatment of workers (e.g., pay, working conditions, etc.); impact on the environment (e.g., pesticide use, water demand/runoff, energy use, etc.); and the economic viability of an operation/industry.

Packers have received sustainability questions from buyers ranging from “How does your growing operation protect labor rights?” to “What was the nitrogen use intensity associated with fertilizer application at the growing operation?” The Commission recognizes that farmers, especially those within California, must comply with very rigorous laws that provide oversight in areas such as labor practices and environmental protections. To make sure California avocado producers are getting credit for current practices, the Commission just completed a review of

existing federal and state laws. As you see in the accompanying tables, the findings clearly demonstrate that California farmers comply with dozens of labor and environmental regulations. Inarguably, California is one of the most regulated production areas in the world, and it is important growers receive proper

asked. One example is the determination of greenhouse gas emissions from both growing operations and supply-chain transportation. That information undoubtedly will be very difficult to quantify and would ultimately require a lifecycle analysis. A lifecycle analysis is a “birth to the grave” or “production

Table 1: Summary of occurrence of Federal and California labor regulations

Regulatory Category	Federal Regulations	California Regulations
Wages and Benefits	2	14
Occupational Health and Safety	7	18
Recruitment and Workforce Management	2	8
Child and Voluntary Labor	4	6
Non-Discrimination	2	5
Freedom of Association	1	2

credit for existing practices when buyers are asking about the sustainability of their operations. Because of our review of federal and state laws, the Commission is now better equipped to advocate on the current sustainability practices, which are extensive.

But CACs efforts can't stop there, as questions into other more challenging areas of sustainability also are being

to consumption” review of all the inputs (and resulting outputs) required for the entire lifecycle of a product. While many growers may think a production to consumption review would begin in the grove with land preparation and tree planting, the review starts well before that time. It looks at the resources, energy and other factors necessary to propagate the trees, transport the trees

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Table 2: Summary of occurrence of Federal and California environmental regulations

Regulatory Category	Federal Regulations	California Regulations
Pesticides and Hazardous Materials Management	4	11
Water Resources	1	9
Air Resources and Climate	4	2 (including AB32)
Ecosystem Protection	5	3
Soil Resources	2	-

to the grove, deliver water to the grove, manufacture the drip-tape, etc.

It's a complex situation, and one the Commission is pursuing with tempered expectations. We realize this is going to be a long, sustained (pun-intended) process, but one that must be started. As such, the Commission has applied for a Specialty Crop Block Grant (SCBG) to develop a web-based system that would allow growers to voluntarily provide information on growing practices, such as nitrogen use and average employee pay. The information would be examined in the aggregate and serve a two-fold purpose. First, it would further quantify the California avocado industry's sustainable practices; second, it would help identify Best Management Practices (BMPs) for improved industry awareness and, in some instances, modification of current management practices.

The Commission submitted an initial proposal in early 2018 for SCBG funding and was then invited to submit a full proposal. The final funding decisions should occur in the fall of this year. We will provide information to the industry as it becomes available.

Produce Safety Rule

As part of the Food and Safety Modernization Act (FSMA), all grow-

ers of fresh produce sold in the United States (with a few exceptions) must be able to demonstrate compliance with the Produce Safety Rule (PSR). Mandatory implementation deadlines are shown in the text box. The PSR requires compliance with a set of procedures and policies intended to mitigate potential microbial contamination. One of those is the requirement for a grower, or his/her designated food safety person, to

Produce Safety Rule Deadlines for producers are as follows:

- **January 26, 2020 deadline for very small businesses** — more than \$25,000 but no more than \$250,000 in average annual produce sales during the previous three-year period
- **January 26, 2019 deadline for small businesses** — more than \$250,000 but no more than \$500,000 in average annual produce sales during the previous three-year period
- **January 26, 2018 deadline for all other farms**

participate in a Produce Safety Alliance (PSA) training. This is a full-day, one-time training that follows the person trained and not the company.

Recently the Commission, with support from multiple handlers, organized two PSA trainings – one in Escondido and another in Ventura. The workshops were set up exclusively for avocado industry members and both were completely sold out. The train-

ings were conducted by Dr. Trevor Suslow of U.C. Davis, a highly respected food-safety extension specialist. If you haven't completed the PSA training yet, the Commission will provide information on upcoming trainings through the *GreenSheet*.

The Food and Drug Administration (FDA) is responsible for the enforcement of the PSR and has contracted with the California Department of Food and Agriculture (CDFA) for the enforcement within California. Although the first deadline of the PSR was in January 2018, the CDFA, acting as FDA's enforcement agents, is only focusing on education and outreach for this year, with inspections beginning in 2019. The Commission has been in close contact with the CDFA, and hosted a training session in an avocado grove to provide a better understanding of the industry and address any areas of confusion. In addition, a visit is being set up for FDA officials to tour an avocado grove and packing facility. These

types of interactions are important for the industry to ensure we identify any inaccuracies or confusion before the inspections begin.

As previously reported, growers who are following the Commission's Food Safety program, which aligns with the Global Food Safety Initiative standard, can almost fully demonstrate compliance with the PSR. The water testing requirements are the one area

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For the past 20 years, our lead attorney, Robert Jackson, has focused his practice on representing fire victims and has helped supervise and consolidate settlements of over \$1.8 billion against the responsible parties. An avocado grower himself with six avocado ranches spanning over three hundred acres in San Diego county, Robert has a keen and unique understanding of the losses felt and the recovery efforts that lie ahead for avocado growers affected by the Thomas Fire. Let Robert Jackson and his team of lawyers, experts and consultants put their experience and expertise to work for you.



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Produce Safety Rule training in Escondido.

that needs to be finalized. Based on concerns from the agricultural industry, FDA has delayed the implementation of the water testing requirements until 2022. FDA is in the process of working with stakeholders as they reconsider the proposed requirements. The Commission is engaged in these discussions and will provide updates as new information becomes available.

International Market Access and Promotional Efforts

The Commission, while remaining focused on the U.S. domestic market, continues to pursue access to additional offshore markets. Currently, the California avocado industry exports roughly 6-8 percent of the total supply, with the primary markets being Japan, South Korea, Hong Kong, Taiwan, Singapore and Canada. In many instances, these international markets provide better pricing options, and during the start of California's season they may present an alternative market for some of the smaller fruit. While the overall volume for exports is still in the single digits, the Commission believes it is prudent to gain access to additional emerging markets to ensure we do not miss opportunities.

Unless there is an existing free

trade agreement that covers multiple products, in order to export to another country a specific agreement concerning the product must be reached between the two countries. These agreements are reached after a thorough Sanitary and Phytosanitary (SPS) review process. The SPS process focuses solely on ensuring invasive pests will not be introduced through the importation of the proposed product. While trade agreements are not supposed to be political, the unfortunate reality is politics seems to find its way into the process.

For more than a decade, the Commission has been working on gaining market access to China. In the last couple years, the Commission has ramped up its pressure both on the USDA's Animal and Plant Health Inspection Services (APHIS) and its Chinese agency counterpart.

Reaching a trade agreement is a delicate process, one that requires diplomacy and tact. In 2016 the Commission was successful in hosting an official Chinese delegation as it conducted a technical visit. Since that time, the Commission has further strengthened its connections with the leadership of both countries. With the recent trade challenges between the U.S. and China, the opportunity to finalize a

long-awaited trade agreement for California avocados faces the likelihood of more delays. However, the Commission is maintaining contact with both governments and believes there may be an opportunity to keep the process moving. As of this writing, reports of a thawing out between the two countries in their trade discussions has occurred, so hopefully the stars are aligning for California avocados to gain access to China. Because China is home to the world's two largest cities – Shanghai (24.2 million people) and Beijing (21.5 million people) – an expanding middle and upper class, and a rapidly growing demand for avocados, the Commission will continue to push on every possible door to gain access.

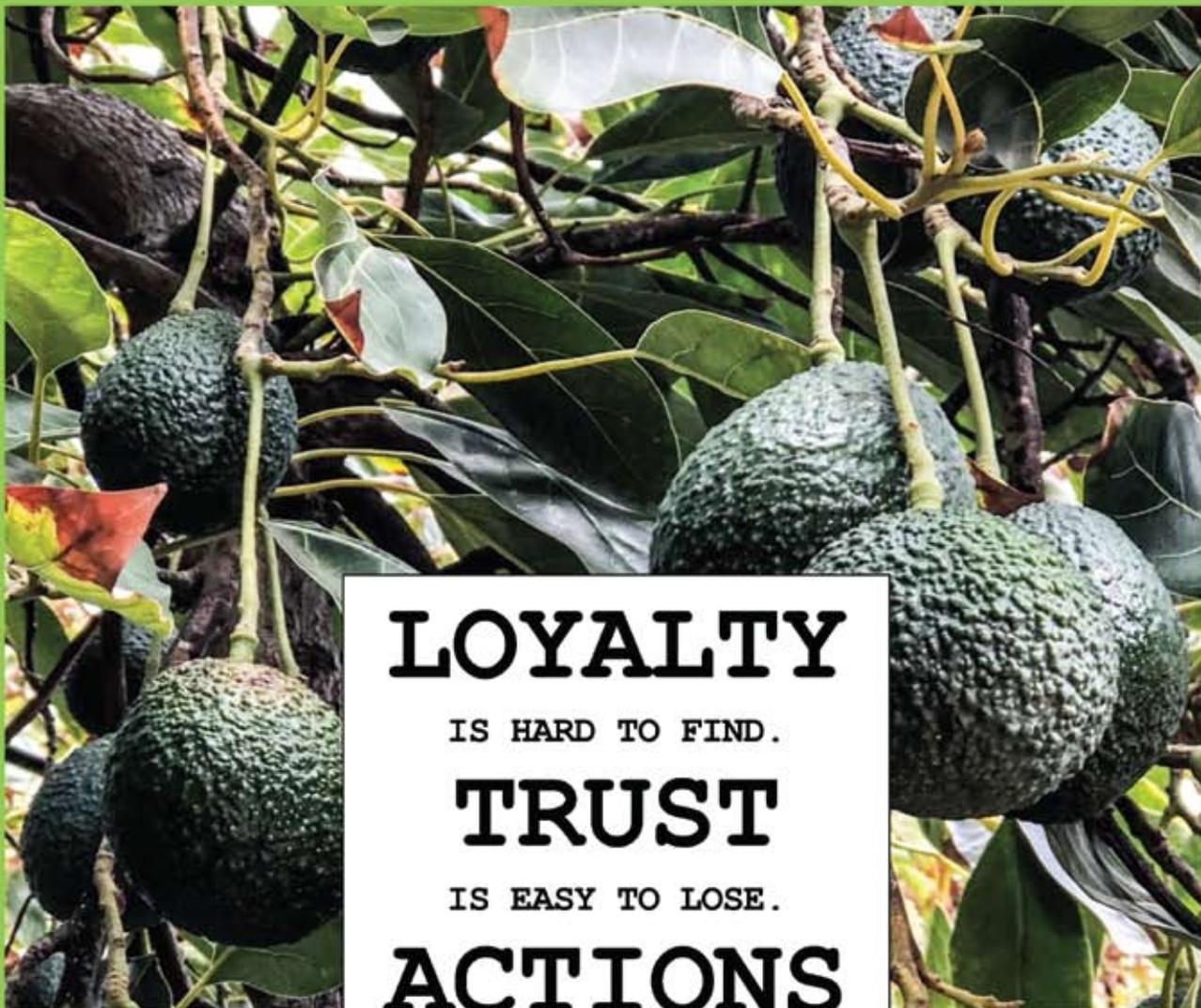
The Commission has pursued access to the markets of Thailand and India as well. In Thailand, there continues to be a tremendous amount of interest for California avocados, and although India may be logistically difficult, it could prove an interesting market if the conditions were right.

For this season, the Commission was successful in securing \$123,000 of Foreign Agricultural Services (FAS) Market Access Promotion (MAP) funding for some limited promotional activities in Japan. As of this writing, the Commission has decided to apply for additional MAP funding for next year with an eye primarily on South Korea and Japan. If successful, these MAP funds will provide the Commission with an opportunity to keep traditional resources focused on the domestic market while working to strengthen the overseas markets.

The Commission's strategy remains the same: target consumers who are willing to pay a premium for California's premium avocado. Yet to be determined is where all those premium California avocado consumers reside. 🥑

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Avocado Decision Support Tools Now Available

By Tim Spann, PhD

Research Program Director

The California Avocado Commission (CAC) is pleased to announce that the avocado decision support tools (DST) are now available online for California avocado growers. The DSTs can be accessed through CaliforniaAvocadoGrowers.com or directly at CaliforniaAvocadoGrowersDST.com.

What are DSTs?

In broad terms, DSTs are software developed to help users make better decisions more quickly, typically for very complex situations. Specific to avocados, DSTs are statistical models that have been developed to guide growers through decisions about fertilization to maximize yield.

This project began in 2012 with a concept from Dr. David Crowley, professor of environmental sciences at UC Riverside (now retired), who proposed using artificial neural network analysis to:

- Determine optimal leaf nutrient values for maximum yield of avocado
- Rank nutrient deficiencies or excesses based on their yield impact

By achieving these two goals, growers would have better information to help them interpret and act on their annual leaf tissue analyses. To make these complex statistical models accessible to growers, they would be imbedded in a user-friendly web interface.

The Data Collected

The project CAC funded with Dr. Crowley consisted of 12 sites in groves ranging from San Diego to San Luis Obispo counties. In each grove, numerous sensors were placed in one or more plots of 15 Hass trees on any available rootstocks — Dusa, Duke 7, Toro Canyon, Thomas and Mexican seedling had sufficient representation to be included in the analysis. For every tree in the test plots, the following data were recorded:

- All water applied as irrigation or received as rainfall
- All fertilizer applications
- Annual leaf tissue analyses and soil sampling
- Irrigation water quality analysis
- Total yield per tree as well as fruit quality and size data

In addition to the data collected specifically for this study,

data from nearly 30 years of avocado fertilizer trials conducted by Dr. Carol Lovatt, retired professor of plant physiology at UC Riverside, also was added to the analysis. This helped to expedite the project and allowed the data analysis to be completed by December 2016 instead of 2018 as originally proposed.

Optimum Avocado Leaf Nutrient Values

Prior to this research, the leaf nutrient values used for avocado were based on those developed for citrus. The citrus values were modified over the years by various plant testing laboratories based on their experience. However, a specific

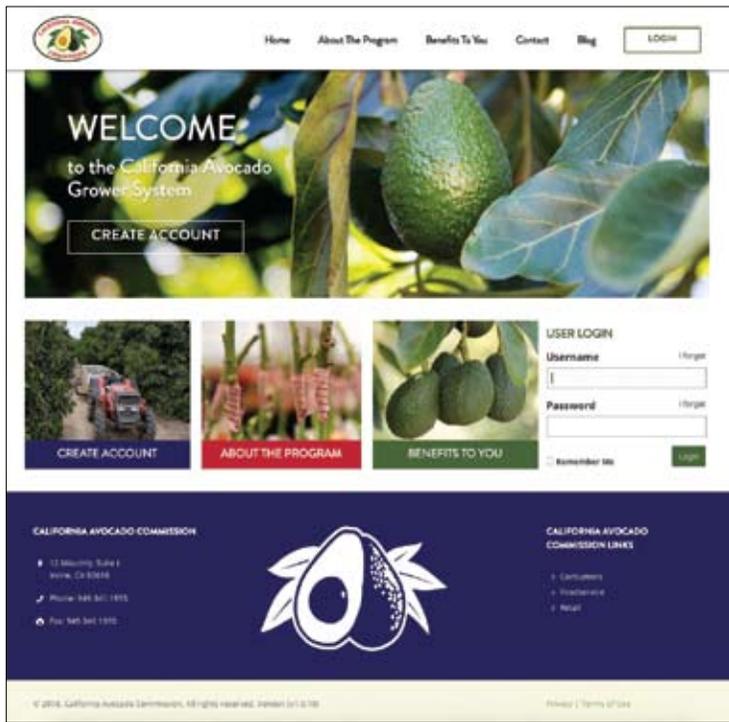
Old optimum leaf nutrient levels for avocado based on modified citrus values, and the new values developed by the decision support tools research project.

Nutrient	Old Optimum Range ¹	New Optimum Range
N%	1.6 – 2.0	2.25 – 2.90
P%	0.10 – 0.25	0.10 – 0.15
K%	0.75 – 2.0	0.70 – 0.90
Ca%	1.0 – 3.0	1.8 – 2.0
Mg%	0.25 – 0.80	0.6 – 0.9
S ²	0.20 – 0.60 (%)	0.45 – 0.53 (ppm)
B ppm	50 – 100	38 – 60
Zn ppm	30 – 150	50 – 80
Mn ppm	30 – 500	110 – 145
Fe ppm	50 – 200	45 – 80
Cu ppm	5 – 15	4 – 7

¹ Old optimum ranges shown here are those published at

<http://ucavo.ucr.edu/General/LeafAnalysis.html>.

² For sulphur, the old optimum range was based on percent sulphur in the leaf tissue, the new range is based on ppm.



From the homepage for the avocado decision support tools, CaliforniaAvocadoGrowersDST.com, a grower can create an account, find out more about the program or login to their account.

study to develop optimum leaf nutrient values based on yield data had never been conducted for avocado. The table on page 14 shows the old leaf nutrient recommendations and the new values developed from the DST research.

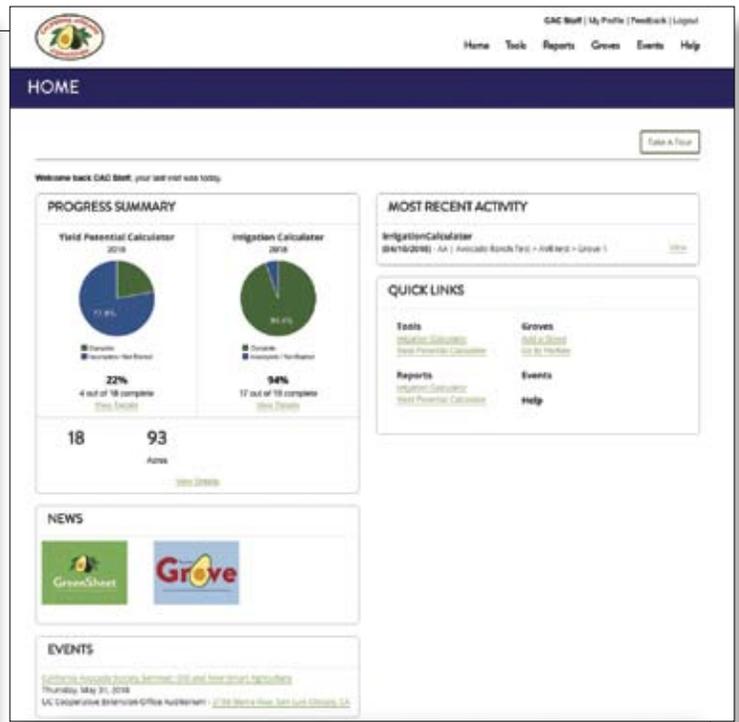
For a more detailed discussion on how these new optimum ranges were developed, please see “Decision Support Tools for Avocado Fertilization & Salinity Management: Preview to the Final Project Report” in the Fall 2015 issue of *From the Grove*.

California Avocado Grower System

The DST website houses what we are calling the California Avocado Grower System (CAGS). Currently, this system has two tools available for use — an irrigation calculator and a yield potential calculator. These tools are described in more detail later in this article.

Growers will need to create an account the first time they access the site. In order to restrict the use of the site to the California growers who paid for its development, you will need your CAC Grower ID number to create your account. You can find your CAC Grower ID on official Commission mailings (e.g., ballots, crop surveys, etc.). If you need assistance locating your CAC Grower ID, please contact CAC at 949-341-1955.

During the account setup process, you will need to enter grove identification information. If you have more than one grove you can add them to your profile after the initial setup



Each user will have a unique homepage associated with their account that has a quick summary of their grove, shortcuts to various reports, and links back to useful information and calendar events on CaliforniaAvocadoGrowers.com.

process is complete. A common question is: how is a “grove” defined in the DST system? Since you will be entering leaf analysis data for each grove, you should think of the grove as whatever unit from which you collect your leaf samples. Thus, if you have a 40-acre “grove” and you collect your leaf samples from four 10-acre blocks within that grove, consider those four blocks as individual groves and name them accordingly.

Once you have created your account and established your first grove in the system you are ready to start using the system. You can begin with either the Yield Potential Calculator or the Yield Impact Calculator.

Yield Potential Calculator

Based on the new optimum leaf nutrient ranges for maximum yield, the various statistical relationships among the nutrients were used to develop the “Yield Potential Calculator” tool within the CAGS.

After your initial grove setup, select the Yield Potential Calculator from the Tools menu. You can select the grove you want to run the calculator on from the groves you’ve set up in your profile. Once you’ve selected the grove, you will need to complete the information under the Inputs tab:

- Grove yield in pounds per acre
- Off or on yield for your grove
- Scion and rootstock varieties

As mentioned earlier, the model was developed for Hass

Yield Potential Report

Criteria

Year	2018
Organization	AA I Avocado Ranch Test
Enterprise	AVR test
Grove	Grove 3

Grove Information

Grove Yield	3500 (pounds per acre) Off-year
Varieties (Scion / Rootstock)	Hass / Dusa

Lab Sample

Lab Sample Date	4/23/2018
Lab Sample Name	

Yield Potential

Nutrient	Entered Value	Yield Impact Potential	Correct By	Rank
Macronutrients				
N (%)	1.25	-39%	Increase Concentration	8
P (%)	1	-31%	Decrease Concentration	6
K (%)	0.35	-49%	Increase Concentration	3
Ca (%)	1	-48%	Increase Concentration	2
Mg (%)	2.25	-89%	Decrease Concentration	1
S (%)				
Micronutrients				
Zn (ppm)	41	Reduction of 5% or less	Increase Concentration	10
Mn (ppm)	50	-29%	Increase Concentration	5
Fe (ppm)	60	-10%	Increase Concentration	9
Cu (ppm)	2	-33%	Increase Concentration	4
B (ppm)	5	-33%	Increase Concentration	7
Na (ppm)				
Cl (ppm)				

This recommendation is not intended to be used as the sole source of information for making nutrient decisions. Local environmental conditions can have a profound effect on irrigation demands. The California Avocado Commission, the University of California, and the California State University are not responsible for the accuracy of this model.

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A sample report from the yield potential calculator, showing the yield impact potential and ranking of each nutrient.

on five different rootstocks. If you select a variety other than Hass or a rootstock other than the five used to develop the model, the system will warn you that the information may not be accurate.

Next you will enter your leaf tissue analysis results for the grove. You will need to enter the date of the sample and then the value for each of the nutrients. If your test results don't include one of the nutrients listed, just leave it blank. **Do not enter a '0' or the system will calculate erroneous results.**

Next, click on the reports tab to see the results. Most growers are familiar with receiving a report from their laboratory of choice that is color coded in some way to indicate which nutrients are within the optimum range and those that are outside the optimum range. However, the grower is then left to determine – based on their experience, consultation with consultants and grove managers, or maybe just by guessing – which of those deficiencies or excesses is most critical to improving their yield. This is where the yield potential calcula-

tor will help.

Yield Impact Potential: For each nutrient, the yield impact potential – that is, how much reduction from maximum yield that nutrient deficiency or excess is causing – will be reported. If the nutrient value falls within ± 5 percent of the optimum range, the report will indicate that no change is needed. For those nutrients whose value is more than 5 percent from the optimum, a percentage value will be given. For example, if the yield impact potential is “-48%,” this means that the nutrient deficiency or excess is potentially causing yield to be 48 percent below maximum.

It is important to understand that these values are named “yield impact potential” because they are just that, potential yield losses. They are not absolutes. Many factors interact with plant nutrition – chief among them irrigation – that may or may not result in these calculated yield penalties being realized.

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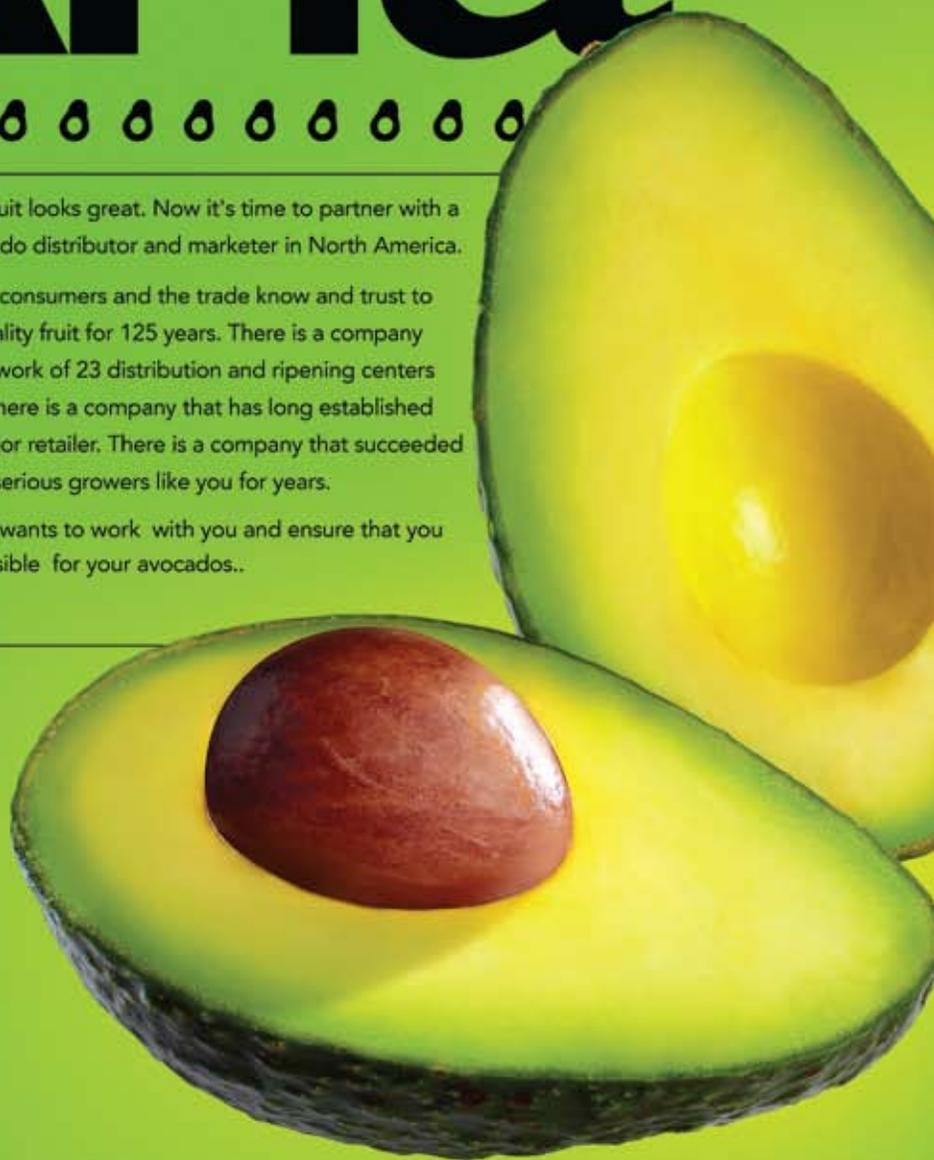
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Rank: Also provided for each nutrient is a ranking. The rank indicates, in order of importance, how critical each nutrient deficiency or excess is to yield. These rank values may or may not directly correlate to the yield impact potential depending on the other factors involved in the model.

A barrel with staves of varying lengths is often used to visualize these rankings. The capacity of the barrel is limited by the length of the shortest staff, and the capacity cannot be increased unless the shortest staff is lengthened. Likewise, avocado yield is limited by the most limiting nutrient. If nutrient deficiencies or excesses are corrected without correcting the most limiting nutrient, yield is unlikely to improve.

Thus, the goal of the yield potential calculator is to help growers understand the yield-limiting factors, in terms of nutrition, and know which of those limiting factors to address first, second, third and so on. As mentioned previously, other factors besides nutrition affect yield so this analysis must be viewed as just one piece of the puzzle in your grove management practices.

You can download the yield potential calculator reports as either a PDF file or an Excel compatible CSV file if you want to store a copy of your results outside of the CAGS.

Irrigation Calculator

Prior to using the irrigation calculator there is some basic setup you will need to do. The first step is to select the grove from your profile that you want to use the irrigation tool for. Next you will need to tell the system what weather data to use to calculate evapotranspiration (ETc) and rainfall. The system can use CIMIS (California Irrigation Management Information System) data from a nearby station that you select from a dropdown menu, or it can use spatial CIMIS data which interpolates weather data for your specific location based on CIMIS station and satellite data. To use the spatial CIMIS data you will need to enter your grove's latitude and longitude. The spatial CIMIS data has a resolution of about one mile so your coordinates do not have to be highly precise.

After you have set up your weather information you will need to provide basic grove details. This includes the age of the grove and your tree spacing. Note that the grove acreage will be automatically filled in based on the profile you created for that grove.

Next you have the option of entering more detailed information about your grove that will expand the information in your report. This advanced setup information includes details about your trees' rooting depth, soil texture and soil moisture holding capacity.

Lastly, you will enter your irrigation system information. This includes:

- Type of emitters you have (microsprinkler or drip)
- Typical irrigation set run times
- Number of emitters per tree
- Emitter output in gallons per hour
- Your system's distribution uniformity (DU)

If you do not know your system's DU many of the state's resource conservation districts (RCD) provide DU testing for free. To find your local RCD office, go to www.CARCD.org and navigate to About Us, RCD Directory.

You can now click on the Weekly Inputs tab. Here you will see the calculated run times necessary to meet that week's ETc and to refill the available soil moisture (ASM; if you entered your soil details in the advanced setup step), as well as the calculated depleted ASM. On this page you can enter your actual system run time, actual soil moisture data if you have soil moisture sensors in your grove, as well as actual rainfall if you have a rain gauge. Entering soil moisture data and/or rainfall data here will override the calculated ASM and CIMIS data. Here you also have the opportunity to enter a description of your trees' observed drought status — minimal, mild, moderate or severe.

On the Reports tab you can now look at a cumulative seasonal irrigation summary. This shows you the actual ETc value for each week and your actual water applied (based on irrigation and rainfall). You also will see an accumulated ETc and

Week	Soil Moisture	Run to meet ETc	Cumulative ASM	Required Run Minutes	Observed Rainfall (Inches)	Observed Drought Status
		Actual	Target	Excess	Deficit	
JAN 13 1/13 - 1/19	0	15.6	0.36	16.2	0.00	34%
JAN 20 1/20 - 1/26	0	27.9	0.51	35.7	0.46	75%
JAN 27 1/27 - 2/2	61	62.5	0.89	62.0	0.96	100%
JAN 29 1/29 - 2/5	61	45.9	0.84	77.9	1.62	100%
FEB 6 2/6 - 2/12	61	36.0	0.66	67.0	1.24	100%
FEB 13 2/13 - 2/19	61	31.3	0.72	70.9	1.36	100%

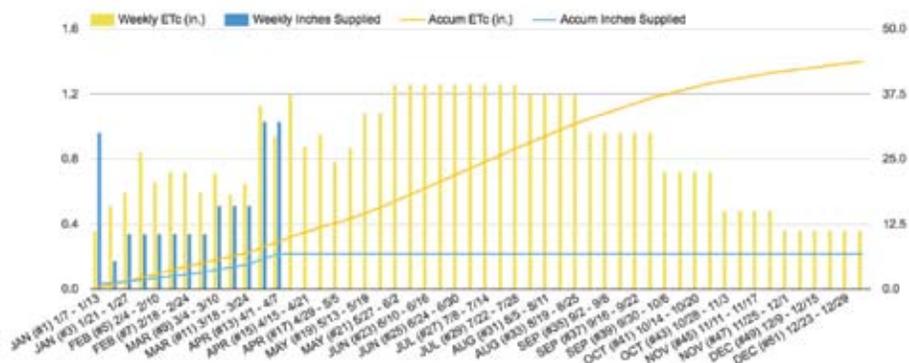
A sample weekly irrigation inputs page of the irrigation calculator. This page shows how much irrigation is needed to meet evapotranspiration and to refill available soil moisture. From this page you can enter your actual irrigation run time, soil moisture and rainfall data if available.

Seasonal Irrigation Summary

Crop Year: 2018 Grove: Grove 1 Organization: AAI Avocado Ranch Test Business: AVR test

Spatial CIMIS: Lat: 33.653686 / Long: -117.73329

Crop Evapotranspiration (ETc) and Supplied Water graph by week. Bars show weekly values; lines show accumulated values.



The Y-Axis displays inches of crop evapotranspiration (ETc) and inches of water from irrigation and effective precipitation. The X-Axis shows time in weeks with month and week numbers.

To set the start-week on the X-Axis, select from "Week To start accumulating ETc." under SETUP tab in the IRRIGATION SETUP section.

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A sample seasonal irrigation report. The blue bars show actual irrigation applied and the yellow bars show evapotranspiration for each week. The yellow and blue lines show cumulative evapotranspiration and irrigation, respectively.

inches-of-water-applied line. Weekly ETc values and accumulated ETc for future weeks are based on historical data and will be updated each week as real-time data are received by the system.

Like for the yield potential calculator, you can download detailed and summary reports from the irrigation calculator as PDF files or Excel compatible CSV files if you wish to keep a copy of your reports outside the CAGS.

It is our hope California avocado growers will find these new tools helpful in improving their grove management practices. If these tools prove successful and growers utilize them, the system could be expanded in the future to add more features to the existing tools or to develop new tools to help with other grove management tasks.

Despite the potential benefits the CAGS and other technologies offer to growers, remember the best tools you have for becoming a better grower are attached to the ends of your legs — get out in your grove, observe what's going on and be an active grower. 🍌

(Funding for this project was provided by the California Department of Food and Agriculture Specialty Crops Block Grant program Agreement No. SCB16030.)

Upcoming DST Grower Seminars:

CAC is hosting a series of seminars to help growers learn how to access and use the online DST system. Mark your calendars and plan to attend one of the meetings below:

Tuesday, July 10, 2018

9:00am - 12:00pm

Pala Mesa Resort

2001 Old Hwy 395

Fallbrook, CA

Wednesday, July 11, 2018

9:00am - 12:00pm

Ventura County Ag Museum

926 Railroad Ave

Santa Paula, CA

Thursday, July 12, 2018

9:00am - 12:00pm

San Luis Obispo County Farm Bureau

4875 Morabito Pl

San Luis Obispo, CA

Engaging with California Avocado Fans at Local Events

Consumer events are an important means by which the California Avocado Commission (CAC) can directly engage with targeted consumers who are passionate about California avocados. The Commission selects premium partners whose fanbase matches CAC's targeted consumer profile.

Having an experienced social media team capable of generating excitement before, during and after the live events by sharing relevant and interesting California avocado content through social media channels is another criterion. The Commission engages directly with fans at the selected live events and then reaches a broader audience with social media content that invites fans to digitally "participate" by sharing, liking and commenting on social media posts related to the activity.

Following is a summary of three unique events the Commission has participated in so far this season.

The Tastemade Smorgasburg Pop-up on the Pier

For the second consecutive year, Smorgasburg brought more than 70 vendors to the Santa Monica Pier providing beach goers with an opportunity to sample some of the best local cuisine. To broaden the reach of the event, Smorgasburg partnered with social media expert Tastemade to share interesting and eye-catching social media posts that garnered the attention of the highly influential, trendsetting super foodie audience located in the heart of Los Angeles.

As a sponsor, the Commission participated in the highly anticipated event by sharing California avocado-themed temporary tattoos and stickers with attendees. California avocado fans also visited CAC's custom-branded photo booth and then shared keepsake photos on their social media platforms.

In addition, 10 select vendors showcased California avocados as the hero ingredient in their custom dishes and celebrated their love for the fruit with California avocado-branded signage at their booths. Tastemade created a video featuring the unique California avocado dishes and shared the mouth-watering photos on social media with those who could not attend. This footage also was used to create a video that was promoted on Tastemade's and Smorgasburg's Facebook and Instagram channels. The Tastemade event recap video has delivered more than 1.4 million video views to date.



A favorite dish of the day at Tastemade's Smorgasburg was the California Avocado Spicy Crab Salad from vendor Sticky Rice on Wheels.





Avocado Time at the Disney Food & Wine Festival was a hit, with California avocado menu items like the Spiced Oumph! On Pita with Avocado Hummus and Garlic Sauce and the Avocado Ice Cream Bar.

The Disney California Adventure Food & Wine Festival

This year the California Avocado Commission was a sponsor of the popular Disney California Adventure Food & Wine Festival, which celebrates the best of California with events, themed dining, live entertainment and shopping.

CAC's marketplace banner and signage — featuring 2018 California avocado campaign illustrations — had prime placement at the festival. During the event, festival attendees could purchase three fresh California avocado-centric menu items — Avocado & Pepper Jack Petite Guacamole Burger, Spiced Oumph! On Pita with Avocado Hummus and Garlic Sauce, and Avocado Ice Cream Bars. Attendees also had the opportunity to enjoy a California avocado culinary demo and meet California avocado grower Doug O'Hara at farm-to-table seminars hosted at the event. Social posts on CAC's Twitter, Facebook and Instagram accounts supporting the grower event with Doug O'Hara gathered more than 24,000 impressions.



A beautiful California avocado campaign illustration was on display in prime placement near the Avocado Time booth at the Disney Food & Wine Festival.



CAC Board Member Ryan Rochefort educates California avocado lovers about nutrition and growing information at the Fallbrook Avocado Festival.

32nd Annual Fallbrook Avocado Festival

At the Fallbrook Avocado Festival, which attracted an estimated 100,000 California avocado fans, the Commission promotion included a 10-foot by 10-foot tent on Main Avenue. The CAC tent served as an information resource for consumers interested in new avocado usage ideas and nutrition information, as well as for backyard growers and California avocado growers who had questions about their trees and groves.

CAC also will exhibit at the Morro Bay and Carpinteria festivals this summer and fall.

By connecting one-on-one with foodie Californians at their favorite events and serving as a credible and reliable source of information concerning California avocados, the Commission builds premium brand awareness, encourages consumption of the Golden State fruit and promotes loyalty to the California avocado brand. 🥑



California Avocado Commission Prepares for the Future

By Tim Linden

Forward thinking has always been the hallmark of the California Avocado Commission (CAC) and that theme was front and center during the three annual meetings, which were held over consecutive days in three of California's distinct avocado growing regions in late March.

Of course, the meetings are always used to preview the current year's crop and discuss marketing expectations as the season progresses. But this year, the meetings also were utilized to highlight some of the cutting edge marketing strategies currently in use that will become even more important as millennials dominate the marketplace. And CAC's younger staff members, including a strong millennial core, also were on center stage as they presented much of the program.

CAC Chairman of the Board Rick Shade opened all three meetings on an upbeat note as he discussed the power of group dynamics when everyone is working toward the same goal. Quoting business management author Patrick Lencioni, he said, "If you could get all the people in an organization rowing in the same direction, you could dominate any industry, in any market, against any competition, at any time"

Shade marvelled at the tremendous strides the avocado industry has made over the years.

CAC President Tom Bellamore continued with the theme of industry cohesiveness as he reviewed the 2017 season and forecast the prospects for 2018. In 2017, the U.S. market consumed about 2.18 billion pounds of avocados, with California accounting for about 10 percent of the volume with its smaller-than-usual 216 million pound production. But in this case good things came in small packages. Bellamore noted that the reduced volume was met with strong demand and premium pricing for California's fruit, which resulted in a record farmgate price for the state's growers. Over the course of the 2017 season, growers received an average return of \$1.60 per pound for their fruit. The average premium for California fruit over the other avocados in the market was 14 percent. An impressive 25 percent premium was reached at several different times during the season, including during the last month of marketing.

At the time of the meetings in late March, Bellamore anticipated that the 2018 season would bring a different dynamic with both California and Mexico experiencing on-years in terms of volume. He said about 2.4 billion pounds are expected to be sold in the United States with California accounting for about 16 percent of that volume. Bellamore noted that the marketplace would have more fruit during California's



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peak shipping period with increased volume expected from Mexico, and Peru acting as a wildcard, expecting to ship their fruit wherever the market is strongest at any given time between the United States and Europe. Considering that volume, Bellamore expects that it will be difficult for growers to get the same per pound prices they received in 2017, but he believes it will be a strong market nonetheless.

The CAC president spent less time than usual talking to the impressive group of attendees at each location as he expressly wanted to showcase the staff. He explained that CAC is preparing for both this year's large crop and the crops to come by building a team that can take the reins when their time comes. The future was on display as the CAC staff looked at the devastating fires this past winter, relayed the crop forecast for the year, took a deeper look at the Commission's well-developed social media presence, and examined government affairs, the financial condition of the organization and the production research effort.

Bellamore noted that both the Commission and the staff have a very good mix of young talent, including several in the influential millennial generation, and older expertise.

Ken Melban, vice president of industry affairs, was first tasked with discussing the devastating December fires in California. While acknowledging the huge number of acres, structures and personal belongings consumed by fires in San Diego, Ventura and Santa Barbara counties, Melban said irrigated agriculture, including avocado trees, acted as a fire break and did help limit the growth of the fire into local communities. All totaled, about 5,300 acres of avocados were within the perimeter of the fires and about 1,350 acres were adversely impacted. Melban said the end result is a crop reduction of about 5-7 percent, equating to about 20-30 million pounds. He summarized the Commission's actions to help growers in the wake of the fire and accompanying wind events, including visits with elected officials and CAC's advocacy to get relief from state and federal agencies.

Melban also discussed ongoing government affairs efforts such as dealing with regulators as the Food Safety Modernization Act's compliance deadlines come into focus. He said there also are continuing efforts with regard to legal issues concerning immigration. He noted that CAC's ultimate goal is still to help secure the passage of immigration reform legislation that recognizes the special needs of agriculture on this front.

He highlighted how provisions in the federal Farm Bill help growers, including the Tree Assistance Program, Foreign Agricultural Service (FAS) work, technical assistance for specialty crops (TASC) and the foreign marketing programs. CAC has been the recipient of TASC funds, as well as Emerging Marketing Program funds for helping gain access to China. Congress is again working on the Farm Bill as it is set to expire

this year. (In April the Agriculture and Nutrition Act of 2018 passed out of the House committee.) He added that the CAC staff is keeping an eye on NAFTA negotiations and how an export war involving tariffs could impact the industry.

CAC Industry Affairs Director April Aymami presented more detailed information concerning the expected availability of the 2018 crop. She said the majority of the crop is expected to be sold in the four-month period beginning April 1 and concluding at the end of July. About 75 percent of the crop should be sold during that time period. About 15 percent of the crop was marketed in the January to March time frame and the other 10 percent is forecast to be sold during August, September and October.

In that late March time frame, Aymami reported that the current estimate for this fiscal year was 374.6 million pounds – Hass 362 million, Lamb 10 million and other varieties 2.6 million. She also explained the process of the forecasting. Finally, Aymami shared industry resources available to help growers, including the *From the Grove* magazine, the *Green-Sheet*, CaliforniaAvocadoGrowers.com and HassAvocadoBoard.com. She encouraged growers to use these resources for a greater understanding of the total U.S. market dynamics.



CAC's Monica Arnett discussed the excellent financial shape of the commission going into the 2018 season.

Monica Arnett, CAC's director of finance and administration did a quick review of the robust financial report and did note that the current level of reserves is at the high end of its typical range. She explained that CAC needs strong reserves because of the seasonal and cyclical nature of the crop. While funds are expended throughout the year on all of the programs, the income is only produced during the shipping

season. She said the high reserves are necessary for cash flow purposes, and added that looking forward, the Commission is preparing for leadership transition and the special circumstances that arise with a crop size that fluctuates significantly from year to year.

Another glimpse into the future was presented by Zac Benedict, CAC's online marketing director, who outlined the more modern way to reach California avocado devotees.

Benedict showed how CAC's marketing programs have evolved to be more targeted and take advantage of new media opportunities, specifically a spotlight on online marketing. He highlighted online marketing channels such as Facebook, Twitter, Instagram and Pinterest, and noted that today's younger consumers are inundated with opportunities as they travel through social media platforms. He said one of the more popular platforms produces 1.3 million pieces of new content every minute. Users spend an average of eight seconds of engagement on a new piece of material. "That's less than the attention span of a goldfish," he quipped, stating that "authenticity" of your content is extremely important to these social media users. They are only spending eight seconds with you; they want an authentic approach.

Benedict said the users on all of the social media platforms are different and CAC has designed content specific to each platform. "What works on one channel may not work on another platform," he said, as users browse these spaces for different reasons. Benedict shared many different ways CAC has adapted to this environment and is using social media to spread its message. During the Winter Olympics from South Korea in February, the Commission launched an "Opening Sharemony" promotion to piggyback on interest in that major worldwide sporting event. The social media posts highlighted different ways to make guacamole themed to the cuisines of various countries around the world, with these recipes shared as specific countries marched in the opening ceremonies. The promotion gathered nearly 200,000 total social impressions.

Benedict also shared how CAC targets consumers using social media to blanket the areas around the stores where California avocados are merchandised.

The research portion of the program was delivered by Research Program Director Dr. Tim Spann. He discussed a new focus that involves getting the information developed into the hands of growers. He said there will be more grower meetings and more avenues to make sure the industry's producers have accessibility to the research results that CAC has obtained. Spann encouraged signing up for area grower meetings.

He also reported that new rootstocks "PP40" and "PP35" are showing good salinity and phytophthora tolerance. UC Riverside has tentatively agreed to an "early release" program to expedite getting these selections to growers. This is an



CAC's Zac Benedict discussed online marketing.

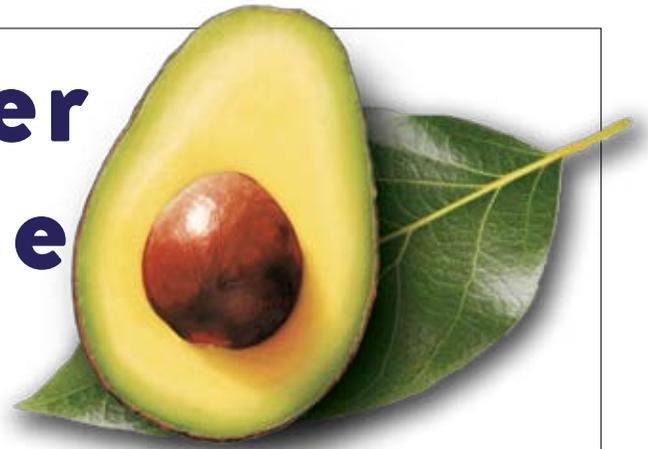
other of the Commission's efforts to reduce the gap between knowledge gained through research and applicability of that learning by growers.

Spann discussed the new avocado decision support tool, which is an interactive web-based tool that will help a grower maximize nutrition to improve his own productivity. Spann revealed that the tool would go into beta testing in April, with a target release date by summer. He also noted that CAC has worked to get an emergency release of gibberellic acid plant regulator – a natural plant hormone that improves fruit size and set and does not increase alternate bearing. The public comment period ended in March, and Spann said a new label should be forthcoming in a relatively short period of time.

During the question and answer period, growers were interested in many different topics but most notably concepts directly involving production issues and research. One discussion involved the GEM variety. Spann said there were about 500 acres in the ground with an anticipated production this year of one million pounds.

At the end of the Annual Meetings, Shade turned over the microphone to a Hass Avocado Board representative to discuss that organization, including its close working relationship with CAC. John McGuigan, HAB director of industry affairs, discussed some of the strategic priorities of HAB, including building demand, funding nutrition research, and providing supply & demand data. The majority of HAB's efforts revolve around nutrition research. McGuigan discussed the mechanics of HAB, including its operation and funding. He noted that the programs are 100 percent focused in the United States. HAB has a 12-member board, which is comprised of seven California producers and five U.S. importers, with USDA oversight. The assessment is 2.5 cents per pound on every avocado sold in the United States with HAB retaining 15 percent for its operations and rebating the other 85 percent back to the country of origin marketing groups. He added that since HAB's establishment, avocado per capita consumption in the United States has more than tripled. 🥑

Grower Profile



Avocados and Education: A Family Tradition

By Tim Linden

At a glance, the Kimball Ranch story is a quintessential American agriculture tale. More than 90 years ago, the family settled in the Santa Paula area, began growing avocados and citrus and today three generations are still involved in the pursuit, not falling far from the family tree.

But further examination reveals a group of avocado growers that have made their mark beyond the avocado grove – in engineering, academia and the race car world – while also paying homage to the agricultural pursuit.

The story actually begins in Carribou, Maine, where the family's roots can be traced back to the early 19th Century. In 1890, Allen Crosby Hardison graduated from the University of Maine with a degree in civil engineering. Some members of his extended family already had come to California and settled in the Ventura County area. Allen followed suit and with his expertise in engineering became involved with the development of some of the local water companies and districts. He also was an incorporator of the Limoneira Company in 1895, two years after it was co-founded by his uncle, Wallace Hardison. In 1911, Allen founded the Hardison Ranch Company, which first grew lemons and began growing avocados by the late 1920s. It is his granddaughter, great grandson, great granddaughter, and great, great granddaughter that recently



The Kimball Family includes from left to right: Gordon and Nancy Kimball, Dorcas Hardison Kimball Thille, Rachael Kimball Laenen and Maggie Kimball.

visited with *From the Grove* to discuss the family history and growing avocados in the Santa Paula district during the past 70 years.

Eighty-seven-year-old Dorcas Hardison Kimball Thille grew up on her father's avocado ranch, which was developed

in 1947 shortly after World War II ended. She farmed with her first husband, Charles Kimball, until his untimely death in 1961 and then continued farming with John Kelly Thille in the Santa Paula area until he passed away. Today she runs the 260-acre J.K. Thille Ranch and is on the board of Calavo. Along the way, she attended Stanford University and instilled her love for farming and education in her children and grandchildren.

Her son Gordon Kimball is the current patriarch of the clan and farms another 115 acres of avocados under the Kimball Ranch moniker. His sister, wife and daughter are all integral collaborators in the effort. Kimball bought his ranch in 1984 after he had already established himself in another career. As a kid, he got involved in Soap Box Derby and began a long love affair with car design and auto racing. It was his paternal grandfather who introduced him to the engineering aspect as he was the developer of the Kimball Topper, a mechanical tool used to top trees in the grove.

After graduating from Stanford in the mid-1970s with both a bachelors and masters in mechanical engineering, Gordon Kimball set out to make his mark in the auto racing sphere. Since then he has had an illustrious career designing and building race cars on both the Indy 500 and Formula One racing circuit. He and his family spent seven years in Europe with Formula One cars. Kimball worked in partnership with the late Ayrton Senna da Silva, a Brazilian racer considered one of the greatest Formula One drivers ever, who won three world championships while driving Kimball-designed cars.

While Kimball was deeply involved in the European car business, his sister Margaret got involved in the avocado business. She was another Stanford grad and, in fact, she spent more than two decades as the university's archivist, cataloguing everything of interest that pertains to the history of that great university.

Margaret – or Maggie as she is known – handled the administrative side of Kimball Ranches from her perch in Palo Alto. About five years ago, she became even more involved when she and her husband bought a five-acre ranch and “retired” to the Santa Paula area after spending a handful of years in New Mexico. “It’s our test ranch,” said Gordon.

The Kimball team began experimenting with different spacing configurations on the test ranch to gauge the output of

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different densities. The family was expecting to accumulate a bit more data on its density project before changing its tree spacing, but nature forced their hand. Their spacing work is coming in handy as the family replants the Santa Paula trees lost in the devastating Thomas Fire in December. “We are planting on a 20- by 10-foot pattern,” Gordon said. “That will give us 191 trees per acre.” Another key member of the team is Nancy Kimball, Gordon’s wife, who also has deep roots in the Santa Paula agricultural community. In fact, generations ago ancestors from both sides of the family worked together on the development of the local water district. Members of each family have served on that board throughout the years, including both Dorcas Thille and Gordon Kimball.

The final member of the current team is Rachael Kimball Laenen, Gordon and Nancy’s daughter. She spent part of her youth growing up in England and made the racing industry her first career after graduating from college with a degree in French and Italian literature. She lived in Europe and worked in event planning and hospitality for Mercedes Benz on the Formula One circuit for 11 years, before returning to the family homestead last summer. “Each time I came home, it was getting harder and harder to go back,” said Rachael. “I wanted to stay; I wanted to be part of this.”

Her parents also wanted her to be part of it as the next generation to carry on the family legacy. However, Gordon Kimball has no plans to retire from either of his life-long pursuits. He still runs Kimball Engineering and works on car designs, including for the team on which his son drives. You see, Charlie Kimball has followed the racing car branch of the family’s collective passion, garnering success on both the Indy and Formula One circuits.

Rachael believes the passion for agriculture in general, and avocado growing specifically, runs deep. “It’s fundamental; it’s in our genes.”

She notes the agricultural pioneering spirit that has been in the family for more than a century. In fact, Dorcas pipes up and tells the story of her grandmother following her husband to Peru 100 years ago to develop agriculture in that part of the world.

That spirit, and the involvement of multiple generations, will come in handy as the Kimball family rebuilds its business after the fire. Rachael said it is a challenging task and an endeavor that she didn’t expect she’d be thrust into so soon after coming back and switching careers. But she has shown that she is up for the task.

Gordon Kimball is taking a very matter-of-fact approach to the job as he has been there before. Since planting the grove in 1984, he has had to deal with significant crop damage as a result of freezes in 1990 and 2007 and a wildfire that wiped out 35 acres in 1976.

Dorcas notes that Mother Nature has a way of getting in-

involved once in a while. But she adds that the ranches that both she and her son run have been blessed with ample water – in part, thanks to the involvement of their ancestors – so that is not an impediment to replanting and rebuilding.

Rachael said that after the December fire, the family sat down and mapped out a long range plan for replanting, taking into account the economics of the situation. “We discussed lemons and other crops but in the end, we decided avocados were the right crop for us.” Maggie noted that “Gordon is a very good avocado grower” and it only made sense to stick with something you do better than others.

By 2020, they expect to have the vast majority of their lost trees replanted. Economics is a limiting factor but so is the availability of trees. They all agreed that the avocado still has a very bright future in California. Showcasing her business acumen, Dorcas recalls being part of the long, hard fight to keep Mexico out of the U.S. market. “But in the long run, it’s the best thing that ever happened to us. We don’t have to buy our shelf space back every year.”

She added that the touting of the avocado’s nutritional elements have helped stimulate sales even further. “Everyone should eat at least half an avocado every day,” she quipped.

Rachael said their decision-making process to stick with avocados factored in the continued growth in consumption in the United States and around the world. “Eating avocados has become a cult thing,” she said, and pointed to the premium position California enjoys in the marketplace.

But there also are challenges. Dorcas expressed frustration about the many regulations imposed on farmers by non-agriculturalists in the government arena. “They do not know agriculture but they want to micro-manage us.”

She did say that the next generation appears to be interested in where their food comes from, which means they might take a greater interest in agriculture. One might presume that could lead to fewer onerous regulations. Displaying the family’s reverence for education, Maggie added: “We do need to educate non-farmers and the next generation about agriculture.”

She also expressed optimism for the future because of the healthier life style that people are living today, which is leading to a greater respect for those who farm the land. Rachael believes the agricultural industry needs to do more “to share our stories” and introduce more people to the realities of farming.

In his circumspect way, Gordon said history portends a good future for the industry. “Look at the past 150 years. Agriculture has faced many challenges, but it has always responded and survived those challenges.” 🍌

Allesbeste Boerdery, Kwekery and Padstal

In 1927, Dr. Adalbert Henry Ernst, a medical doctor, moved his family from Ceylon (modern day Sri Lanka) to South Africa where he purchased 200 hectares (ha; about 500 acres) of farm land in the Lataba region of Limpopo province. Dr. A.H. Ernst produced citrus, timber, cattle and vegetables, laying the foundation for A.H. Ernst and Sons.

In the mid-1960s, under the direction of son Chicot Ernst, the citrus was removed due to citrus greening disease and the first avocado and bananas were planted. Today, led by the third generation, Dr. Andre Ernst, the farm continues to evolve and is slowly removing the banana trees and expanding its avocado production.

Andre took over the farming operations from his father in 1980 and established the modern company known as Allesbeste Boerdery, Kwekery and Padstal — literally translated to “All Best Farm, Nursery and Shop.”

Nursery Operations

Allesbeste is one of three major avocado nurseries in South Africa producing trees on clonal rootstocks. Allesbeste propagates their trees using a method they developed, which they refer to as “micro clones.” The technique

is a modification of the Brokaw method (commonly referred to as the Frolich method in South Africa). They believe the micro cloning technique, which is described below, has several advantages over the Brokaw method, including:

- The ability to produce more than one clonal plant per nurse seed
- Repeated use of the nurse seed until it is exhausted
- Reduced propagation cost due to efficiencies of the technique
- Reduced shipping costs for micro clone trees
- No risk of nurse seed survival in finished trees
- Improved tree uniformity

The micro cloning technique begins with a nurse seed just like the Brokaw method. Allesbeste likes to use ‘Edranol’ seeds because of their large size, but also use ‘Velvick’; they produce about 50 percent of their nurse seeds in their own groves. Large seeds can be split in two, through the embryo, resulting in two nurse seeds from one.

Nurse seeds are sterilized in hot water (122 °F) for 30 minutes before being sown in community flats. The flats are held at 77 °F with humidity of about 95 percent; germination usually occurs in 12 to 15 days. As the seeds germinate, they are removed from the community

flat, sorted and transplanted into liner bags about 2.5 inches in diameter and 6 inches deep. When the seedlings reach a diameter about the size of a pencil, they are ready for the rootstock graft.

The rootstock of choice — ‘Dusa’, ‘Duke 7’, ‘Bounty’ — is grafted to the nurse seed using a whip graft. The grafted nurse seeds are moved to an etiolation room, where the rootstock grows in darkness, producing a blanched (white) shoot or shoots that are ready to be rooted.

The etiolated rootstock shoots are slightly wounded and treated with rooting hormone. A small micro clone container, which is about 1-inch square and 4 inches long, is slipped over the etiolated rootstock stem and filled with potting media. Some of the rootstocks produce more than one shoot during the etiolation process and when this occurs both shoots will be rooted. The plants are moved to a heated greenhouse with a minimum temperature of 68 °F for rooting.

Once rooted, usually in about 20 days, the micro clones (still attached to the nurse seed) will be grafted with the scion variety of choice. Typically, when the rootstock has produced more than one sprout, one will be stronger. The stronger shoot will be grafted and the

weaker one will be removed from the nurse seed and allowed to grow for an additional week or two to catch up before being grafted.

After the scion graft has produced a shoot and the first flush of leaves has hardened off, the micro clone is severed from the nurse seed and transplanted into seven-liter grow bags to produce a finished tree. The nurse seed with rootstock is returned to the etiolation room to produce another one or two shoots to repeat the process a second time. With this method, Allesbeste is producing at least two trees from each seed and at least four in the case of split seeds.

Allesbeste considers traceability to be crucial to maintaining a quality product. Throughout the propagation process, the nurse seed mother tree, the rootstock budwood mother tree and the scion budwood mother tree are tracked and every tree's origins can be fully traced. In addition, the identity of the rootstock and scion grafter also is tracked up until the micro clones are transplanted into the large grow bags.

In recent years the nursery has undergone several expansions and is getting ready for another one. Their current capacity is 200,000 clonal trees per year and they are sold out through 2026!

In the spirit of innovation that defines Allesbeste, its in-house IT department is working on an RFID (radio-frequency identification) system to allow for easier tree tracking. The hope is that this system could be extended one day to the field and be used to track individual trees for their entire life.

They also have recently opened four satellite locations throughout South Africa. Ungrafted micro clone trees are shipped — 100 per box — to the satellite locations where a contracted grower grafts and finishes the trees to Allesbeste standards. This system significantly reduces the transportation

costs associated with getting trees to other growing regions and allows Allesbeste to charge the same price for trees wherever they are sold.

Speaking of selling, finished tree prices went up 33 percent in 2017 and are likely to go up another 25 percent next year. Currently Allesbeste sells finished clonal trees for about \$10.

Farming Operations

In total, Allesbeste now has four different farm locations with a total of about 230 ha (568 acres) of avocados and the ability to plant another 100 to 130 ha. The original 200 ha farm now has about 130 ha (230 acres) of avocados, with timber, bananas and preserved areas making up the balance of the acreage. Allesbeste intends to replace the bananas with avocados as tree availability allows.

The fourth generation of Ernsts, Andre's sons Zander and Edrean, oversee the farming operations. Zander specializes in farming practices and Edrean oversees the company's technology department, applying modern technology to the farming operations. Just as in the nursery, Allesbeste's farming operations are marked by innovation and testing with more than a decade of substantial trialing and testing.

- 2006: First high density 'Maluma' trial planted, 4.5 ha
- 2009: High density commercial block planted, 12.5 ha
 - Dusa, Duke 7 and Bounty rootstock trial planted
- 2010: First high altitude (1,200 meter, 4,000 feet) 'Maluma' trial, 1.8 ha
- 2012: First ultra-high density trial planted, 1 ha at 2.5 x 2.5 meter spacing
- 2014: 'Dusa', 'Duke 7' and 'Bounty' 4.8 ha trial
- 2015: Rootstock trial, 'Maluma' on 28 different rootstocks, 1.2 ha

- First drip irrigation trials started
- Improved stump grafting method applied to 25+ ha
- 2016: First trellises installed with 60 trees on Bounty and Dusa rootstocks
 - Drip irrigation moves to commercial scale
 - Precision orchard development implemented
- 2017: Commercial scale trellis trial, 1.9 ha
 - Top-work 1000+ trees to four new semi-commercial varieties

To manage tighter tree spacings, Allesbeste utilizes mechanical hedging equipment followed with hand pruning. Their theory is to use the hedger to establish the overall size of the canopy, but the hedger produces random heading cuts. Therefore, they follow the hedging with hand pruning to clean up the random heading cuts and prune limbs back to lateral branches. This disrupts the hedged "wall," creating an irregular shaped canopy with holes where light can penetrate. They prune annually, and the method is proving to be quite effective.

In a recent planting on a steep slope, Edrean used a drone and RTK (real-time kinematic) mapping software to develop a detailed topographic map of the hillside. Software was then used to determine precisely where to make cuts in the hillside to develop terraces, following the natural contours, with 1 to 2 percent pitch to direct runoff. The terracing essentially turned a 45-degree slope into a planting with an effective grade of no more than 5 percent. They are continuing to look at how else drones and various imaging technology can be used to improve their grove management operations.

Allesbeste is actively seeking new rootstock and scion varieties for use in South Africa and elsewhere. They have been instrumental in bringing the



1. Nurse seeds graded and ready for rootstock grafting; 2. Nurse seeds grafted with rootstock; 3. Etiolated rootstock shoots with the micro clone containers in place to induce rooting; 4. Micro clones being grafted with scion variety; 5. Finished micro clones ready for transplanting to 7-liter grow bags; 6. Micro clones being transplanted into the 7-liter finishing containers; 7. Zander Ernst discusses Allesbeste's trellising trials with Avocado Brainstorming 2018 attendees; 8. Finished trees ready for sale; 9. Tags identifying the nurse seed, rootstock budwood and scion budwood mother trees; note that the tags stay with the finished trees; 10. A terracing trial mapped and designed using drones and imaging software technology.

Maluma cultivar and Bounty rootstock into common use, and a future *From the Grove* article will look at these two selections in detail. Currently, they have four scion cultivars in semi-commercial trials and are getting ready to plant a rootstock trial with 60 different rootstock selections.

In addition to nursery and farm

operations, Allesbeste also is the majority owner of the Afrupro packinghouse and runs a high-end farm store (padstal) that sells fresh produce from their own orchards and local farms, as well as various locally made jams, jellies, preserves, pickles and candies.

Allesbeste is a four-generation strong farming enterprise that is poised

to be a major player in the South African avocado industry for years to come. Their innovation and drive to continue moving the avocado industry forward is impressive and can serve as a model for other major avocado producers. 🥑

2017/18 Mid-Season California Avocado Crop Update

The California Avocado Commission (CAC) would like to thank all of the growers who participated in the recently concluded California Avocado Grower Crop Estimate Survey. Crop survey forms were mailed out in mid-April with an early May return date. Responses represented a wide range of grove sizes from across the growing regions, with more than 21,000 acres reporting (nearly 43 percent of CAC's bearing acreage). While CAC typically prefers an overall survey response rate closer to 50 percent, because the response rate of many of the individual growing regions was near that threshold, we believe the overall survey results capture a fairly accurate snapshot of the industry and the crop currently being harvested.

The mid-season crop update is compiled by applying survey responses to predefined avocado acreage according to growing region to project an estimated total industry volume. For the purposes of the mid-season crop update, CAC typically performs an annual aerial spring survey to update avocado acreage. This year, however, CAC has contracted with a new company to complete the acreage survey, and as part of the project, will be utilizing a more in-depth, boots on the ground approach to verify avocado acreage. As such, the results of this work will not be available until later this summer; therefore, existing acreage figures from 2016 were utilized to calculate the results of the mid-season grower crop estimate survey.

The results of the 2017/18 mid-season crop update, using 2016 bear-



ing acres, have yielded a crop volume of 340.5 million pounds (all varieties), nearly 35 million pounds less than the pre-season estimate of 374.6 million pounds. In addition to the grower survey, CAC recently conducted a round of handler crop estimate surveys — where responses ranged from 322.5 to 380 million pounds — that resulted in a mid-season crop estimate of approximately 360.5 million pounds (results are computed based on average).

While crop estimating can be difficult to perfect, CAC management will continue to review, monitor and evaluate the available datasets to estimate the California crop in an effort to provide the industry with the most accurate and timely statistics possible. Whether the final harvest volume is 340 or 360 million pounds, these mid-season estimates have confirmed for CAC that the industry is on track for a sizeable crop

that provides promotable volumes of premium quality product throughout the California avocado season.

Included on the following page are details of the 2017/18 mid-season California Avocado Grower Crop Estimate Survey, which contain variety breakdowns and production by county. A few important items to note when reviewing county production details — historically, the crop estimate for San Diego County has been overstated, while Ventura and Santa Barbara Counties are typically underestimated. Despite these discrepancies, the mid-season estimate has proven accurate, within 3 percent, during the last three years.

Additional mid-season survey details also can be found on the Commission's grower website at CaliforniaAvocadoGrowers.com/industry/crop-projections-and-estimates/2017-18-mid-season-crop-estimate. 🍷



California Avocado Mid-Season Crop Update 2017/18

Variety	Bearing Acres	Estimated Yield		Response %
		Lbs/Acre	Lbs (MM)	
Hass	48,458	6,829	330.9	43%
Lamb-Hass	1,587	4,984	7.9	37%
Other	811	2,115	1.7	26%
Total	50,856	6,696	340.5	43%

County	Hass Only			All Varieties		
	Bearing Acres	Estimated Yield		Bearing Acres	Estimated Yield	
		Lbs/Acre	Lbs (MM)		Lbs/Acre	Lbs (MM)
San Diego	16,760	7,384	123.76	17,741	7,161	127.05
Riverside	4,974	6,341	31.54	5,058	6,290	31.81
Orange	1,198	5,632	6.75	1,250	5,399	6.75
Ventura	16,074	6,674	107.28	17,104	6,570	112.38
Santa Barbara	4,889	6,954	34.00	4,980	6,871	34.22
San Luis Obispo	3,952	5,833	23.05	4,015	5,842	23.46
Minor Counties	611	7,449	4.55	708	6,906	4.89

Estimated yields are on-tree forecasts and do not attempt to adjust for weather factors or project carry-out. Bearing acres include producing and topped/stumped trees four years or older.

ACE Statistics: 05/15/18



The soil moisture sensor trial planting at the end of year one. The row in the foreground is a mulched row and the next two rows are not mulched.

Using Soil Moisture Sensors to Schedule Avocado Irrigation – First Year Trial Report

In April 2017, the California Avocado Commission (CAC) planted a trial at Pine Tree Ranch in Ventura County to look at using soil moisture sensors to manage irrigation in avocados and to determine potential water savings that could be achieved compared with traditional calendar-based irrigation scheduling.

Trial Design

The trial was planted on April 4, 2017, with ‘Hass’ on ‘Toro Canyon’ and consists of eight rows of 20 trees planted at a spacing of 10 feet between trees and 15 feet between rows. Four of the eight rows were mulched to look at the potential added benefits of mulch on water savings. The trees were established on

drip irrigation using one one-gallon-per-hour dripper per tree.

Each pair of rows — one mulched, one not mulched — serves as a treatment block for a total of four treatments. The treatments originally were planned to be irrigation-based using one of three different types of soil moisture sensors and a calendar-based control. However,

as will be detailed later in this article, some of the sensor types have proven unreliable so the treatments have been modified and are now as follows:

- Irrigate based on soil moisture sensor data to turn on/off at designated soil moisture readings
- Run daily if evapotranspiration (ET) has exceeded a preset cumulative threshold and turn off based on flow meter data
- Run daily if ET has exceeded a preset threshold and turn off based on soil moisture sensor data
- Calendar-based irrigation

These treatments were implemented in the spring of 2018 and results will be discussed in future articles.

The project is irrigated from well water stored in two 5,000-gallon tanks. The tanks fill automatically when the well runs using a float valve. A small electric pump is used to pump the water from the tanks and irrigate each row as needed. This setup allows us to operate this small test block independently from the rest of the ranch.

Soil Moisture Sensors and Flow Meters

Three different types of soil moisture sensors are used in this project. The sensors used are:

- EnviroPro EP100G-04 capacitance probe
- Irrometer Watermark 200SS granular matrix sensor
- Acclima SDI-12 Digital TDT sensor

The pros and cons of each of these sensors, based on our year of experience with them, will be discussed in more detail later.

Within each of the eight rows of the planting, one or two trees were selected to be the data tree(s). Every row has an EnviroPro sensor installed on one tree. The four non-mulched rows also include the Irrometer and Acclima sen-



An in-field data logger and radio station used to record and transmit soil moisture sensor data back to the base station.

sors. The EnviroPro sensors are a single 40 cm (approximately 16 inches) probe with temperature, moisture and salinity sensors built in at 10 cm intervals (4, 8, 12 and 16 inches approximately). The Irrometer and Acclima sensors are individual sensors and were installed in sets of three at 4-, 10- and 16-inch depths.

The entire system is equipped

with four Netafim M series flow meters. Each meter records the flow for two rows (one mulched, one not mulched) and the data are captured electronically. By comparing the time stamps on the flow data and the valve opening/closing we can determine the exact volume of water applied to every row.



The water tank, irrigation controller, valves and flow meters used for the soil moisture sensor trial planting.

Control System

Because of the number of sensors we are using in this project and the fact that we are using different types of sensors with varying data outputs, we did not use a traditional control system that growers would be familiar with (e.g., Ranch Systems). The control system used for this project is from ADCON Telemetry, a Vienna-based company with extensive expertise in data collection, radio and cellular communications, and software development. The ADCON system essentially allowed us to create a unique system for this trial and to manage the trial exactly as needed.

Each soil moisture sensor's data

is captured by a data logger in the field. That data is transmitted by radio to a base station elsewhere on the property. That base station is connected to a PC that runs the ADCON software and can be programmed to manipulate the irrigation in whatever way we need. The computer is then connected to the Internet, which allows users to access data, make programming changes or simply monitor things from anywhere in the world.

What We've Learned in the First Year

Sensors: The Acclima sensors are a moderately priced sensor option (about \$200 each) for those who want to solely

monitor soil moisture. These sensors use a technology called time domain transmissometry (TDT) to measure soil volumetric water content (the percentage of soil pore space filled with water). They measure the speed of an electrical pulse through a loop. In principle, the wetter the soil is the slower the pulse moves. One advantage of this technology is that the readings produced are highly stable over a wide range of soil temperature and salinity.

However, the soils we have at Pine Tree Ranch are very gravelly and this has proven to be the Achilles heel for the Acclima sensors. The readings they provide are erratic at best and not reliable or consistent enough to be used for turning irrigation on and off. In a finer textured soil or a nursery setting with soilless potting medium this type of sensor can be very reliable, but there are probably very few avocado growers who have the ideal soil type for this type of sensor.

The Irrrometer Watermark sensors are very inexpensive — \$40 each — and are time tested, reliable technology. Watermark sensors measure soil moisture as tension, which is analogous to how easy or difficult it is for a plant root to extract water from the soil. A soil tension of 0 indicates a saturated soil and the tension increases as the soil dries out. This is the same principle that a tensiometer works on, but the Watermark uses a pair of electrodes in a special matrix to measure changes in electrical resistance due to moisture content. Unlike a tensiometer, the Watermarks are installed permanently and do not need periodic servicing. Like the TDT sensors, they are relatively unaffected by soil temperature and salinity.

The Watermark sensors have proven reliable over the past year. However, that reliability is predicated on a good installation, which can be tricky, especially in gravelly soil. If installed

correctly, these sensors should provide years of reliable service. The Watermark sensors provide a lot of flexibility when it comes to reading the data. The sensor leads can be connected to a datalogger and computer system for continuous monitoring, or they can be read manually by periodically connecting a small battery-powered meter to the sensor leads.

The EnviroPro sensors are the Cadillac of sensors with each 40 cm probe costing about \$1,000. Although that sounds like a lot, and it is, consider that these probes have 12 sensors built into them — temperature, moisture and salinity at four different depths. If all those sensors were purchased separately the cost would be similar. However, not everyone is going to need or want all that data, but for those who do this type of sensor is a good deal.

The EnviroPros are capacitance probes. That means that, like the previous two types of probes, they use the concept of electrical resistance to determine soil moisture. As soil moisture increases, the capacitance changes, which is directly correlated to water content. The EnviroPro probes have built in technology to correct soil moisture for variation in salinity, and moisture and salinity are both autocorrected for temperature.

Over the past year, the EnviroPros have proven to be the most consistent sensors we have installed. Since they are a straight probe (about 1.5-inch diameter) they can be affected by installation, especially if the soil does not make continuous contact with the length of the probe. Water channeling — i.e., water flowing down the length of the probe between the probe and the soil — also can be an issue and will result in errant readings. Again, this issue can be avoided with careful installation.

Mulch: Agromin generously donated their ES-2 mulch for use in this

trial. This is a recycled wood mulch product consisting of 2-inch minus pieces. To date it has been difficult to discern any significant benefit of mulch in terms of soil moisture content. This is likely because the trees are still young, and we did not place the mulch tight against the trees but kept it back about

6 to 8 inches all the way around the tree. Since we have been applying water through a single dripper between the mulch and the tree trunk and the soil moisture sensors are in this same area we may simply be missing the mulch effect at this time. That said, mulch has a myriad of benefits for your trees beyond

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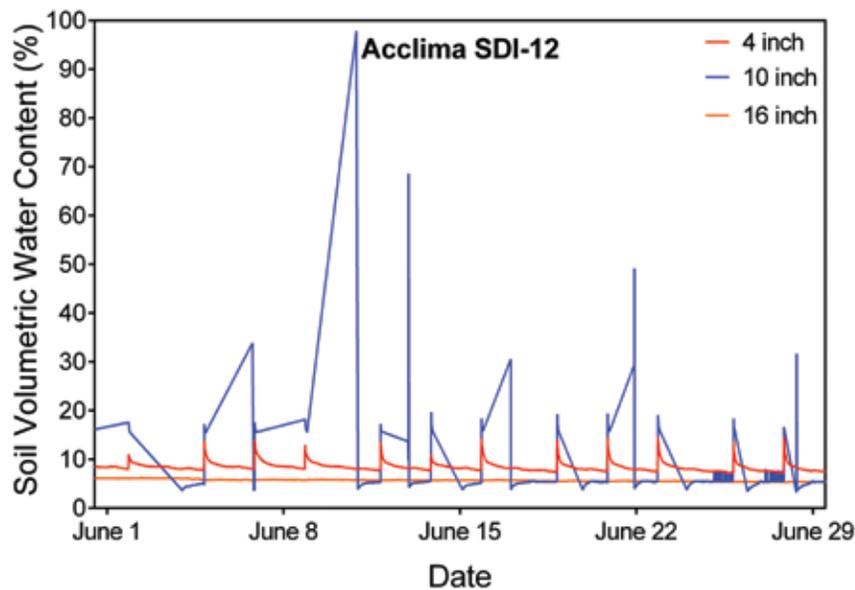
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Data from June 2017 for the Acclima SDI-12 soil moisture sensors installed at three different depths at Pine Tree Ranch. Notice the erratic data from the sensor at 10 inches and the lack of movement in the sensor data at 16 inches. This sensor design has proven unsuited to the soil conditions at Pine Tree Ranch.

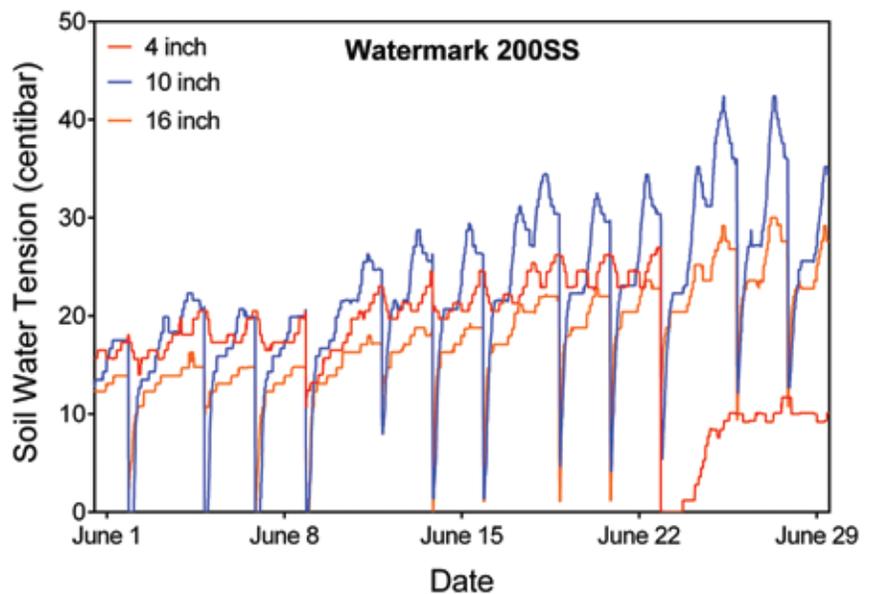
simply retaining soil moisture, so it is still a recommended best practice.

One unanticipated side effect of the mulch application was the attraction of coyotes. Within a week of application, we noticed very large volumes of water flowing during irrigation sets. We found several lines chewed, only in the mulched rows. The damage stopped after a couple of weeks once the mulch had aged a bit, but the fresh mulch was apparently very attractive to coyote pups who liked to dig in it and chew on irrigation lines. We have heard of growers having similar experiences, so you should be aware of this potential issue when applying mulch.

Soil Moisture: Samples of the data from all three sensors for June 2017 are shown in the accompanying graphs and demonstrate the inconsistency associated with some of the sensors. Some of this inconsistency could potentially be corrected by removing and reinstalling the sensors, and maybe sifting the

soil to ensure there are no rocks touching the sensor. However, part of our objective for this project was to find sensors that are user friendly and don't require finicky installation. Making too many modifications to the environment around the sensor — such as sifting out rocks — may give more consistent data, but those data may no longer be indicative of what is happening with the soil the tree is growing in.

One interesting observation that has come from watching the soil moisture conditions over the first year is noting where the trees are using water. The deepest sensors, at 16 inches, showed very little change between irrigations after the soil reached field capacity. This indicates the trees are not taking up much water from these depths. This is well-illustrated in the graph showing the EnviroPro sensor data and also can be seen in the Watermark data. For the



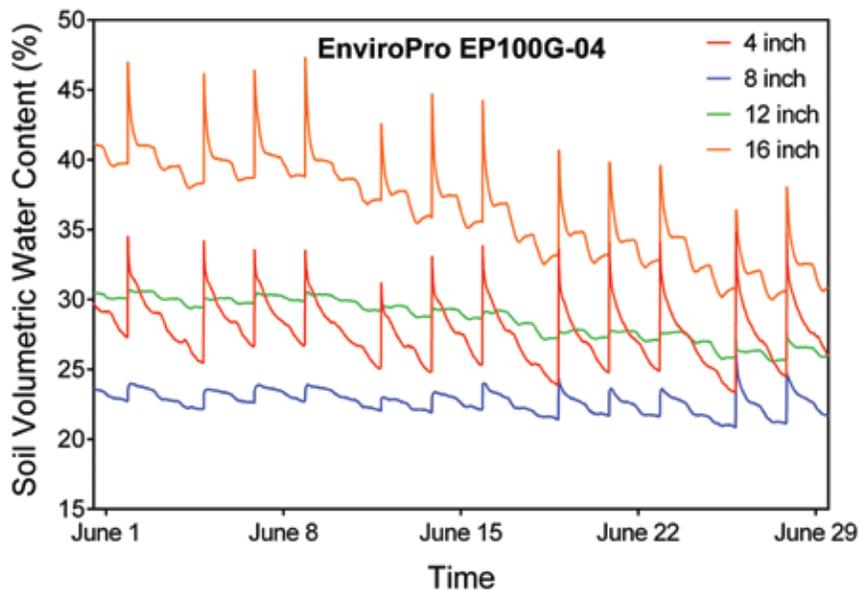
Data from June 2017 for the Watermark 200SS soil moisture sensors installed at three different depths at Pine Tree Ranch. A lower soil water tension value indicates wetter soil. Note the different wet/dry patterns for the sensors at different depths and the changes from early June (cooler temperatures) to later June (warmer temperatures).

EnviroPro data, the higher the volumetric water content percentage, the wetter the soil; whereas for the Watermarks, the lower the soil water tension value, the wetter the soil. The 16-inch depth is clearly the wettest soil in the profile for both of these sensors.

In contrast, sensors at 4 inches showed the greatest fluctuation between irrigations illustrating the influence of solar radiation and wind, as well as tree uptake. This can best be seen in the EnviroPro data where there was about a 10 percent variation in soil moisture between irrigations at 4 inches compared with the other depths that were steadier.

The sweet spot appeared to be in the 8-12-inch range. At these depths, soil moisture tended to be the lowest (lowest volumetric value or highest soil tension), indicating the driest soil. Again, both the EnviroPro and Watermark data demonstrate this. Interestingly, the deepest sensor (16-inches) revealed the water at that depth was available to the tree, but was apparently only accessed during hotter weather, such as occurred in the latter half of June 2017. For the EnviroPro data, the soil volumetric water content begins to drop steadily after about June 15; whereas for the Watermark data the soil tension steadily increases after June 15.

The interesting and important dynamics of soil moisture cannot be observed with the naked eye. Regardless of whether you are in a situation where you can fully automate your irrigation, soil moisture sensors can prove a valuable tool for improving grove management. Soil moisture sensor data allow you to better understand where the water is going when you irrigate, monitor tree water use and know how much water is left in your soil. This information can help you avoid overirrigation, as well as avoid periods of drought stress because of too infrequent irrigation. 🍷

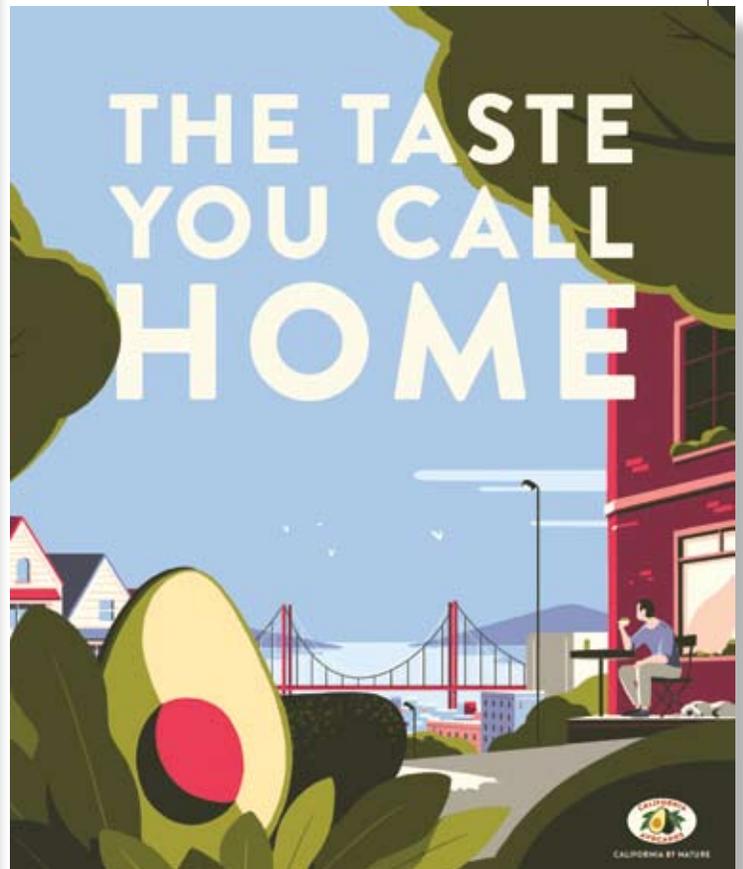
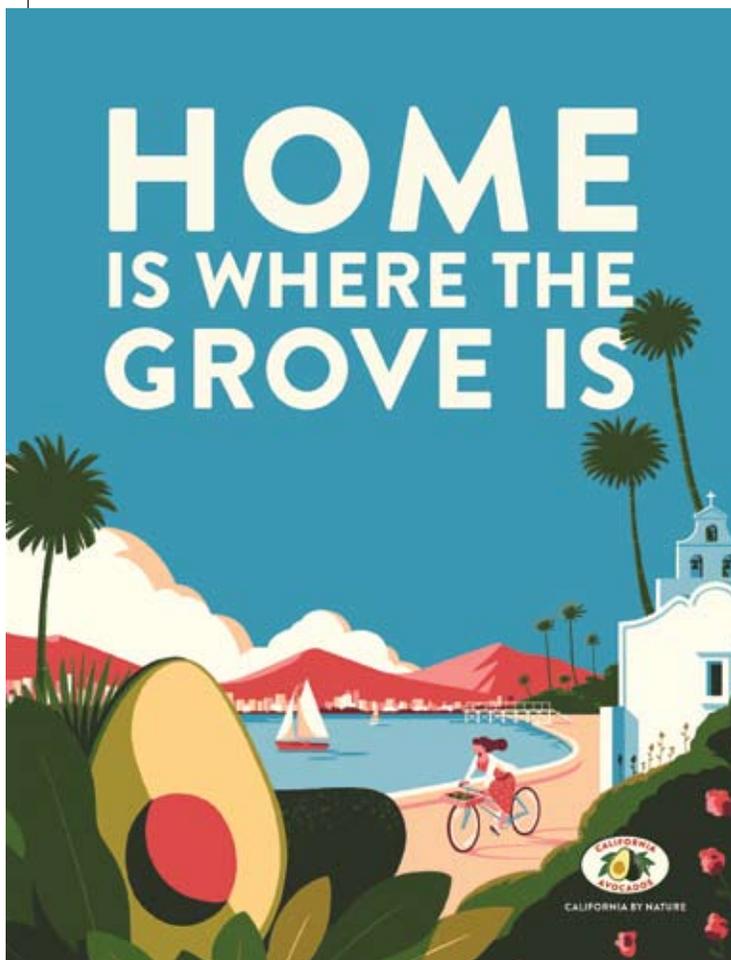


Data from June 2017 for the EnviroPro EP100G-04 soil moisture sensors installed at Pine Tree Ranch. This sensor probe has integral sensors at four depths. Higher volumetric water content indicates wetter soil. Note the different wet/dry patterns for the sensors at different depths and the changes from early June (cooler temperatures) to later June (warmer temperatures).

(Funding for this project was provided by the California Department of Food and Agriculture Specialty Crops Block Grant program Agreement No. SCB16061.)

Fresh Consumer Advertising Campaign for California Avocados

Fresh advertising creative and innovative media plans are on tap to support this year's California avocado harvest. The California Avocado Commission (CAC) is continuing its *Made of California* marketing campaign with new creative and customized marketing plans that promote close-to-home California avocados. Print and outdoor ads have a fresh look with illustrations specific to the market in which they will appear, showcasing how close fresh California avocados are grown to the consumers in those areas.



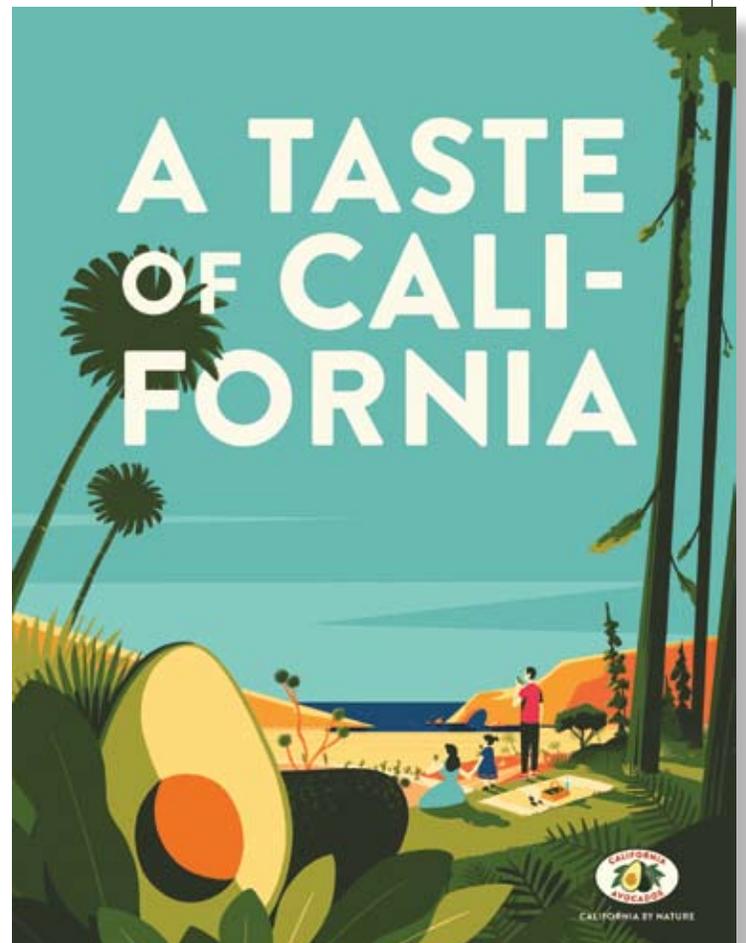


Within California, the creative emphasizes that locally grown California avocados are grown close to home, and in other areas CAC’s ads promote “A Taste of California”. Complementary content with multiple digital partners, including the very popular *Tasty*, features “Iconic California” recipes that emphasize the connection between California avocados and the Golden State.

“The new creative is designed to create an emotional connection with avocado consumers in the region, helping them to realize just how close they are to where the fruit is grown,” said Jan DeLyser, CAC vice president marketing. “The messaging is designed to increase the value, preference for and loyalty to California avocados in season.”

The Commission’s media plan focuses on key markets and retailers where California avocados are in distribution, including California, markets in the west, and loyal chains across the country. The plan targets the “super users” of avocados who drive category sales. These super users represent about 80 percent of category sales in California avocado markets.

Blending traditional media tactics, such as print, outdoor and in-store radio, with digital and audio advertising, online content and social media, the plan is flexible and customizable to support participating retailers (see story on page 42). Outdoor “wild postings” are optimized to encourage consumers to engage by taking selfies with the graphics and sharing on their social media channels. California avocado growers are encouraged to share any selfies they take and let the Commission know. Locations of the wild postings can be found at CaliforniaAvocadoGrowers.com/articles/california-avocado-commission-score-number-firsts-consumer-advertising-season. 🥑



Multi-faceted Early Season Campaign Reaches Consumers at Home & on the Go

With consumers eager for the start of the California avocado season, the California Avocado Commission (CAC) launched an early-season integrated campaign to drum up excitement for the fruit while making it easy for consumers to locate nearby retail locations with fresh California avocados on display. Using a combination of traditional, digital and social media channels, the Commission was able to engage with consumers on the road, at home and in the store with a series of videos, recipes, contests, giveaways, ads, promotions and posts.

chandising California avocados.

The Commission also provided recipe videos — customized with colorful end cards showcasing the California avocado brand and retailer logos — for retailers to post on their own social media channels.

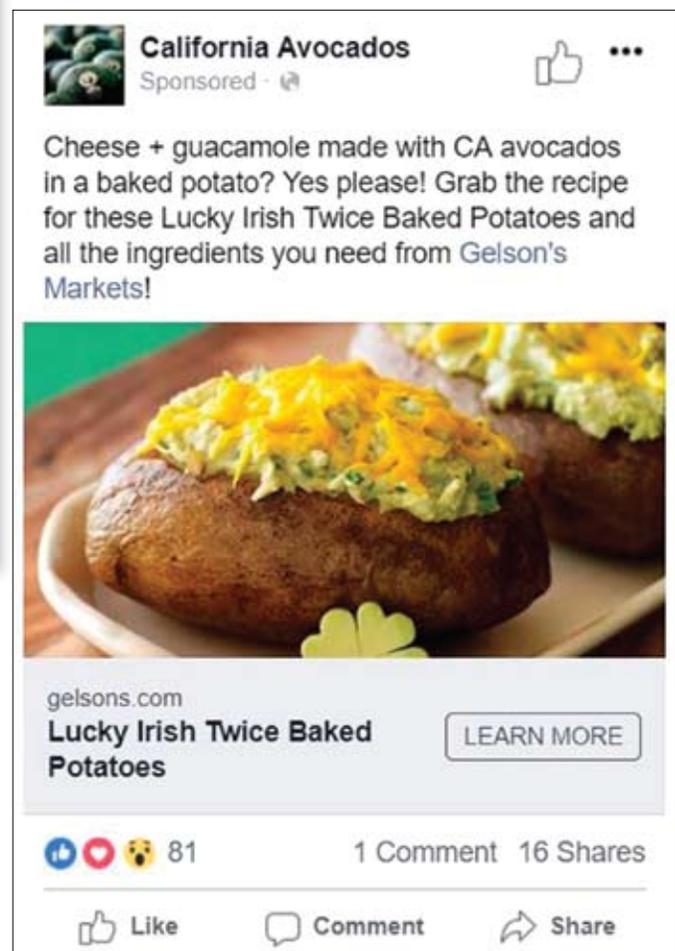
Using precise social media targeting technology, the Commission engaged with “Premium Californians” in close proximity to retailers with fresh California avocados on hand. Twitter posts were targeted to zip codes of retail locations while Facebook posts were targeted to a three-mile radius around retail locations. These highly-targeted posts are used throughout the California avocado season and activated in real-time



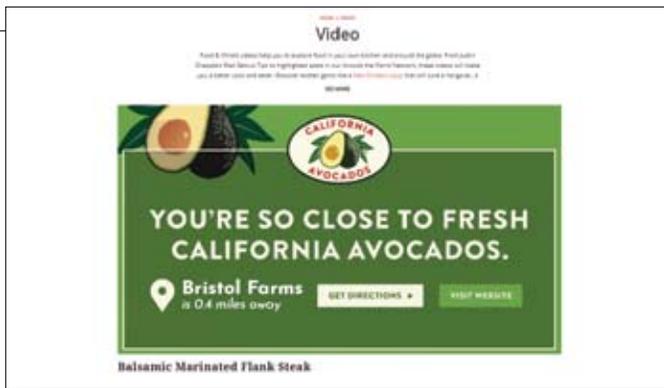
As California avocados arrived in partner retail locations, the Commission showcased the retail chains on its social media channels and encouraged fans to visit their local vendor.

Recipes & Store Locators Pique Interest

One of the most effective means of piquing the interest of California avocado devotees and driving sales of the fruit is providing fans with new recipe ideas and an easy means of locating a California avocado retailer. To that end, the Commission launched a series of videos featuring iconic California avocado recipes ranging from classic guacamole and *California Avocado Grilled Cheese* to *California Eggs Benedict*. CAC released the videos on its social media channels and tagged selected retailers to showcase which retail chains were mer-



Consumers within a three-mile radius of a Gelson's location were targeted with this Facebook post featuring the chain's St. Patrick's Day promotion.



This Food & Wine recipe video featured a California avocado overlay that made it easy for the viewer to locate the closest California avocado vendor.

to dovetail with retailers' special promotions, such as Gelson's St. Patty's Day celebration.

The Commission also assisted its retail partners with friendly "take overs" of their social media channels. As part of Bristol Farms' Cinco de Mayo celebration, the Commission "took over" the chain's Instagram channel showcasing California avocado recipes during this peak consumption period.

Digital media partners for 2018 were selected based on audience alignment with CAC's targeted consumer and the platforms' targeting capabilities. While consumers viewed content in select digital publications, banner ads and pre-roll video overlays informed them they were "so close to fresh California avocados" and provided them with directions to the nearest retail location. In a similar fashion, Pandora listeners could view audio ads with retail tags making it easy for them to access recipes and locate California avocados.

Using PlacelQ and other technology, the Commission targeted its mobile ads based on a consumer's location — be it near a California avocado grove or a select grocery store.

In-store Promotions Showcase Start of the Season

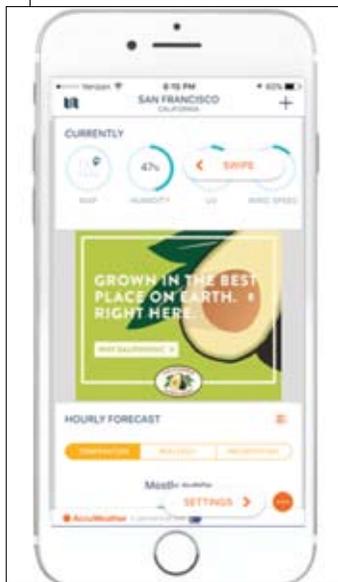
To generate excitement around the California avocado season within retail locations, the Commission provided custom display bin inserts and POS (point-of-sale) materials featuring CAC's 2018 illustration creative.

The Commission also hosted a series of sales contests to in-

spire promotional creativity. Retailers including Bristol Farms, Mollie Stone's, Ralphs and Safeway NorCal participated. In addition, California avocado in-store demos were held at Dierbergs, Hy-Vee, Sam's Club, Schnuck's and Walmart. Each of the retailers provided a unique demo experience for the customers — ranging from cross-promotional demos with Triscuit® and Cinco de Mayo recipes to camping-themed recipe ideas and cross-promotional guacamole and salsa Memorial Day-themed samples. The demos reached a broad swath of targeted markets, with in-store events held in retail chains located in Arizona, California, Colorado, Missouri, Nevada, New Mexico, Oregon, Utah and eight Midwest states.

Building awareness concerning the nutritional value of California avocados also was a critical component of the Commission's retail promotions. At Raley's, every team member received information about the role avocados play in good health, including an article and video by Registered Dietitian Nutritionist Manuel Villacorta, and a California avocado spreader. California avocados were featured in Raley's chainwide May Team Member Wellness Campaign with prizes awarded to the top three stores and two Wellness Champion team members.

Raley's California avocado season consumer promotions paired wellness information with an American Summer Holidays and Summer Entertaining theme. The retail chain hosted a California avocado recipe contest on its Facebook page, and, in keeping with the summer-themed promotions, hosted a random drawing for a Weber Spirit 201 Grill provided by the Commission. 🥑



The Commission's mobile ads were triggered by a consumer's location — for example, after visiting a specific grocery



CAC developed custom bin inserts featuring 2018 California avocado season illustrations for Ralphs.

Three Retired Retail Veterans Offer Perspective on the Rise of the Avocado

By Tim Linden

To Mike Aiton it is still somewhat of a mystery why he and Denver's King Soopers played a pivotal role in the launching of "Ripe for Tonight" California avocados.

It was 1982 and Aiton was the director of produce and floral at King Soopers. It was a local chain that did have about a 50 percent market in Denver and the surrounding communities. But, according to Aiton, King Soopers did not have a national presence and somewhat flew under the radar. One day Gil Henry, longtime industry veteran and the top dog at Henry Avocado Corporation in Escondido, came knocking at the retailer's buying office. "I didn't know Gil Henry from third base, so why he chose King Soopers is beyond me," Aiton recalls. "It was quite an adventure and a great success story."

Henry wanted to greatly expand the amount of display space dedicated to "ready-to-eat" avocados. This was before avocado producers had forward distribution centers and regional ripening rooms. Henry started talking to Aiton and the two devised a strategy that they thought just might succeed.

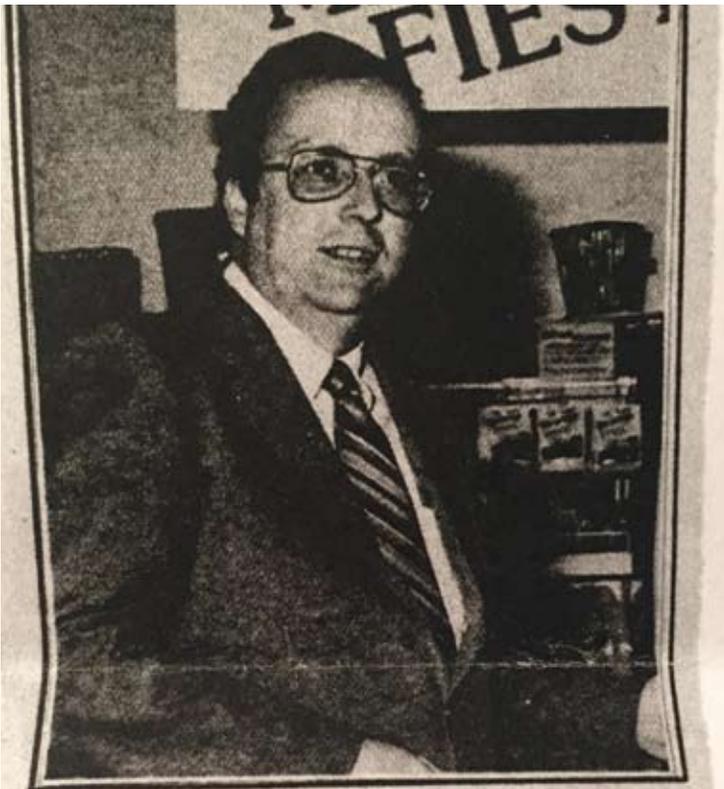
Over the next several months, Aiton, Henry and Vic Tocar, another Henry Avocado employee, put together the program. King Soopers converted two of its old banana ripening rooms to avocado ripening rooms and went about trying to figure out how to pre-condition the fruit so it could be sold "Ripe for Tonight".

The learning process wasn't free. "I have to tell you, it did cost us a lot of money," said Aiton. "But my boss came up through produce and was a former produce director. He let us do it. At the time, the driving force for most retailers was sales. Now margin is the first concern, but back then it was sales."

This seemed like a credible idea to increase sales.

Through trial and error, a protocol was developed and King Soopers began selling ripe avocados to its customers. The product was stickered with "Ripe for Tonight" labels that had been developed by the California Avocado Commission (CAC).

Editor's note: It is rare to have three produce industry leaders retire in such close proximity as Mike Aiton, Roger Schroeder and Hugh Topper did toward the end of last year and the beginning of 2018. Each have been significant retailer leaders who had a profound impact on the retailing of fresh fruits and vegetables. When thinking about the meteoric rise of avocados over the past 30-40 years, there is no doubt about their impact on California avocados. We thought it would be interesting to present their recollections about the growth of the category... the introduction of ripe, the versatility of the fruit, the opportunities with secondary displays and the positive impact resulting from year-round availability. Stay tuned for additional perspective offered by today's decision makers in the Fall issue of From the Grove.



Mike Aiton, the first retailer to merchandise controlled-ripened fruit, now is a strong believer in the benefits of providing shoppers the benefits of ripe avocados. He is with King Soopers in Denver.

In the early 1980s, Mike Aiton's help in launching a "Ripe Tonight" California avocado program was chronicled in a number of industry publications.

Aiton said for the initial promotion period the avocados were put on ad at two for \$1 and they almost flew off the shelves. "The customer reception was so good. I think we went through 5,000 cases of avocados during that promotion, which was 10 times normal. It became a regular part of our program. I give all the credit to Gil."

Over the years as both a retailer and an industry member, Aiton has watched the sales of avocados grow exponentially for a variety of reasons. As chronicled above, he knows the ripe program in the 1980s played an important role, but he said perhaps the most significant development in the rise of the avocado was when California switched most of its production to the Hass variety. Before that, he said there were Zutanos, Pinkertons, Fuertes – none of which were as good as the Hass, nor as consistent. "The Hass also extended the season; selling some of the other varieties was a hard sell."



Roger Schroeder was a longtime supporter of California avocados during his Southern California retail career which spanned more than half a century.

Roger Schroeder was another retailer who was on the front lines witnessing how the power of ripeness changed the trajectory of the avocado. He called CAC's relentless effort to convince retailers to carry ripe avocados the game-changing event that launched avocados into the mainstream.

"The California Avocado Commission had studies that showed that you would get at least a 25 percent increase in sales if you offered ripe fruit," Schroeder recently recalled. "When we tried it at Hughes (Family Markets), that's exactly what happened."

Schroeder began his career with The Vons Companies as a box boy in high school in the late 1950s. He quickly moved to produce and by the mid-1980s had risen to the position of second in command in the retailer's corporate produce department. It was then that he moved to Hughes and soon became its top produce guy. From the mid-'80s until his retirement earlier this year, he had a front row seat watching the mercurial rise of the avocado. "In those early days, avocados were an impulse buy. You needed ripe avocados to improve sales. That was one of the biggest turning points in the growth of avocados."

Going back further, the longtime retailer agreed the evolutionary switch to the Hass was another turning point. He remembers when Fuerte avocados and other varieties were also in the mix, which created an inconsistency of quality and tasting experience that hampered growth of the sector.

But Schroeder reiterated that selling ripe avocados at the right price point was the major momentum changer. Because of its close proximity to the point of origin for California av-



CAC's Dave Cruz with Hugh Topper of H-E-B. at a CAC event several years ago. H-E-B. was one of the first to use multiple displays for California avocados.

ocados, Hughes worked closely with the packer/shippers to have the ripe avocados delivered to the company's distribution center where they were then delivered to the stores. He said the company also worked with CAC on promotional opportunities. "That's when eating avocados started to become a habit and sales grew."

He said the Commission did an excellent job of touting other uses for the fruit and convincing consumers that guacamole wasn't their only option. He noted that Hughes' Southern California location was an advantage in the early days as the avocado was not unfamiliar to most people. There was a large and growing Hispanic population and avocados and guacamole were regular menu fare for many, many area restaurants.

Schroeder said the next big leap in sales and consumption came with the year-round distribution of the fruit. He moved to Stater Brothers in the late 1990s and watched avocados boom as their availability expanded. While California did expand the season as the Hass flourished, he said the advent of Mexico into the marketplace meant year-round supplies and year-round promotion, which has moved the avocado beyond the next level and into rarified air. "From a sales standpoint, today avocados are one of the top items in the department," he said, adding that they generate big dollars, have a good margin and are an excellent draw into the department.

Being that Stater Brothers is a California firm, Schroeder said the "California" designation on avocados is an important

selling point during that time of the year when the state is in production. "Our customers always lean toward California products. As a California company, we do believe it's important to support California producers. And also, for whatever reason, the quality of the fruit we get from California, is better."

The H.E. Butt (H-E-B) Grocery Company, headquartered in San Antonio, Texas, is another retailer that did not have to introduce its customers to the avocado in the '90s when sales started to take off. Like California, Texas shares a border with Mexico and Hispanic cuisine is commonplace. In fact, the fusion of cooking styles denoted by Tex-Mex dates back more than 150 years, with the recipes heralded on both sides of the border.

Hugh Topper, another longtime produce retailer, who recently retired from H-E-B, said about two decades ago the chain was actively seeking a way to increase avocado sales. It had heard of the success other retailers had with the ripe program "and we decided we needed to start our own program. We decided to do it in-house."

The company converted a couple of banana ripening rooms at its distribution center and launched the program. Sales took off and more space was devoted to the effort. To this day, H-E-B still does its ripening in-house. "We view it as a way to control cost and maintain control over the process," he said.

When they launched the effort, Topper said there was a learning curve, but they learned quickly and sales took off. Then and now, the company pre-ripens 100 percent of its avocados to several different stages with the goal of having the fruit ripen at home over the next couple of days. H-E-B does not use stickers touting "ripe for tonight" as its customers are very familiar with the fruit and its ripening stages.

"In the late 1980s, avocados were a smaller item, but it has grown into one of the top volume items. It's definitely in the top five to eight at H-E-B," he said.

H-E-B also used another merchandising tool to increase avocado sales: selling more than just one size. "Offering multiple sizes offers options for consumers at different price points," he said. "This broadens the opportunities to reach more consumers."

He said that strategy also appeals to the same consumer depending upon what they are using avocados for on that particular occasion. "It gives each consumer more options depending on their usage plans at the time."

And if that wasn't enough of a reason to offer multiple SKUs, Topper added that it had a logistical advantage as well. "Handling multiple sizes makes a buyer more flexible in their purchases and hopefully a better buyer for growers and shippers." 🥑

Understanding Avocado Branch Canker

Avocado branch canker (ABC) is a fungal disease of avocados that occurs on twigs and branches. Previously, this disease was commonly referred to as *Dothiorella* branch canker. However, recent research has revealed that the causal agent is several different species of fungi all from the *Botryosphaeriaceae* family. Thus, the current common name of *Botryosphaeria* branch canker, or simply avocado branch canker.

This group of fungi is ubiquitous in avocado groves and they are generally epiphytic. That is, they live on the plant surface, but do not rely on the plant as a food source. However, these fungi are opportunists and under certain conditions they can enter the plant and cause disease. Typically, this is associated with:

- Pruning wounds (especially from improper pruning cuts)
- Sunburn
- Frost damage
- Broken limbs

Infection is more likely if the tree is drought stressed or suffering from other diseases (e.g., phytophthora root rot) or nutrient deficiencies.

Current Situation

In 2017, many growers started noticing an increase in the occurrence and severity of ABC throughout the industry. Outbreaks were associated with heatwaves, both dry and moist, but not necessarily sunburn. Due to the somewhat variable presentation of the disease, samples were collected at locations from San Juan Capistrano to



An avocado tree with several branches displaying typical symptoms of avocado branch canker.

Morro Bay to see if any new pathogens were present. Initial testing revealed the same cast of characters. However, upon more detailed analysis several other species of fungi were found, including species of *Colletotrichum*, a genus that causes anthracnose diseases.

To help conduct a more in-depth assessment of this situation and determine if we were missing something, the California Avocado Commission assembled a group of experts. The group included avocado pathology experts as well as tree crop fungal experts. This group met in March 2018, toured groves with symptoms and then spent a day reviewing information and brainstorming on the situation.

Based on their initial impressions of the situation, it doesn't appear that we are dealing with a new disease. But it is still unclear why things appeared so different in 2017. One hypothesis is the drought. We know that many of our trees were suffering during the drought that ended with the 2016/17 rainy season, and the drought was followed by a very profuse bloom in spring 2017 in response to the rain. Perhaps these stresses – drought and very heavy bloom – sufficiently weakened our trees to increase their susceptibility to ABC.

The rains that ended the drought also may have helped to increase pathogen inoculum levels in groves. In response to wet conditions, particu-

Current Management Recommendations

A review of the California Department of Pesticide Regulation databases reveals that currently there is only one fungicide registered for use on avocados in California that lists *Botryosphaeria* on the label. That product is K-Phite 7LP (manufactured by Plant Food Systems); however, we cannot locate any independent research data that show efficacy of this product against ABC. There are a number of products registered for use on avocados that include anthracnose (*Colletotrichum* species) on their label if that pathogen should prove to be a key agent in ABC. As a reminder, be sure to carefully read all pesticide labels before use and, when in doubt, the label is the law.

A number of cultural practices are recommended for managing ABC.

These include:

- Avoid pruning during or immediately after rain, dew or heavy fog. The moisture causes the fungi to release spores, which can easily cause infection. Spore counts will be lower during dry conditions.
- Prune out dead limbs and twigs that house the pathogen pycnidia – structures that produce spores.
- Remove dead wood and old fruit from the grove to the extent practical to reduce inoculum levels in the grove.
- Make proper pruning cuts that will heal quickly (for a pruning primer see “Pruning 101: Pruning Dos and Don’ts for Healthy Trees” in the Winter 2017 issue of *From the Grove*).
- Maximize tree health with proper irrigation and fertilization. 🍌



A citrus tree with a branch displaying symptoms of a new *Colletotrichum* disease.

larly warm and wet, these fungi release spores that can be carried in water films or moved around by splashing of raindrops.

Furthermore, researchers at the University of California, including Dr. Akif Eskalen at UC Riverside, recently identified a new disease in citrus caused by two species of *Colletotrichum* — *C. karstii* and *C. gloeosporioides*. Neither of these are species that have been identified in avocado — *C. alienum* — but the similarity of the symptoms observed in citrus and avocado are striking. Akif Eskalen believes that the *Colletotrichum* may serve as a means of weakening shoots making them more susceptible to ABC.

The Commission will continue to evaluate the situation and communicate with the team of experts to determine what research, if any, can be done to better understand ABC and develop practical management tools.



Members of the avocado branch canker review team visit an affected grove. From left are: Akif Eskalen, UC Riverside; Randy Ploetz, University of Florida; David Rizzo, UC Davis; Tim Spann; Leo McGuire, chairman CAC Production Research Committee; and Themis Michailides, UC Kearney Agricultural Research and Extension Center.

ProGibb LV Plus® Plant Growth Regulator to Increase Fruit Size and Yield of Avocados

By: Carol J. Lovatt,

*Professor of Plant Physiology, Emerita
Professor in the Graduate Division
Department of Botany and Plant Sciences-072
University of California Riverside
carol.lovatt@ucr.edu*

On March 27, 2018, gibberellic acid (GA_3) was approved for use on avocado to increase fruit size and yield. The only material registered for this purpose is ProGibb LV Plus®, a low volatile organic compound (LVOC) formulation, manufactured by Valent BioSciences, Corporation. The older formulation sold under the name ProGibb® and other generic GA_3 products cannot be used. Note: (i) the restricted entry interval is only 4 hours; (ii) the preharvest interval is 0 days; and (iii) ProGibb LV Plus® is OMRI (Organic Materials Review Institute) listed and can be used in certified organic orchards.

ProGibb LV Plus® Usage Instructions

Application Timing. ProGibb LV Plus® is applied as a foliar spray at the cauliflower stage of avocado inflorescence development (Figure 1). The applications should be made when 50 percent of the trees in the block have 50 percent of their bloom at the cauliflower stage. This means that 25 percent of the bloom will be at an earlier stage of inflorescence development and 25 percent will be approaching bloom (open flowers). If you are unable to make the application at this time, being slightly late in applying the treatment affords better efficacy than being too early. Applications made at full bloom are typically not effective.

Dose and Dilution Rate. The sprays should be applied like a pesticide spray to give full canopy coverage, especially of the developing inflorescences, but not sprayed to run-off. For ground application, use 12.5 fluid ounces of ProGibb LV Plus® (equivalent to 25 grams of active ingredient) in 100 gallons of water per acre. For aerial (helicopter) application, use 12.5 fluid ounces in 75 gallons of water per acre. The maximum allowable dose is 12.5 fluid ounces per acre per year. The results



Figure 1. Cauliflower stage inflorescence during early bloom of 'Hass' avocado.

of our research documented that lower and higher doses are less effective.

Spray Solution pH. The final pH of the spray solution in our research was between pH 5.5 to 6.0. ProGibb LV Plus® is stable at pH 4.0 to 8.5. The pH of the water used should be adjusted accordingly. Prolonged exposure of GA_3 to a pH > 8.5 should be avoided.

Spray Volume. For ground applications, we used an equivalent amount of GA₃ with a spray volume of 200 to 250 gallons of water per acre depending on tree size. Best practice is to achieve good coverage without causing the material to run-off the tree and with minimum spray volume left in the tank after application.

Use of spray volumes greater than 100 gallons of water per acre for ground application is at the discretion of the Agricultural Commissioner for each county. Consult with your County Agricultural Commissioner, if you wish to apply ProGibb LV Plus® (12.5 fluid ounces per acre) in more than 100 gallons of water per acre as a ground spray.

For aerial (helicopter) application, the greatest efficacy was achieved with ProGibb LV Plus® (12.5 fluid ounces) in 75 gallons of water per acre.

Wetting Agent. In our research, we used the organosilicone surfactants Silwett L-77® or Widespread Max® at a final concentration of 0.05 percent. Similar pure organosilicone type surfactants are acceptable and recommended.

Additional Comments for the Use of ProGibb LV Plus®. The cauliflower stage of avocado inflorescence development represents an important stage in fruit production. Integuments – tissues that will later develop into the seed coat – are forming around the ovule, which after pollination and fertilization will develop into the seed.

Previous research has shown that combining two simple fertilizers, boron (sodium borate) and nitrogen (low-biuret urea)

to ‘Hass’ avocado trees at this stage of inflorescence development results in double pistils, each with an ovule. Thus, at this time, we recommend that other materials **not** be included in the ProGibb LV Plus® spray solution. The California Avocado Commission is testing the efficacy of ProGibb LV Plus® combined with boron and low-biuret urea, respectively, and will share results as they become available.

In general, GA₃ seems to be compatible with low-biuret urea, potassium, zinc and manganese, but the sensitivity of the cauliflower stage of avocado inflorescence development to these spray combinations is unknown. Growers should not apply a combination spray to a large number of trees without first testing the treatment on a few trees over several years to identify any unfavorable interactions, including those precipitated by differences in climate from one year to the next.

In our research, the treatment significantly increased fruit size and yield. Our research also indicated that ProGibb LV Plus® is most effective when there is a good bloom on most of the trees in the orchard and may not be effective when there are only few inflorescences per tree. The target of the ProGibb LV Plus® application is the cauliflower stage inflorescence of the current bloom, but GA₃ applied at this time has been documented to also increase the size and slow the blackening of the peel of mature fruit on the tree. These results are dependent on crop load and how long the fruit remain on the tree before they are harvested.

GA₃ treatment had no negative effects on quality of mature fruit or quality of the fruit that develop from the treated bloom. GA₃ application had no effect on the number of days

Table 1. Effect of GA₃ on two-year average yield and fruit size as pounds and number of fruit per tree in an alternate bearing ‘Hass’ avocado orchard in Irvine.

	Treatment	Total yield	Net increase (%)	Yield of large size fruit ¹	Net increase (%)	Total yield	Net increase (%)	Yield of large size fruit	Net increase (%)
		lb/tree			no. fruit/tree				
2-year avg yield	GA ₃	50.5 a ²	51	37.6 a	47	115 a	60	77 a	51
	Control	33.4 b		25.7 b		72 b		51 b	
Individual year yield averaged across treatments	Year								
	On-year	69.4 a		50.9 a		162 a		105 a	
	Off-year	14.6 b		12.4 b		26 b		22 b	

¹ Large size fruit = packing carton sizes 48+40+36.

² Values within a column followed by different letters are significantly different statistically.

from harvest to “eating ripe” (eating soft), nor on external exocarp (peel) and internal mesocarp (edible portion of the fruit) quality parameters, which included decay, discoloration and vascularization (presence of vascular bundles and associated fibers in the mesocarp). The GA₃ treatment did not alter the ratio between fruit length and fruit width. There was no reduction in mesocarp width and no increase in seed diameter. Germination of the seed within mature fruit was not affected.

Research Trial Data

A note about the data and discussion that follows: All the research trials conducted for the registration of ProGibb LV Plus® were conducted with the old product formulation known as ProGibb®. Valent BioSciences Corporation submitted data to the California Department of Pesticide Regulation during the registration process for the new ProGibb LV Plus® formulation demonstrating product equivalency. All of the data shown are from trials conducted using 25 grams of active ingredient (equivalent to 12.5 fluid ounces of ProGibb LV Plus®) and applied at the cauliflower stage of inflorescence development.

Ground-based Application of GA₃

Alternate Bearing Orchard. Repeated measure analysis was used to determine statistically whether the yield increase resulting from GA₃ application at the cauliflower stage of inflorescence development of ON bloom trees reduced yield the following year. That is to say – did GA₃ application in the ON year make the next year’s OFF crop more OFF?

Despite large differences in yield between the two crop years in this experiment (69.4 vs. 14.6 pounds per tree, see Table 1), GA₃ applied as directed significantly increased yield and fruit size when averaged across both years of the experiment. Compared to untreated control trees, GA₃ significantly increased the two-year average total yield of pounds per tree by 51 percent and the number of fruit per tree by 60 percent.

GA₃ increased the two-year average yield of commercially valuable large size fruit (packing carton sizes 60+48+40) of pounds per tree by 47 percent and the number of fruit per tree by 51 percent, compared to untreated control trees (Table 1). The results provide evidence that the response to GA₃ was positive in both years of the experiment and demonstrate that GA₃ application during an ON bloom did not exacerbate alternate bearing.

Untreated control trees were used for comparison in the results listed below.

Table 2. Effect of GA₃ on yield and fruit size of ‘Hass’ avocado trees in Corona.

Treatment	Total yield	Net increase (%)	Yield of large size fruit ¹	Net increase (%)
GA ₃	74.7 a ²	84	34.3 a	128
Control	40.6 b		15.0 b	

¹ Large size fruit = packing carton sizes 48+40+36.

² Values within a column followed by different letters are significantly different statistically.

Fruit Size and Yield: Corona. In Corona, CA, GA₃ was applied to ten-year-old ‘Hass’ avocado trees on Duke 7 clonal rootstock.

Results:

- Increased the total pounds of fruit per tree 84 percent (Table 2)
- Increased the yield of large size fruit (packing carton sizes 48+40+36) by 128 percent (Table 2)
- Net increase in total yield of 3,751 pounds of fruit per acre (110 trees per acre)
- Net increase in large size fruit of 2,123 pounds per acre

Table 3. Effect of GA₃ on yield and fruit size as pounds and number of fruit per tree in an alternate bearing ‘Hass’ avocado orchard in Irvine.

Treatment	Year 1 yield			
	Total yield	Net increase (%)	Yield of large size fruit ¹	Net increase (%)
	lb/tree			
GA ₃	92.2 a ²	70	67.9 a	65
Control	54.2 b		41.2 b	
	no. fruit/tree			
GA ₃	215 a	76	141 a	70
Control	122 b		83 b	

¹ Large size fruit = packing carton sizes 48+40+36.

² Values within a column followed by different letters are significantly different statistically.

Fruit Size and Yield: Irvine. In Irvine, CA, GA₃ was applied to ten-year-old ‘Hass’ avocado trees on clonal Duke 7 rootstock.

Results:

- Significantly increased total yield as pounds and number of fruit per tree by 70 percent and 76 percent, respectively (Table 3)
- Significantly increased the yield of commercially valuable size fruit (packing carton sizes 60+48+40) as pounds per tree by 65 percent and as number of fruit per tree by 70 percent (Table 3)

- Net increase in total yield of 4,180 pounds per acre (110 trees per acre)
- Net increase in commercially valuable large fruit of 2,937 pounds per acre

Since GA₃ increased total yield and yield of commercially valuable size fruit as number of fruit per tree, it is clear this treatment increased both fruit set (fruit retention) and fruit growth to increase total yield and fruit size as pounds per tree.

Table 4. Effect of GA₃ on yield and fruit size of 'Hass' avocado trees in Somis.

Treatment	Total yield	Net increase (%)	Valuable size fruit ¹	Net increase (%)	Large size fruit ²	Net increase (%)
lb/tree						
GA ₃	408.1 a ³	10	379.4 a	13	294.1 a	16
Control	372.6 b		335.3 b		253.3 b	

¹ Valuable size fruit = packing carton sizes 60+48+40.

² Large size fruit = packing carton sizes 48+40+36.

³ Values within a column followed by different letters are significantly different statistically.

- Net increase of 2,618 pounds per acre of commercially valuable size fruit of packing carton size 60

Summary. The results presented herein provide strong evidence that foliar application of GA₃ (12.5 fluid ounces ProGibb LV Plus®) at the cauliflower stage of inflorescence development of 'Hass' avocado significantly increased total yield and fruit size. Net increases in total yield ranged from 3,751 to 4,400 pounds per acre per year (110 trees per acre). Increased fruit size was documented by the increased yield of:

- Commercially valuable size fruit of packing carton size 60
- Fruit in the combined pool of packing carton sizes 60+48+40
- Larger fruit in the combined pool of packing carton sizes 48+40+36
- Commercially valuable size fruit plus larger fruit of packing carton sizes 60+48+40+36+32

Fruit Size and Yield: Somis. In Somis, CA, GA₃ was applied to eight-year-old 'Hass' avocado trees on Duke 7 clonal rootstock.

Results:

- Produced significantly greater total yields (pounds per tree) and significantly greater yields of commercially valuable size fruit (packing carton sizes 60+48+40) as pounds per tree (Table 4)
- Increased the yield of large fruit (packing carton sizes 48+40+36) as pounds per tree (Table 4)
- Net increase of 3,905 pounds per acre, with a net increase of 4,851 pounds per acre of commercially valuable size fruit (packing carton sizes 60+48+40)
- Net increase in large fruit (packing carton sizes 48+40+36) of 4,488 pounds per acre

Fruit Size and Yield: Santa Paula. In Santa Paula, CA (2010-11), 11-year-old 'Hass' avocado trees on Duke 7 clonal rootstock were treated with GA₃.

Results:

- Significantly greater total yield (pounds per tree) (Table 5)
- Significantly greater yields of commercially valuable size fruit (packing carton size 60) as pounds per tree (Table 5)
- Net increase in total yield of 4,400 pounds per acre

Aerial Application of GA₃

The efficacy of aerial (helicopter) applications of GA₃ was tested in orchards located in Pauma Valley (40-year-old 'Hass' avocado trees on 'Topa Topa' rootstocks) and Carpinteria (four-year-old 'Hass' avocado trees on 'Toro Canyon' and 'Dusa' rootstocks). In each orchard, GA₃ was applied by helicopter at 25 grams of active ingredient per acre (equivalent to 12.5 fluid ounces ProGibb LV Plus®) in 25 gallons or 75 gallons of water (pH 5.5-6.0, containing 0.05 percent Silwett® L-77) per acre. Untreated control trees were used for comparison.

In Pauma Valley, GA₃ applied in 75 gallons of water per acre resulted in young fruit having significantly larger (6 percent) transverse diameters than fruit on trees treated with GA₃ applied in 25 gallons of water per acre and untreated control trees (Figure 2).

Table 5. Effect of GA₃ on yield and fruit size of 'Hass' avocado trees in Santa Paula.

Treatment	Total yield	Net increase (%)	Packing carton size 60	Net increase (%)
lb/tree				
GA ₃	155.2 a ¹	34	74.1 a	47
Control	115.5 b		50.3 b	

¹ Values within a column followed by different letters are significantly different statistically.

Pauma Valley

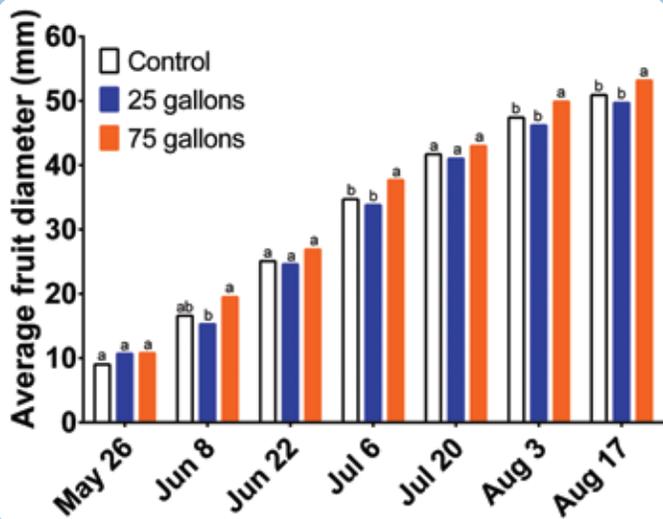


Figure 2. Effect of aerial-applied GA₃ on the diameter of young fruit (average for eight shoots per tree) at Pauma Valley. GA₃ was applied in either 25 gallons of water per acre or 75 gallons of water per acre, and a water control.

In Carpinteria, GA₃ applied in 75 gallons of water per acre resulted in young fruit having significantly greater fruit set (fruit retention; 55 percent) than trees treated with GA₃ applied in 25 gallons of water per acre and control trees (Figure 3).

Taken together the results of the aerial applications in two orchards demonstrated that GA₃ applied at the cauliflower stage of inflorescence development in 75 gallons of water per acre is efficacious in increasing fruit set (fruit retention) by 55 percent into the last week of August and fruit size by six percent through mid-August (five months after application). Increased fruit set (fruit retention) and increased fruit size are important factors in yield. The results of the aerial applications are consistent with the effects of GA₃ applied as a ground spray and indicate that 75 gallons of water per acre is the optimal volume for aerial application.

Conclusions

Foliar application of ProGibb LV Plus® to ‘Hass’ avocado trees in commercial orchards, when the trees reach the cauliflower stage of inflorescence development (typically March), significantly and reliably increases total yield and fruit size when applied at 12.5 fluid ounces per acre. This dose was superior to lower or higher doses. In addition, GA₃ had no negative effects on ‘Hass’ avocado fruit quality.

At typical prices growers receive for their crop, the yield and fruit size increases obtained in these experiments would result in substantial increases in net dollar return per acre to the grower.

Carpinteria

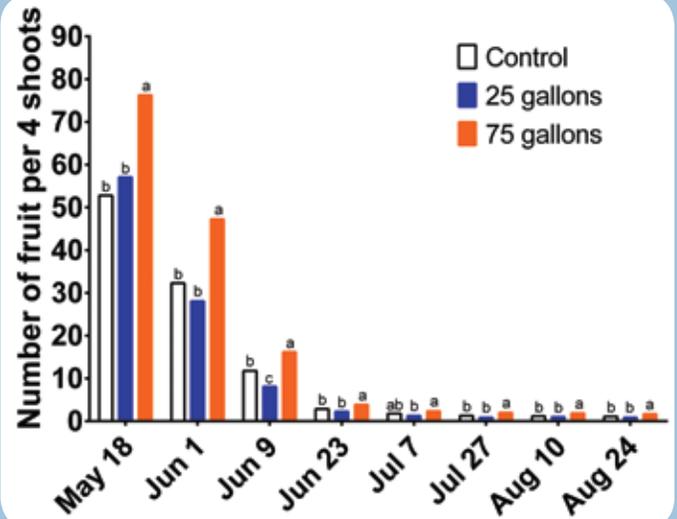


Figure 3. Effect of aerial-applied GA₃ on the retention of young fruit (number of fruit per four shoots) per tree at Carpinteria. GA₃ was applied in either 25 gallons of water per acre or 75 gallons of water per acre, and a water control.

Consistent with the results obtained with the ground sprays of GA₃, aerial applications of GA₃ at the cauliflower stage of inflorescence development also increased fruit set (fruit retention) and fruit size (diameter) at 12.5 fluid ounces in 75 gallons of water per acre. This rate was superior to 25 gallons of water per acre and untreated control trees.

Given the considerable acreage of ‘Hass’ avocado trees on slopes and in high-density plantings that are not suited to ground application, aerial application of ProGibb LV Plus® is vital to the California avocado industry to increase grower income per acre to help sustain the California avocado industry.

Acknowledgements

This research was supported in part by the University of California Citrus Research Center and Agricultural Experiment Station and by grants from the California Avocado Commission. A special thank you to the following for the use of their orchards and for their assistance with harvest: Corona Foothill, Inc.; Jesus Ruiz, Irvine Co.; Gus Gunderson, Limonera, Co.; Charles and David Vanoni, Rancho Bella Vista; Rick Shade, Shade Farm Management; and Chuck Bandy, McMillan Farm Management. Additional thanks to Toan Khuong, Associate research Specialist, for statistically analyzing the data; Rob Fritts, Valent BioSciences, for donating the ProGibb® and ProGibb LV Plus®; and to Bob Hoag, Hummingbird Helicopters and Kevin Miskel, Aspen Ag Helicopters, who made the aerial applications. 🍷

Increased California Volume Expected on Back End

For a variety of reasons, the volume of California avocados shipped on a weekly basis during the first half of the season was a bit less than expected. Consequently, several handlers said the back end of the deal will be heavier than anticipated with good volume in August and enough supplies for targeted promotions even into September.

"We are definitely going to have California fruit in September," said Rob Wedin of Calavo Growers Inc., Santa Paula, CA. Speaking as May was coming to a close, he said the market for California fruit was strong and steady. He added that cooler spring temperatures were giving growers the ability to keep the fruit on the trees and many were taking advantage of that. Wedin noted that August and September of 2017 produced very high farm gate prices and growers might be eyeing another advantageous situation this year, albeit with prices a bit lower.

Giovanni Cavaletto of Index Fresh, Bloomington, CA, said the 2017/18 season appears to be headed for one of the longer seasons on record. "We picked some Hass in December, which was the first time we had done that in eight or 10 years." He added that some shipments from the most northern regions are expected to last into early October, making this a 10-month marketing season.

Cavaletto said Index is continuing its series of grower seminars in an

effort to help growers become more efficient and market their crop to their best advantage. The firm is holding these seminars three times a year with an emphasis on various cultural practices.

Cavaletto marveled at how well the market is reacting to much larger supplies this year. He said the run-up to Cinco de Mayo saw record numbers of avocados shipped and said June also was expected to produce a series of weeks with more than 65 million pounds sold each week. "And despite that, the market is strong and we are not seeing any major downward pressure on the price."

Another veteran of the California avocado industry, Jim Donovan of Mission Produce, echoed the sentiments of his colleagues. "California growers went into this season knowing they had a big crop and I believe most are pretty pleased with where we are at," he said in late May. "Overall the market is good and that is with a lot more supplies than last year."

He agreed that growers who are able to keep fruit on the tree for the August/September time slot should reap some rewards. Last year, there were some very high grove prices with \$2 per pound being topped at some points. Donovan does not believe the average price will be as high as last year but he said with the increased volume, most growers will do very well. He reasoned that Peru's volume will drop off significantly from mid-August on and Mexico

should not yet be shipping big numbers on the front end of its 2018/19 crop.

However, Donovan did caution against holding your fruit simply to cash in on higher prices. He said the field price has been solid all year and some growers just can't keep their fruit on the trees that long. There is always a trade off as pulling fruit off the tree early will help the growth of the following year's fruit.

Rankin McDaniel of McDaniel Fruit Co., Fallbrook, CA, said 2018 has been a good year for California growers if you consider the increased volume from many points of origin and gauge that against the prices growers are receiving. "For the most part, I'd say they are 'happy', not 'happy happy' but we've had a good pricing structure all season."

Speaking before the California Avocado Commission had released its mid-season estimate predicting about 360 million pounds for the season, McDaniel said he did not expect the industry to get to the 370 million pound level. "We'll come close but I don't think we will get there." He noted that the fires, wind and small fruit have combined to decrease total pounds this year from the pre-season estimate.

All the handlers said the bloom was relatively good for the 2018/19 crop but it was much too early to offer any type of guess with regard to next year's volume. 🍷

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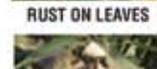
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