From the Grove

Summer 2019

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COMMISSION UPDATES GROWER VIDEO PROFILES

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From the **Grove**

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Message from the President

Tom Bellamore

Every Vote Counts

Several years ago, the California Avocado Commission (CAC) established a threshold for the commercial production of California avocados. Growers having an average annual production of less than 10,000 pounds in the three preceding marketing years are deemed "exempt" from paying the current year's assessment. The change was meant to reduce the cost burden on the non-commercial grower, but it has election implications, too. Non-commercial growers do not receive a ballot in the Commission's annual general election.

The size of the Commission's board of directors changed as well, from 29 members down to 19 presently. The five growing districts currently in place are represented by two members and one alternate member from each district, for a total of 15 grower commissioners. The balance of seats is held by two handler members, one handler alternate and one public member. Each year, five grower members, and one handler member, are elected to the board. Every two years alternate grower and handler members are elected to the available seats. Accordingly, CAC election ballots will vary slightly from year to year.

When a candidate puts forth their name for election to the Commission in a year when both a member seat and alternate member seat are open, it is no longer required that they declare which seat they are interested in filling. The preference of some candidates is to first serve as an alternate member, usually to get better acquainted with the operation of the Commission before stepping up to the board table. To date, when the votes are counted in a year when two seats are open, the two candidates with the most votes have been offered seats on the Commission board. The candidate with the highest number of votes has been offered their choice of the member or alternate member seats, and the candidate with the second highest number of votes has been offered the remaining seat. In the event of a tie, lots are drawn to determine which candidate receives first choice.

Of the roughly 3,400 growers of California avocados, more than half may be exempt from payment of an assessment in any given year, leaving the voter base hovering around 1,700 grow-

VOTE (NO MORE THAN 3)			DISTRICT 3 CANDIDATES	BOARD SEAT PREFERENCE
1ST CHOICE	2ND CHOICE	3RD CHOICE	ONE MEMBER AND ONE ALTERNATE SEAT ARE AVAILABLE	MEMBER, ALTERNATE, OR NO PREFERENCE
◯	◯	◯	John Smith	Alternate Seat Preferred
◯	◯	◯	Jane Clark	Member Seat Preferred
◯	◯	◯	Write-in (Optional) *must include write-in name / phone number / email address*	

ers in a typical election year. Even more reason, then, to make sure that nothing deters interested growers and handlers from stepping forward as candidates and that the voting process for the electorate is simple and straightforward. Every vote must count.

With these objectives in mind, the Commission recently set about making some adjustments to the documents used to conduct the annual elections and the process itself. If you wish to become a candidate you will still have to complete an Affidavit of Eligibility, a Disclosure of Affiliations, a Nomination Petition and (optionally) a Candidate Statement, but these forms are being redesigned for ease of use. Things will look a little different on the ballot, too, when it comes time to cast your vote.

The Commission's Governance Committee reviewed various fair voting methods for multi-seat elections and recommended board adoption of ranked choice voting as a means of achieving proportional, more representative results. The ranked choice method allows voters to rank their choices in order (first, second, third) to show not only a preference for a single, top choice but a second or third choice as well. This method avoids splitting votes among similar candidates and ensures that more votes count toward the election of each voter's choice. With ranked choice voting, the way the winner is chosen and how remaining seats are filled is a bit complicated and doesn't warrant mention here, but the California Department of Food and Agriculture—the agency charged with receiving and tallying the ballots—has assured the Commission that it is up to the task.

The annual CAC board election will be held in October 2019 for one producer member seat and one producer alternate seat in each of the five districts. In addition, one handler member seat and one handler alternate member seat also are open. All seats are for two-year terms. An election announcement and self-nomination packet will be sent to all commercial producers and handlers by July 15, 2019, and ballots will mail by September 23, 2019.

The board typically meets five times per year in Irvine, CA, and although travel can sometimes be tough, the meetings are focused and productive. If you are interested in running for a seat on the board, please review the self-nomination packet carefully, because a few things will have changed. If you're content with just casting your vote, pay attention, please, to the new ballot format so that your choices can be properly registered. Remember, a mistake can result in a disqualified vote.

The new board will be seated at the meeting at the Commission office on November 21, 2019. The Commission board always welcomes new talent and embraces diversity among its members, so don't hesitate to step forward if you would like to join your fellow growers and handlers in guiding the industry and promoting the California avocado brand.

"Of the roughly 3,400 growers of California avocados, more than half may be exempt from payment of an assessment in any given year, leaving the voter base hovering around 1,700 growers in a typical election year."

Board of Directors

District 1

Member/Jessica Hunter-**Secretary**
Member/ Ryan Rochefort
Alternate/Michael Perricone

District 2

Member/Charley Wolk
Member/Ohannes Karaoghlanian-**Vice Chair**
Alternate/Bob Schaar

District 3

Member/John Lamb-**Chairman**
Member/Robert Grether-**Treasurer**
Alternate/John Lloyd-Butler

District 4

Member/Ed McFadden
Member/Jason Cole
Alternate/Bryce Bannatyne Jr.

District 5

Member/Salvador Dominguez
Member/Tyler Cobb
Alternate/Randy Douglas

Handlers

Member/Gary Caloroso
Member/Peter Shore
Alternate/Neil Witt

Public Member

Daniella Malfitano

To contact a CAC representative, please visit: CaliforniaAvocadoGrowers.com/Commission/your-representatives

Chairman's Report

Cautious Optimism as We Wait for Fruit

John Lamb

As I write this, it is Memorial Day weekend and in the last 24 hours we have had rain, a high of 63 and a low of 41. Our bloom has been very strong this year due to the wonderful winter rains; however, it is certainly extended with the cool spring and late rains. This is a time of cautious optimism for most growers as we wait impatiently for the fruit for next year's crop to set.

We have always felt the fruit set was best when low temperatures are above 50 degrees. So 41 degrees is ridiculous. No wonder all the BBs are just sitting in their jackets waiting for some warmer weather. Leaf expansion is happening incredibly fast this year, hopefully covering next year's crop.

At the last California Avocado Commission (CAC) Board of Directors meeting it was proposed, and passed, that a budget amendment was necessary to extend the marketing and media budget by $300,000 through mid-August. The marketing committee feels there may be late-season fruit from the north to support this. As much of our media buy today is in digital format, we can easily extend or curtail our programs depending on the fruit flow from the fields. Through the end of April, sizing has been well ahead of last year with a shift of 4–5 percent moving up a size. Average returns for conventional fruit also are up nearly $12 per lug.

If you have never done so, I would encourage you to look at the marketing dashboard on the CAC grower website. Your board sees this at every meeting. The dashboard covers not only industry statistics, but also where the marketing spending is going. Jan DeLyser and her team dive very deep in promoting your avocados, and feature the following information on the dashboard: outdoor advertising, social media, consumer advertising, registered dietitians, blogger advocates, retail promotions, trade advertising, foodservice chain promotions, public relations, chef ideation, foodservice events, digital and print advertising.

Marketing Dashboard
www.californiaavocadogrowers.com/marketing/marketing-dashboard

The production research committee has been looking into proposals on several fronts; the most interesting to me is the potential for registration of Orondis®. This is a new class of fungicide that effectively eradicates Phytopthora propagules from the soil for at least a year. It is applied via the irrigation system. It has been registered for citrus but has been held up at the California Department of Pesticide Regulation due to a recent court case. The committee is going to try to pursue a Section 18 registration for the short term. If this product works as advertised, it could be a game changer for many of us that have fought root rot for generations.

Transparency is a major buzzword these days. I sincerely believe that the California Avocado Commission is as transparent as possible. All meetings are subject to the Brown Act and, accordingly, must be noticed 10 days in advance. All board and committee meetings are open to the public unless the topic has the potential for litigation or involves employees. All agendas and minutes from all board and committee meetings are posted on the website. All business plans, financial statements and check registers can be viewed by anyone at any time. All roll call votes are in the minutes so you can see exactly how your commissioner voted on items of particular interest to you. The finance committee reviews all disbursements, and if there is a question, CAC's Director of Finance Monica Arnett can pull up all supporting documentation in an instant.

You won't have to file a Freedom of Information Act request to get backup for CAC expenditures; all you have to do is look at the grower website or simply ask. We will be happy to provide you with the non-redacted information that is available.

Aha

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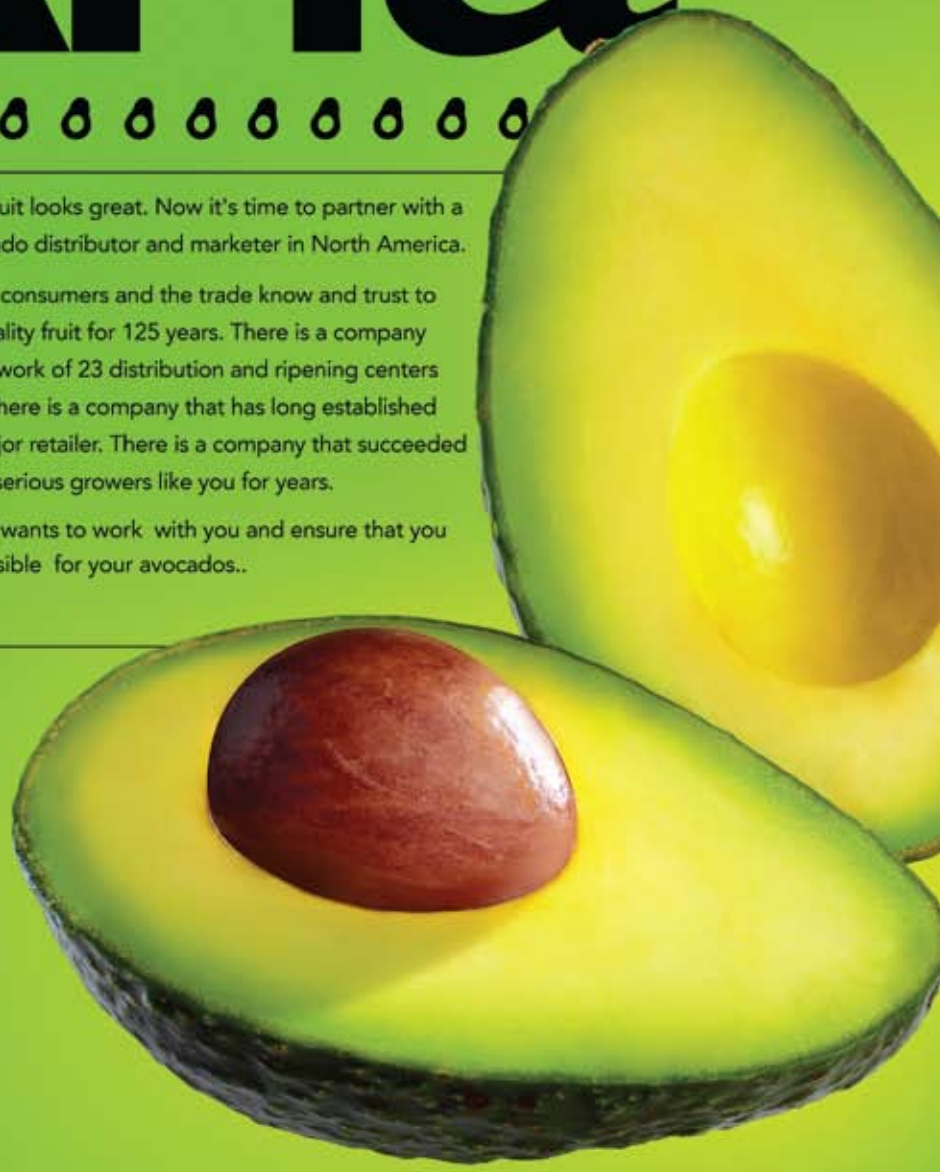

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Issues Watch

By Ken Melban
Vice President of Industry Affairs

CAC Hosts Regulatory Officials On Grove Tour

The California Avocado Commission (CAC) partnered with the California Citrus Quality Council (CCQC) in April to host a four-day tour of avocado and citrus production areas. Representatives included staff from the Environmental Protection Agency (EPA), United States Department of Agriculture's (USDA) Animal Plant and Health Inspection Service (APHIS) and Foreign Agriculture Service (FAS), along with the California Department of Agriculture (CDFA) and the California Department of Pesticide Regulation (CDPR). A total of 33 agency personnel participated in the tour. Government agency representatives included attorneys, environmental scientists, regulatory and public affairs specialists, biologists and agency directors.

The first morning of the tour began with pre-briefing presentations. Dr. Tim Spann, CAC research program director, and April Aymami, CAC industry affairs director, joined me as we presented information on the state of the California avocado industry. Topics discussed included the importance of crop protection materials, and challenges like labor and water shortages along with the threat of invasive pests. Many of the attendees, in their professional roles, have direct input on decisions that affect agriculture. The tour provided a great opportunity to establish and/or improve relations with officials who are tasked with creating and enforcing regulations that impact farming.

John Lamb, CAC chairman, and his brother Bert Lamb opened their farm, Camlam Farms in Camarillo, for an avocado grove tour and dinner. "We were pleased to have the tour stop at our farm so we could interact with the officials," said Chairman Lamb. "This is a great opportunity to show these agency staff members what farming is all about and how hard we work to protect the environment."

Many CAC board members and other industry representatives joined the group, which provided a great opportunity for meaningful interaction between the growers and agency personnel. Some of the agency representatives had never visited a commercial agriculture enterprise, let alone an avocado grove. By touring agricultural production operations, agency staff have a much better understanding of what is involved with farming — including the many challenges farmers face.

This tour provided attendees with a much different perspective than found in their Washington, D.C. and Sacramento offices. Hopefully, when they are involved in future policy and regulatory decisions that impact agriculture, they will draw from the insights they gained during the Commission's production agriculture tour.

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By April Aymami
Industry Affairs Director

2019 Mid-Season Crop Update

Results of Grower and Handler Crop Surveys

Each spring the California Avocado Commission (CAC) conducts a mid-season grower crop survey in which growers provide detailed information regarding their estimated crop volume for the current year. In addition to the grower crop survey, in recent years the Commission also has begun to survey California handlers to gather total industry volume estimates, as well as estimated timing of harvest. Together the results of these surveys play an important role in helping CAC adjust crop estimates and predict the flow of avocados to market during the critical mid-season.

Leading up to the 2019 mid-season crop survey, the California avocado crop was estimated to be about 175 million pounds. Due to the much-welcome rain this past winter, the season's harvest kicked off a bit later than projected, but at the time surveys were mailed to growers and handlers in mid-April, all indicators pointed to little variation from the early season estimated volume. When the survey responses were tallied, however, the grower and handler estimates were at odds. The grower survey came back with a crop size of more than 218 million pounds, while the handler survey reported 170 million pounds – a nearly 50-million-pound difference.

While it may seem that a large discrepancy in crop size estimates would be cause for concern, it happens more often than one may think. In years like this, the key is digging into the data and understanding what the leading cause of the discrepancy could be. To do this, the Commission begins by determining which of the two estimates (grower or handler) should be considered most accurate, and then works to analyze the second set of data to identify logical reasons for the variance.

As previously mentioned, going into the mid-season survey all indications were that the crop volume was not significantly different than the preseason estimate, therefore CAC determined the handler estimate of 170 million pounds was the most accurate. The Commission then focused on analyzing the grower survey responses, combing through mid-season county results to identify regions reporting pounds per acre higher than the industry average — for 2019 that was any county reporting more than 4,640 pounds per acre.

As highlighted in the table to the right, both San Diego and San Luis Obispo counties reported average pounds per acre exceeding the identified threshold. At this point in the process, CAC staff made calls to growers, handler field representatives and farm managers to discuss the accuracy of the reported pounds per acre. As a result of those discussions, it was determined that San Diego County was over-estimating their harvest and that while San Luis Obispo County's estimate was high, it should not make a significant impact on the overall crop volume based on the percentage of acres it represents.

Armed with this new information, the Commission set out to revise the estimates utilizing readily available tools — previous mid-season grower crop estimates and actual year-end production

2019 GROWER Crop Survey Results
Hass: 209.4 million pounds
Lamb-Hass: 7.2 million pounds
Other: 2.2 million pounds
Total: 218.8 million pounds
Estimated Pounds per Acre: 4,640

2019 HANDLER Crop Survey Results
Hass: 162 million pounds
Lamb-Hass: 6 million pounds
Other: 2 million pounds
Total: 170 million pounds
Estimated Pounds per Acre: 3,605

County	Hass Only			All Varieties		
	Producing Acres	Estimated Yield Lbs/ Acre	Estimated Yield Lbs (MM)	Producing Acres	Estimated Yield Lbs/ Acre	Estimated Yield Lbs (MM)
San Diego	14,117	5,697	80.43	14,946	5,587	83.50
Riverside	4,006	2,538	10.32	4,134	2,531	10.46
Orange	897	1,895	1.70	935	1,880	1.76
Ventura	16,097	4,113	66.20	17,129	4,166	71.36
Santa Barbara	5,212	3,461	18.04	5,383	3,409	18.35
San Luis Obispo	3,792	7,877	29.87	3,848	7,866	30.27
Minor Counties	686	4,110	2.82	780	3,943	3.08

records. Utilizing four years of historical data sets, CAC developed a mid-season crop survey county-level accuracy factor to examine how each region's mid-season estimates compared to their year-end county production volumes. The analysis indicated that San Diego County historically overestimates its mid-season crop projections by an average of 27 percent, while most of the remaining counties have a tendency to underestimate their volume.

When CAC applied the four-year accuracy factor to the current mid-season grower estimates, the overall volume was reduced by a mere 11.5 million pounds – the resulting mid-season 207.3-million-pound estimate was still significantly greater than the 170-million-pound handler survey. At this point it became clear that revising the pounds per acre volume would not be enough to reduce the total industry volume by 37 million pounds. Thus, CAC turned its attention to the second factor used in crop estimating: the number of producing acres being multiplied by the estimated pounds per acre.

In 2018, the Commission entered into a contract with a new vendor, Land IQ, to complete the annual acreage survey. In just over a year, Land IQ has not only successfully delivered three years of acreage surveys (2016, 2017 and 2018), but done so with a high degree of accuracy, utilizing CAC staff, industry field reps and their own employees to ground truth acreage before finalizing the results. The Commission has confidence in the number of acres identified as avocado acreage by Land IQ's surveys, however it was important for CAC to determine whether the impact of the July 2018 heat event had been accounted for in the mid-season grower estimates. That event impacted nearly all California avocado growing regions, thus it was reasonable to assume that a significant number of acres identified as "producing" in the 2018 acreage survey may not actually have fruit to harvest in 2019. According to conversations that took place in the summer of 2018, specific areas may have been more greatly impacted by the heat event than others, including those east of the I-15 (in the South), Ojai and areas east of Hwy 150 in Ventura County and a large portion of Goleta. The heat-affected areas totaled more than 14,000 acres identified as "producing" in the 2018 acreage survey.

With that in mind, CAC staff re-examined the acreage base used in the mid-season grower survey, with special attention paid to those counties identified as "severely heat impacted". While it is impossible to know exactly how many acres experienced loss, and to what extent, for the purposes of this analysis it was assumed that 50 percent of the 14,000 acres was severely impacted and therefore 7,000 acres were removed from the "producing" acreage total. *It is important to note that it is more likely that a larger number of acres were in fact impacted to a lesser degree, however the 50 percent assumption made for a simplified analysis.* Utilizing the new acreage base, along with the four-year accuracy factor, the Commission recalculated the mid-season grower survey, resulting in a total crop volume of 180 million pounds (details of which can be found in the chart below).

At this point in the season, the Commission typically issues the results of the mid-season grower crop survey as an official mid-season crop estimate update. However, because of the large discrepancy between the grower and handler mid-season crop estimates, various indicators pointing to a crop volume closer to handler projections and the various factors that may have played a role in the grower estimates being improperly high (at 218.8 million pounds). It is the Commission's position that the 2019 crop size is more closely aligned with the pre-season estimate and mid-season handler survey volume of 170 million pounds. We have provided the context behind this decision in order to help interested parties better understand how the Commission came to this decision. If you would like more information, please contact the Commission at 949.341.1955.

2019 Grower Crop Estimate Survey Results
Adjusted for Accuracy and 2018 Heat Impact

County	Hass Only			All Varieties			4-Year Accuracy Factor	Revised Estimated Yield Lbs (MM)	Revised Estimated Yield Lbs/ Acre
	Revised Producing Acres	Estimated Yield Lbs/ Acre	Estimated Yield Lbs (MM)	Revised Producing Acres	Estimated Yield Lbs/ Acre	Estimated Yield Lbs (MM)			
San Diego	10,777	5,697	61.40	11,606	5,587	64.47	(17.14)	47.33	4,078
Riverside	4,012	2,538	10.18	4,080	2,531	10.33	0.89	11.22	2,750
Orange	897	1,895	1.70	935	1,880	1.76	(0.10)	1.66	1,775
Ventura	13,747	4,113	56.54	14,779	4,166	61.70	5.41	67.11	4,541
Santa Barbara	4,061	3,461	14.06	4,232	3,409	14.37	3.51	17.88	4,225
San Luis Obispo	3,792	7,877	29.87	3,848	7,866	30.27	2.23	32.50	8,446
Minor Counties	509	4,110	2.09	603	3,943	2.34		2.34	3,881

World cuisines inspired these recipe concepts for guacamoles and dips featuring California avocados.

Gelson's Extends Avocados Beyond Produce Department

This April, the California Avocado Commission (CAC) bridged the traditional gap between retail and foodservice, inspiring California supermarket chain Gelson's to promote California avocados beyond the produce department, through flavorful menu concepts that could be offered in the chain's prepared foods programs (deli and catering).

Motivated by foodservice research data points that indicate the growth of prepared foods in grocery stores and foodservice menu items featuring California avocados positively impact California avocado sales at retail stores, the Commission reached out to Gelson's with an offer to provide innovative ideas that could be implemented into the chain's prepared foods program.

A cross-functional CAC team, including participants from the marketing staff, the foodservice team and the retail dietitian group, had two objectives for the project. First, to inspire Gelson's executive director and his team to think outside of the box with California avocados and also to strengthen the retail partnership through foodservice activities. The team put together a plan that encourages additional sales via usage of California avocados at various touchpoints in the retailer's operations.

CAC's chef spent time in a typical Gelson's store observing available equipment, prep space and layout, as well as team member culinary skill levels. Based on the information gathered, and Gelson's request to provide blue sky ideas, CAC's chef prepared a list of 20 concepts that could be prepared on-site in each store and would appeal to Gelson's customer profile. The concept list was pared down to about seven items

based on input from Gelson's corporate chef.

The foodservice team spent a day and a half shopping for and preparing all the ingredients for the final presentation at Gelson's corporate office in Santa Fe Springs, CA. From the list of seven items, a total of 11 dishes were prepared and presented to the Gelson's team. As the Gelson's representatives sampled the dishes, the culinary team described the taste profile and suggested alternative ways to present or prepare the dishes in order to avoid menu fatigue among Gelson's customers.

An interdisciplinary group from Gelson's attended the presentation, including Executive Director Paul Kneeland; Senior Director of Service Deli/Bakery Mark Morton; Senior Director of Floral and Produce John Savidan; Corporate Executive Chef Abraham Van Beek; Senior Buyer John Fujii and Staff Dietitian Sarah Wright.

The final dishes presented to the Gelson's team were:

Guacamoles of the World – global flavors melded with California avocados for inspired Waldorf, Hawaiian, Mediterranean, Asian and Korean-Kimchi guacamoles

California Sopes – Beyond Burger® "chorizo" incorporated with California avocado radish salsa, over a sope with arugula

Chicken al Pastor Salad – al pastor marinated chicken, California avocado chunks, charred pineapple, pickled red onion, lime aioli, cilantro and cotija cheese topped with crispy tortilla strips

LoboAvo (Lobster Avocado Rangoon) - butter braised lobster and California avocado stuffed crispy rangoon

Sikil P'ak – a Yucatecan toasted pumpkin seed dip with roasted garlic, dried chiles, onion, dried tomatoes, cilantro and blended California avocado

Med-East Roasted Turkey Shawarma with Pickled California Avocado – grilled turkey breast spiced with black pepper, coriander, cumin, paprika, cinnamon, turmeric then stuffed into a pita with cabbage, pickled California avocado, yogurt, feta and roasted peppers

Avocado and Prosciutto Pizza Rose – thin pieces of pizza dough layered with tomato, California avocado, parmesan, prosciutto and basil then rolled into a rose shape and baked

California Avocado Chocolate Mousse – a bonus dish using chocolate mousse mix and replacing milk with pureed California avocados

During the presentation the teams noted that consumers often try new recipe ideas in the Service Deli because the dishes are already prepared. These new ideas can inspire

CAC Retail Marketing Director Connie Stukenberg sharing the value of California avocados and the positive impact on retail sales.

The versatility of California avocados was demonstrated in hot and cold applications; snacks to entrees, salads to beverages.

repurchase in the Service Deli and additional sales of California avocados in the produce section. The Gelson's team was very appreciative of the Commission's efforts to help Gelson's capitalize on the growth of fresh prepared foods that satisfy consumer demand for the convenience of restaurant quality meals that do not need preparation at home.

Key insights from this program will be utilized to build a case study that can be used for CAC's retail and foodservice teams as they seek to partner with other retail grocery chains interested in expanding their prepared foods programs.

Gelson's team members help themselves to Guac around the World —five different guacamoles with various ingredients.

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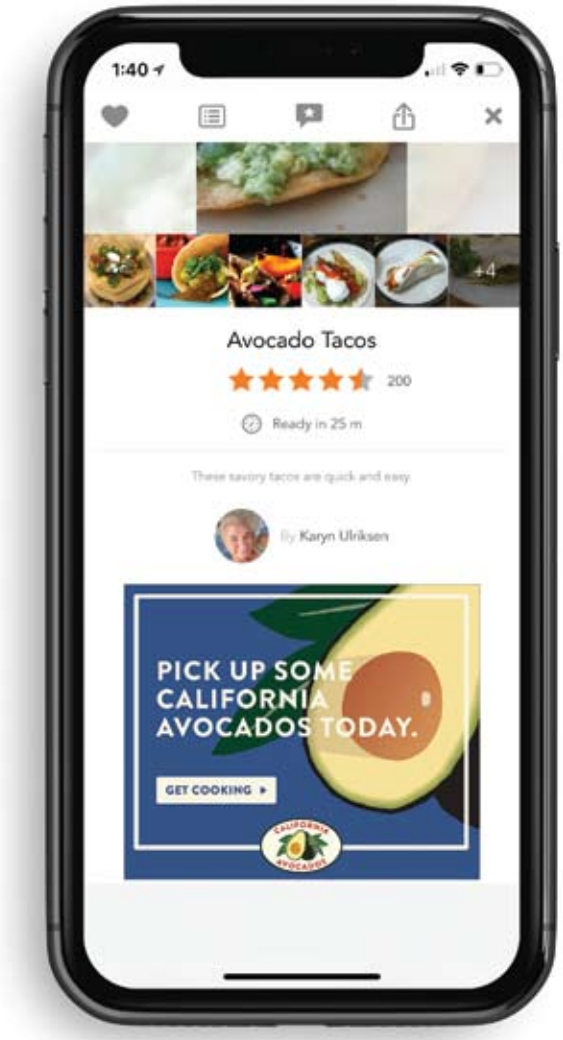
Online Location-Based Marketing Spotlights California Avocado Availability

In 2015, the California Avocado Commission (CAC) began supporting select retail partners with online advertisements that specifically targeted the retailers' shoppers – based on their location. This outreach makes it possible to share avocado seasonality and availability messages encouraging consumers to purchase the premium fruit at the retailers' stores while it is in season. In comparison to the Commission's overarching online media campaign that generates awareness of in-season California avocado availability, these digital advertising and social tactics home in on a highly targeted audience. The audience includes retail and foodservice partner patrons who are enthusiastic about California avocados and eager to act on the advertising by purchasing the fruit at their local retailer or foodservice operator.

According to the Retail Feedback Group, the percentage of shoppers who digitally interact with supermarkets has grown from 56 percent in 2017 to 63 percent today. As retailers have ramped up their digital marketing efforts and staff, CAC's online retail advertisement programs have evolved from a couple of partnerships to a majority of CAC's targeted retailers. The Commission has worked with this growing base of retail partners to expand their social media networks. In addition, CAC has enhanced their ability to target consumers near locations that are confirmed to be merchandising California avocados and produced a variety of personalized ads with calls-to-action that create a sense of urgency about purchasing the fruit in season.

In order to leverage consumers' burgeoning online engagement with retailers and foodservice operators, the Commission uses a variety of digital tools. Geo-fenced ads via paid media (PlaceIQ, Viant and Pandora) allow CAC to use the



Digital media ads are served on smart devices while consumers view web and app-based content in retailer stores carrying California avocados.

The CAC store locator tool is updated as availability is confirmed with retailers and chain restaurants.

global positioning system (GPS) from consumer devices (computers, smartphones, tablets) to target messaging and ads relevant to the consumers' interests. Consumers must have enabled location sharing on their devices to be served geo-fenced advertising.

In addition, the Commission utilizes geo-targeted ads on social platforms, such as Facebook and Twitter, that allow CAC to target social posts and advertisements to consumers within chosen zip codes.

The Commission launched a store locator tool in 2017 that is housed at CaliforniaAvocado.com/store-locator.com to help consumers find the exact locations where California avocados can be purchased in season. Retailers are enthusiastic about being listed in the digital store locator directory, which includes links to their websites. The store locator page also links to useful content, such as blogs providing the latest news about the current California avocado crop and tips for finding the fruit. In 2018, the CAC store locator received approximately 5,000 visits with some in-season days peaking at more than 100 views per day. The tool continues to grow in popularity thanks, in part, to CAC's online advertisements showcasing the store locator.

In 2018, the Commission netted nearly 65 million targeted, retailer-specific impressions that communicated California avocado availability. By connecting California avocado consumers with point of purchase, the Commission is driving consumers to locations of retail and foodservice partners who are loyal to California avocados and willing to pay a premium for them. In smaller crop years like 2019, these online location-based tactics are more important than ever to ensure that the avocado consumers who prefer California know where to find the premium fruit. Ultimately, these efforts further engender partner loyalty and create grower value as consumers seek out California avocados and increase purchase frequency during the season.

A consumer responds enthusiastically to a California avocado post announcing the start of the season on Twitter.

A California avocado fan on Twitter engages with the Commission concerning news that the fruit is available at Save Mart.

Avocado Weed Management

By Leo McGuire
Production Research Committee Chair
and
Tim Spann, PhD
Research Program Director

Glyphosate, the active ingredient in RoundUp® herbicide has been an avocado grower's go-to weed management tool for decades. However, to quote Bob Dylan, "the times they are a-changin'." The court of public opinion, as well as several courts of law, have decided that RoundUp® is public enemy number one. At least 34 California cities – including ag powerhouses like Fresno and Watsonville, and avocado producing areas like Irvine and Carlsbad – have taken some level of action against RoundUp®, from outright bans on city-managed property to reviews of the chemical's safety.

That said, RoundUp® is not the product it used to be. When it was first introduced in 1974, the common belief was that plants could never develop resistance to the unique mode of action of RoundUp®. But every grower knows that isn't the case, and many weed species have developed some tolerance, if not outright resistance, to RoundUp®.

One of the authors had a weed science professor at Cal Poly San Luis Obispo many years ago who was apparently close to retiring and didn't want to write a new exam to address products coming to market. Instead, he wrote on the chalk board, "RoundUp® is not the answer to any of these questions." And he was known for telling his students, "No matter what you kids think, RoundUp® is not always the answer." His warnings proved prophetic!

California's arid climate guarantees only the strongest of weeds survive. If a weed is tolerant to glyphosate and its neighbors are not, the tolerant weed becomes the dominant weed due to the lack of competition. We have always had marestail and pig weed, but as these species have developed glyphosate resistance, they are now all you see in some groves.

Although there has been no action taken officially at the California state level to withdraw the registration for glyphosate, growers need to be prepared for that eventuality. So, let's review your weed management options.

Mechanical Weed Control

If you are lucky enough to be on relatively level ground, mowing is an option. Make sure the ground is dry enough so you do not move disease (e.g., Phytophthora root rot) or cause soil compaction. Be cautious, as mowing can be difficult to do without disturbing leaf litter that is so important as mulch to our shallow rooted trees. "Weed eating" is also an option but is slow and labor intensive, and cut weeds grow back. There are various flame weeders on the market as well, but they are generally not recommended in our dry climate.

Mulching can be considered a means of mechanical weed control because the thick layer of mulch keeps most weed seeds from germinating. The key to a good mulch cap is to keep it thick enough to keep sunlight off the soil — 3 to 4 inches is the standard recommendation — and never pile mulch up against the trunk of trees, keep it back at least 6 to 12 inches, especially on young trees. Be sure you are getting your mulch from a reputable source to ensure it is disease free. Use mulch that is screened and that has been piled to generate heat and kill weed seeds. Note that mulch is not compost. Mulch should be composed of relatively large chunks that will allow air and water to penetrate through to the soil surface and feeder roots. Avoid the "free" yard waste available from many municipalities that is mostly lawn clippings. This mulch breaks down quickly and is often loaded with weed seeds and lawn chemicals you do not want in your grove. See "Dispelling the Myths of Mulch" (Californiaavocadogrowers.com/cultural-management-library/dispelling-myths-mulch) for more information.

Chemical Weed Control

Currently, there are 143 herbicide products registered in California for use in avocado groves; 54 of which are some form of glyphosate. Another 18 products contain paraquat (Gramoxone®) or diquat (Diquat 2L®), which will be dis-

cussed later in this article. In total, the 143 registered herbicide products represent 18 different active ingredients (see accompanying table). Of these 18 active ingredients, eight are for use only in non-bearing groves, which we will not discuss in this article. Take out glyphosate and paraquat, and you are left with eight active ingredients that can be used in bearing avocado groves, two of which are organic products, and two of which, although labeled, are impractical.

Glyphosate is the only systemic herbicide that is registered for food crops. Once glyphosate is inside the weed it is only a matter of time until the weed dies from the roots up. But to be effective, glyphosate must be absorbed by the plant. A plant like mustard — with its tiny little waxy leaves, prickly trunk and yellow flowers — does not absorb anything. Standard applications of glyphosate do not work for this type of plant. You spray it this year, next year you have more yellow mustard. This is one of the reasons weeds that do not take up glyphosate are now taking over groves. Statewide we have different species of weeds that are becoming "super weeds" because of overuse of glyphosate.

Thus, the remaining post-emergence herbicides are contact "burn down" products, such as paraquat. These products do exactly what the name implies, they chemically burn any part of the weed that the product contacts. These were commonly used before glyphosate became the go-to cost-effective tool. Burn downs often will kill a young weed that is not well established but only will knock back an established weed. Think of these products as "chemical mowers." Knock the weed down, get some rain and it's back.

As an industry, we need to re-learn how to apply burn downs; there's an

Herbicide active ingredients registered for use in avocados in California.[a]

Active Ingredient	Trade Name[b]	REI/PHI[c]	Signal Word[d]	Comments
Ammonium nonanoate	Axxe	4 hr/0 day	Warning	Organic
Prodiamine	Barricade	12 hr/0 day	Caution	Non-bearing only
Sodium salt of bentazon	Basagran	48 hr / 1 yr	Caution	Non-bearing only
Flumioxazin	Chateau	12 hr/1 yr	Caution	Non-bearing only; do not apply within 2 months of planting; trees < 1-year-old must be protected with non-porous wraps
Diquat dibromide	Diquat	24 hr/1 yr	Warning	Non-bearing only
Fluazifop-P-butyl	Fusilade	12 hr/1 yr	Caution	Non-bearing only
Isoxaben	Gallery	12 hr/1 yr	Caution	Non-bearing only
Oxyfluorfen	Goal	24 hr/0 day	Warning	
Paraquat	Gramoxone	24 hr/0 day	Danger	Restricted use
Sethoxydim	Poast	12 hr/1 yr	Warning	Non-bearing only
Simazine	Princep	12 hr/0 day	Caution	Do not apply within 1-year of planting; 1 application per year max
Glyphosate	RoundUp	4 hr/14 day	Caution	
Pelargonic acid and related fatty acids	Scythe	12 hr/24 hr	Warning	
Carfentrazone-ethyl	Shark	12 hr/0 day	Caution	Apply at least 1-day pre-planting
Trifluralin & Isoxaben	Snapshot	12 hr/1 yr	Caution	Non-bearing only
Norflurazon	Solicam	12 hr/60	Caution	Do not apply within the first 6 months after planting; do not replant
		day		within 12 months of application
Caprylic acid	Suppress	24 hr/0 day	Warning	Organic
Oryzalin	Surflan	24 hr/0 day	Caution	½-1-inch of rain/irrigation required for activation

[a] Data are based on a search of the Agrian database on May 14, 2019 and are accurate as of that date. Growers are reminded that the label is the law and all label guidelines must be followed when using any ag chemical.

[b] Trade names are provided as examples only and do not constitute an endorsement of any product.

[c] REI = Restricted-entry interval is the period of time after application when entry into the treated area is restricted; PHI = Preharvest interval is the wait time between when a product is applied and when the crop can be harvested.

[d] Signal words are found on product labels and they describe the acute (short-term) toxicity of the formulated product. CAUTION means the product is slightly toxic, WARNING means the product is moderately toxic, and DANGER means the product is highly toxic.

Hairy fleabane.

entire generation of growers and farm managers who've never known a world without glyphosate. When discussing ag chemical efficacy, you often hear the phrase "coverage is key," but with glyphosate about 30 percent coverage of a susceptible weed provided good kill because it's a systemic product. In comparison, contact herbicides need good coverage and higher volumes than glyphosate, maybe as much as 250 gallons per acre for good control.

In addition to the downfall of glyphosate, paraquat is impractical to use. The chemical is extremely toxic to humans with no known antidote and is a restricted use chemical. New regulations will be going into effect no later than November 1, 2019, that will further restrict paraquat's use. These new restrictions include the requirement that anyone applying paraquat be a certified applicator; applicators no longer will be allowed to work under the supervision of a certified applicator. In addition, paraquat applicators will need to take the Environmental Protection Agency's paraquat training and exam, passing the exam with a 100 percent score. Retraining and examination will be required every three years. Paraquat also is required to be mixed in a closed mixing system. Although these changes take effect November 1, some changes may start to appear on product labels sooner, so if you use paraquat be sure to review the product label and follow all restrictions.

Norflurazon (Solicam®) is another herbicide that is impractical in avocados due to the 60-day preharvest interval (PHI). Oryzalin (Surflan®) is likewise impractical because it requires ½ to 1 inch of rain or irrigation for activation. In a wet winter like the one we just had, you may be able to make the timing work, but in most years that won't be the case. And irrigating oryzalin in is impractical since microsprinklers only irrigate the area under a tree's canopy, where weeds tend to be shaded out, and not the row middles where the weeds grow.

This leaves a total of six herbicides for use on bearing avocados: ammonium nonanoate (Axxe®), Oxyfluorfen (Goal 2XL®), sethoxydim (Poast®), pelargonic acid and related fatty acids

Sow thistle.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Marestail (horseweed, left) and hairy fleabane (right) rosettes.

(Scythe®), carfentrazone-ethyl (Shark EW®) and caprylic acid (Suppress®).

Ammonium nonanoate and caprylic acid are both organic certified broad-spectrum contact herbicides. They have no residual activity and are relatively expensive to apply because they are applied at higher concentrations (up to 15 percent for ammonium nonanoate, and 9 percent for caprylic acid) compared with many conventional herbicides. Pelargonic acid is a similar product to the previous two chemistries, but never received organic certification.

Oxyfluorfen is primarily effective against broadleaf weeds, such as marestail and pigweed, but also has efficacy against some grass species. Sethoxydim is only effective against annual and perennial grass species.

Carfentrazone-ethyl is a broadleaf specific herbicide that some growers are finding good success with. Timing is critical with this product; it is only effective if weeds are sprayed at the right stage of growth. Some growers are finding good success with a tank mix of carfentrazone-ethyl and glyphosate. However, you must keep in mind when tank mixing that the restricted entry interval (REI) and PHI will be for the chemical with the greatest restriction, so a tank mix of carfentrazone-ethyl and glyphosate will have a 12 hour REI and a 14 day PHI.

No matter how many options we review in this article your weed problem is specific to your grove. Young trees, old trees, high density, low density, yellow mustard, Russian thistle, pigweed, marestail, we all have different challenges that need different solutions.

The Future of California Avocado Weed Control

Your California Avocado Commission Production Research Committee has been looking for alternatives to glyphosate. We have been working with weed scientists to give us some safe economical options that work well. This includes seeking proposals for screening trials to look at new chemistries as well as possible tank mixes of existing chemistries to improve efficacy.

The old professor was right, RoundUp® is not the answer to everything.

All photos by Lynn M. Sosnoskie, University of California.

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Grower Profile

Bryce & Elaine Bannatyne Take Circuitous Route to their Newest Passion

By Tim Linden

Ventura County growers Bryce and Elaine Bannatyne each have a family history with agricultural roots, but their path to the avocado industry was anything but a straight line. In fact, it snaked through California, several art history eras and the education profession.

Nonetheless, under the company name Rancho Resplandor, the duo farm 375 acres in and around Santa Paula with half of that land devoted to avocados and the other half to lemons. And today, the Bannatynes are big promoters of the Gem variety, believing it holds great promise for the industry and can be a sought-after niche variety, much like a top-shelf wine.

But first the history and geography lesson. Elaine's family traces its California and agricultural lineage to the late 1800s when her grandfather Margarito Veyna came to the United States from his native Mexico and went to work for Orange County Nursery in Southern California. In fact, he eventually bought that nursery. Mr. Veyna, his children and grandchildren ran the wholesale nursery for more than a century with avocados and citrus trees being two of their major crops in the early to mid-20th century. The operation eventually resettled in Ventura County and though it remains in the family, it is no longer an operating nursery.

Bryce Bannatyne was born in Napa where his family had two ranches. He explains that was before wine grapes took control of the region. His grandfather grew Bing cherries and melons on the land.

Bryce and Elaine met in college at Mount St. Mary's University in Los Angeles. Elaine was an art and Spanish major heading toward a career in education, while Bryce was a graduate student studying industrial technology. They married and spent the next three decades pursuing careers in education and the art business.

Elaine started as a bilingual teacher but spent most of her career as a resource teacher and as an administrator. She started her educational work life at the Los Angeles Unified School District, spent many years in the public school district in Richmond in the Bay Area and finished her career at the Santa Monica Unified School District. Along the way, she earned a master's degree and a law degree.

Bryce explains that in the early '70s he migrated into the art business, owning a gallery that specialized in historical pieces of artistic value purchased by museums, collectors and businesses. "Over the years we sold art to 30-35 museums all over the world," he said, explaining that they were period pieces from the 19th through mid-20th centuries.

The initial gallery was in San Francisco, which Bryce and Elaine owned with his parents. In the late '80s, they split off from that operation and opened a gallery in Santa Monica.

The Southern California gallery had a little different focus specializing mostly in American and British furniture from late 19th century through mid-20th century, like Frank Lloyd Wright and Green and Green pieces.

Along the way, they also raised two children, one of whom is in the art industry while the other is in the wine and spirits trade. At this point neither are involved in the family's avocado pursuit, but neither were Elaine and Bryce at a similar time of their lives.

Becoming growers came to them as an offshoot of Elaine's family nursery business. The nursery had relocated to Ventura County, which acquainted them with the area. In 2004, the couple bought a 42-acre ranch in Fillmore that was in a distressed state. They started rehabilitating the ranch and discovered it was a full-time job. That led to the end of their longtime careers and began the transition to full-time fruit growers. Over the next few years, they closed down the art gallery, Elaine retired from teaching, they moved to their ranch in Fillmore and bought six more ranches.

"It was a sharp learning curve," Elaine said. "We didn't know very much about farming. We attended a lot of seminars, talked to other growers and learned by trial and error."

But the original purchase turned into their business model for Rancho Resplandor. "All of the ranches we have purchased have been rehab properties," Bryce said. "We look for properties that have been mistreated or at least not farmed with good farming techniques."

The Bannatynes pay very close attention to cultural practices, making sure they apply the right amount of water and fertilizer. They also pay close attention to research and new practices being studied and adopted. Bryce said they got into farming as a business proposition. They are avid learners and want to be involved, volunteering their time and efforts where needed. Bryce is an alternate on the California Avocado Commission (CAC) Board. He is on CAC's Production and Research Committee and is Chairperson of the California Department of Food and Agriculture Avocado Inspection Committee. Elaine has served on the Hass Avocado Board.

It is this involvement that led to their fascination with the Gem variety. "We first were introduced to it at the World Avocado Congress in Lima, Peru, about four years ago," Bryce said. "There were presentations on two new varieties and Gem was one of them. It attracted my curiosity. I decided if I had a chance, I'd try Gem."

Since then, the Bannatynes have planted about 10 acres of Gem avocados at three different locations. They have used a semi-high-density planting pattern and are very pleased with the results. The plantings were completed in June of 2015. The first fruit for commercial consumption was harvested in 2018 and they are looking forward to this year's crop. They also are anticipating planting five more acres of Gem trees this year.

Bryce has a checklist of reasons why he likes this variety and thinks it has great promise:

- It produces larger fruit than a Hass.
- It lends itself to high-density plantings because the tree's natural growth pattern takes up less space.
- It also lends itself to hillside plantings because of its cylindrical shape. "It is only eight to 10 feet in diameter," he said.
- The fruit has excellent flavor.

Elaine expounded on the last point. "The fruit tastes very good and has a very good texture," she said. "And the exterior is very protective."

Bryce added that when he shares the variety with friends and family, everyone comments on the taste, without prompting. And, he said, it is the only variety about which people have commented on how good the exterior looks. "It's a handsome piece of fruit," he said.

He added that the Gem variety is already being sold in Europe in relative volume and it is gaining a premium in the marketplace over Hass. As a practical matter, he believes their Gem trees will produce more fruit per acre than the Hass, and he says it's easier to pick as the fruit grows on the interior of the tree. He added that because of the smaller vertical size of the Gem trees, pickers do not need poles to harvest the fruit, which is another big advantage in this era of labor shortages and high workers' comp insurance rates.

The Bannatynes are bullish on the future of the California avocado industry. They are impressed with the members of the industry and their dedication to producing a great piece of fruit. While it has proven to be a tough business, Elaine said, "We have no regrets. We have a tremendous amount of respect for the people in this industry. They are a highly-educated, sophisticated group of people that are very down to earth."

Bryce said the commercial avocado is unique in the fruit business. He noted that many other fruits, such as apples and grapes, have many different varieties and colors, but the avocado stands by itself. It has no substitute nor equal. He added that its nutritional content also allows it to rise above others.

While the pair has left their earlier professions, they still have an affinity for specific periods of art. Their house contains paintings and furniture of the Mexican Colonial period. "My wife really likes Mexican Colonial while I like California history, including when California was part of Mexico," Bryce said.

In fact, their abode at Rancho Resplandor, which translates to radiance or glowing in Spanish, has hosted several art programs because of their fine collection. Elaine said the company name itself ties together many of their interests, including her Mexican roots and their love of the avocado.

Form I-9
Know the Requirements

By Anna Genasci
AgSafe

In agriculture, our labor needs change with the seasons, which means we are regularly pulling together the new-hire paperwork packet for our employees. One of the most critical, and frankly complicated, forms in that packet is the Form I-9, the Employment Eligibility Verification form that needs to be filled out for every person hired in the United States after November 6, 1986. Let's spend some time diving into each section and its requirements.

Section 1: Employee Information and Attestation

It is the employee's responsibility to provide the following information:

- Full legal name
- Other names used, like a maiden name
- Current address, no P.O. Boxes
- Date of birth
- Mark the appropriate citizen or noncitizen box
- Signature and dates

It is the employer's responsibility to review the information provided by the employee in Section 1 and ensure all of the information is filled in legibly, including the employee's signature and the date signed. You should note whether your employee indicated in Section 1 that their employment authorization will expire, and mark your calendar with the date to re-verify. In addition, be sure you are using the most recent version of the form (the date can be found in the upper right-hand corner of the first page). It also is important to only use blue or black ink and never use a highlighter or whiteout on the form. These latter reminders are important as an employer can be given an administrative citation for not following the directions on any part of the form.

Section 2: Employer Review and Attestation

Employers must complete and sign Section 2 on the I-9 within three business days of the date of hire of the employee (the hire date means the first day of work for pay). For example, if your employee began work for pay on Monday, you must complete Section 2 by Thursday of that week. If the job lasts less than three days, you must complete Section 2 no later than the first day of work for pay. The employee must present documents that verify his or her identity and the right to work in the United States. A variety of documents satisfy both requirements and are referred to in List A of the instructions.

Alternatively, an employee can present a document from List B validating their identity and List C with their work authorization. To review a complete list of the accepted documents, including pictures of examples for reference, visit I-9 Central at https://www.uscis.gov/i-9-central/acceptable-documents/list-documents/form-i-9-acceptabledocuments?topic_id=1&t=b.

It is the employer's responsibility to take the documents provided and subsequently complete the section with the employee's name, along with the information from the documents in the appropriate List A, B or C column. Employers are responsible for visually inspecting the documents presented to ensure they are legally acceptable and genuine. In addition, the business name, address, date hired, date signed, and signature lines all should be completed.

In Section 2, common administrative mistakes include not following the correct date format (mm/dd/yyyy), (i.e. 01/08/1980). It is often common for employers not to complete the form within the three business days, as previously mentioned. Lastly, illegible handwriting creates challenges when and if the form is ever audited.

Section 3: Reverification and Rehires

This section requires attention when your employee's employment authorization or documentation of employment authorization has expired. Employers should not re-verify the following documents:

- U.S. citizens and noncitizen nationals
- Lawful permanent residents who presented a Form I-551, Permanent Resident or Alien Registration Receipt card for Section 2. This includes conditional residents.
- List B documents

That being said, if you rehire an employee within three years from the date that the Form I-9 was previously executed, you may either rely on the employee's previously executed Form I-9 or complete a new form. If you choose to rely on a previously completed Form I-9 follow these guidelines:

- If the employee remains employment-authorized as indicated in the previously executed form and doesn't need additional documentation, then reverification is not needed.
- If the previously executed form indicated a document that is subject to reverification, if it has expired then it needs to be reverified and the updated information should be noted in the section.

If you already used the Section 3 on the current Form I-9, a new form will need to be completed. Remember that employees hired after three years from the date of the original hire must complete a new I-9 Form.

Form I-9 Storage and Retention

The question of how and how long to store I-9s is one of the most common points of confusion for employers. The form's instructions are fairly detailed in these areas and as such, it is best to make sure you read the directions thoroughly and on an annual basis so as to ensure no new details are missed. The following is a practical synopsis of what to keep in mind:

Storage:

- Form I-9 must be on file for all current employees – full-time, part-time, regular, and seasonal.
- Store the forms securely in a way that meets your business needs – on-site, off-site, storage facility or electronically.
- Store the forms and copies of documents separately, if you choose to make copies.
- Ensure that only authorized employees have access to the files.
- Be prepared to make them available within three days of an official request for inspection.

Retention:

Forms should be kept either:

- Three years after the date of hire or
- One year after the date employment terminates, whichever is later

If completing the Form I-9 feels overwhelming, visit the USCIS website, I-9 Central for further explanation and training videos at https://www.uscis.gov/i-9-central/learning-resources.

For more information about the Form I-9, or any worker safety, human resources, labor relations, pesticide safety, or food safety issues, please visit www.agsafe.org, call (209) 526-4400 or email safeinfo@agsafe.org.

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By Ben Faber
Soils, Water and Subtropical Crops Farm Advisor
University of California Cooperative Extension

It's Not Just Water, It's Salt

Irrigated agriculture must always contend with salts. Five years of drought followed by an exceptionally wet winter and their effects can magically disappear, but they will be back again. Low rainfall is the norm for California. We rely on winter rainfall to leach the salts from root zones that have accumulated salts from previous irrigations. Salinity affects plant growth and understanding what it is and how it is measured and evaluated is important. Just having wet soil that is full of salts is not going to help a plant, it's going to add stress and eventually physiological and disease problems.

All waters, even rainwater, have some salts dissolved in them, so all waters could be called saline. The term saline is restricted to waters with concentrations that could cause harm to plants or people. Seawater is highly saline; many wells are moderately saline. But unlike humans that excrete salts, plants are often affected by salt levels that have very little health impact on humans. Well waters that are fit for human consumption and used for irrigation can often exceed standards for plants. However, with proper management many waters can be used on plants, depending on the plant species. Domestic water supplies from cities typically have better quality than some well waters because they are monitored and often blended to meet human consumption. Most domestic water supplies have low concentrations of salts and are not considered to be saline. However, using even domestic water in growing subtropical crops does not mean that we should not be concerned about salinity.

1.5 feet of water with EC of 1.6 dS/m adds 10,000 pounds of salt per acre!

Before going any further, it is worth remembering that salt is not just the sodium chloride that's on the table. Salts are combinations of electrically charged ions. These ions separate from one another when a salt dissolves in water. Water with dissolved sodium chloride and potassium nitrate contains sodium, potassium, chloride and nitrate ions. The most common ions in natural waters are:

- sodium (Na^+)
- chloride (Cl^-)
- sulfate (SO_4^{2-})
- calcium (Ca^+)
- boric acid (H_3BO_3)
- magnesium (Mg^+)
- bicarbonate (HCO_3^-)

Different waters can have very different proportions of these ions and these proportions can change with time. Some typical analyses of City of Ventura water can be seen in the accompanying table.

Total dissolved solids (TDS) and electrical conductivity (EC) are two different ways of measuring the total amount of salts in water. The old way of taking a specified volume (L for liter) of water and boiling it down to the residue which is weighed (mg for milligram)

Tip burn on avocado leaves caused by irrigating with water high in salinity.

gives TDS (mg/L). The more modern technique is to measure the electrical current water will carry (µmhos/cm or micromhos/cm), which is in proportion to the number of ions in the water.

Natural waters also contain low concentrations of many other elements. For most, the amounts are too low to be either harmful or beneficial to plants. The main exception is boron, which can be a problem for sensitive plants such as citrus, avocado and probably cherimoya as well, when in excess of 1 mg/L. Many well waters in Santa Barbara and Ventura counties contain potentially harmful levels of boron for plants. This is not a common problem in San Diego County.

In addition to the ions mentioned, there also are those that come from fertilizers and the soil. The main extra ions are potassium, ammonium, nitrate and phosphate. The concentrations of these will depend on the type of soil and the amounts and kinds of fertilizers applied, minus the amounts taken out by plants, held by the soil and lost by leaching or erosion.

In evaluating a water for its potential to harm plants, it is necessary to look at total salinity, as well as the specific ions. Waters with a TDS in excess of 1000 mg/L or an EC greater than 1500 µmhos/cm might pose problems for sensitive subtropical plants, and none at all to tolerant plants like figs, apricots or pomegranates. Waters with an excess of sodium and/or chloride (more than 100 mg/L) can induce symptoms that are similar to high levels of salinity.

In most cases, plants respond to high salinity by initially having their leaf margins turn yellow and die. This happens first on older leaves because they have had the longest time to accumulate the ions. Annual plants are often less affected than perennials, since they do not grow long enough to accumulate

Ionic composition of some wells in Ventura

Sample	Na^+	Ca^+	Mg^+	Cl^-	SO_4^{2-}	TDS	EC
	mg/l or ppm						µmhos/cm
1	200	259	70	92	839	1668	1990
2	45	92	191	44	210	645	874
3	28	59	21	20	140	316	580

Source: 2015 Annual Report of the City of San Buenaventura

sufficient ions to cause damage.

As trees remove water from the soil, the concentration of salts in the remaining soil water increases. Plants adapt to moderate increases, but if the plant is sensitive (and most subtropical crops are), it will slow growth in response. If the salt increase is small, the growth reduction will be small and acceptable. But if the level of fertilizer use is high, the water quality poor, or the soil has not been properly leached, the increased soil salinity could reduce growth seriously.

The effects of salinity are usually gradual on plants, unless too much fertilizer has been applied suddenly or strong, dry wind causes rapid drying. Also, with some domestic water there is variation in concentration and kinds of salts in the water with time.

The 200 mg/L of sodium in water sample 1 in the table would be a problem if this were what the homeowner continuously received. However, according to city data, this house does get 94 mg/L at times (not on the table). The better quality water serves to flush out the higher concentration salts. This is a practical method for dealing with poorer quality water: occasionally leach the soil with a volume of water in excess of plant need. When there are no leaching rains, we need to be more aware of the potential for salt accumulation in the soil. With proper plant selection and water management even extremely saline waters can be used.

Understanding Ion Concentrations in Water

The ions in water are measured as parts per million (ppm) or milligrams per liter (mg/L), terms which are interchangeable. This is like saying a percent, but instead of the ions' weight per 100 weight of water, it is the ions' weight per million weight of water.

The ion concentration also can appear as milliequivalents per liter (meq/L). A milliequivalent is the parts per million of that ion divided by its atomic weight per charge.

Example

Assume we have a Ca^{2+} solution with a concentration of 200 ppm. What is the concentration of this solution in meq/L?

Ca^{2+} has an atomic weight of 40

Ca^{2+} has two charges per atom, thus an atomic weight of 20 per charge

200 ppm / 20 = 10 meq/L

Water Terminology

Total Dissolved Solids (TDS): a measure of total salts in solution in ppm or mg/L

Electrical Conductivity (EC): similar to TDS but analyzed differently

EC Units: deciSiemens/meter (dS/m) = millimhos/centimeter (mmhos/cm) =

1000 micromhos/cm (µmhos/cm)

Conversion of TDS to EC: 640 ppm = 1 dS/m = 1000 µmhos/cm

Hardness: measure of calcium and magnesium in water expressed as ppm of $CaCO_3$ (calcium carbonate)

pH: measure of how acid or base a solution is

Alkalinity: measure of the amount of carbonate and bicarbonate controlling the pH, expressed as ppm $CaCO_3$

Sodium Adsorption Ratio (SAR): describes the relative sodium hazard of water

$$SAR = (Na)/((Ca+Mg)/2) \times 1/2, \text{ all units in meq/L}$$

By Tim Spann, PhD
Research Program Director

Understanding Plant Mineral Nutrition

All plants require 17 elements to grow and develop properly. Those 17 essential elements are: carbon (C), hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), nickel (Ni) and zinc (Zn).

The first three elements — C, H, O — are acquired from water (H_2O) and carbon dioxide (CO_2) through the process of photosynthesis. During photosynthesis plants take in carbon dioxide from the atmosphere through small pores in their leaves called stomates. The carbon dioxide is combined with water absorbed by the roots to produce carbohydrates (CH_2O) and oxygen (O_2). Carbohydrates (sugars) are the plant's basic energy source and the oxygen is released to the atmosphere through the stomates.

The remaining 14 elements are known as essential mineral nutrients and are taken into the plant through its roots. An essential nutrient is defined as a nutrient without which the plant cannot complete its lifecycle. These nutrients are further subdivided into macronutrients — those required in relatively large quantities (N, P, K, Ca, Mg, S) — and micronutrients — those required in relatively small quantities (B, Cl, Cu, Fe, Mn, Mo, Ni, Zn). In plant nutrient analysis reports, the macronutrients are reported as percent of leaf dry mass, whereas the micronutrients are reported in parts per million (ppm). It's important to remember that the classification of a mineral nutrient as a macro or micronutrient does not make it any less essential to the plant.

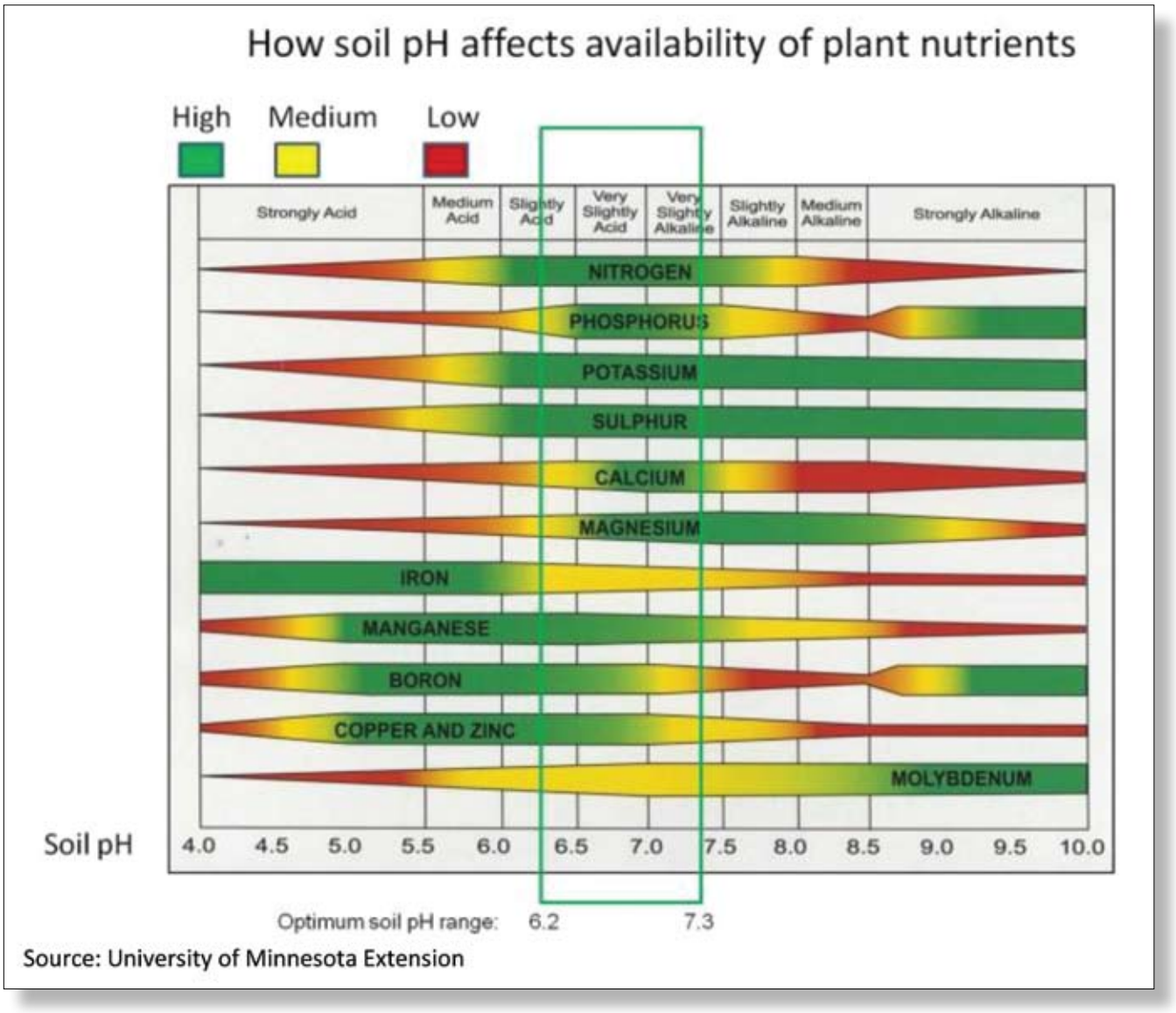
The 14 essential mineral nutrients required by plants, their chemical symbol, and their uptake forms in soil.

	Nutrient	Symbol	Uptake form in soil
Macronutrient	Nitrogen	N	ammonium ion (NH_4^+) or nitrate ion (NO_3^-)
	Phosphorus	P	phosphate ion ($H_2PO_4^-$, HPO_4^{2-})
	Potassium	K	potassium ion (K^+)
	Calcium	Ca	calcium ion (Ca^{2+})
	Magnesium	Mg	magnesium ion (Mg^{2+})
	Sulfur	S	sulfate ion (SO_4^{2-})
Micronutrient	Boron	B	boric acid (H_3BO_3) or borate ion ($H_2BO_3^-$)
	Chlorine	Cl	chloride ion (Cl^-)
	Copper	Cu	cupric ion (Cu^{2+})
	Iron	Fe	primarily ferrous ion (Fe^{2+}); some ferric ion (Fe^{3+})
	Manganese	Mn	manganous ion (Mn^{2+})
	Molybdenum	Mo	molybdate ion (MoO_4^{2-})
	Nickel	Ni	nickel ion (Ni^{2+})
	Zinc	Zn	zinc ion (Zn^{2+})

There are other elements that are currently known to be essential for only specific groups of plants. These include cobalt (Co), which is essential to the N-fixation process in legumes, and silicon (Si), which is essential in grasses like rice. Other elements, such as selenium (Se), are not essential to plant growth, but are essential nutrients for humans and many animals who consume plants and so are considered beneficial nutrients.

Nutrient Uptake

For plant roots to absorb nutrients, the roots must either go to the nutrients or the nutrients must come to the roots. Plant roots take up nutrients in one of three ways: interception, mass flow and diffusion. Interception is where roots growing through the soil encounter nutrients in the soil. This uptake method is entirely dependent on root growth — if roots are not actively growing then uptake by interception will be minimal. Furthermore, even in vigorously growing plants, roots may only be present in a small portion of the soil volume, maybe as little as one percent. Lastly, interception is dependent on good soil structure that can be easily penetrated by roots. Soil compaction or the presence of an impervious hardpan will limit the volume of soil the roots can explore. In avocados, which have a shallow root system, interception likely accounts for a small fraction of nutrient uptake because of the small soil volume the active roots explore.



Mass flow is the movement of nutrients in water to the root. As the plant extracts water from the soil, soluble nutrients are taken up along with the water. Soluble nutrients such as nitrogen, calcium, magnesium and sulfur are most likely to be taken up through mass flow. Nutrient concentration is very important for mass flow uptake — there must be a sufficient quantity of soluble nutrients in the soil to flow in the soil water. The more nutrients moving in the soil water (i.e., the higher the concentration) the more uptake by mass flow. However, the solubility of these nutrients also makes them highly susceptible to leaching if irrigation is not well managed.

Diffusion is the movement of a substance along a concentration gradient — from an area of high concentration to low concentration. As roots take up nutrients from the soil immediately surrounding them, the concentration of the nutrients decreases and nutrients from areas of higher concentration diffuse toward low concentration and toward the roots. Diffusion of nutrients in the soil takes place on a relatively small scale within the area immediately surrounding roots, known as the rhizosphere. Nutrients that are not highly mobile and don't move by mass flow, like P and K, move by diffusion. Thus, the concentration of these nutrients must be maintained at relatively high levels in the soil to drive diffusion.

How Soil Factors Affect Plant Nutrition

Cation exchange capacity (CEC) is a very important soil trait that affects plant nutrient availability. A cation is simply a positively charged ion. As you can see in the accompanying table, most essential nutrients are positively charged — they are cations — in their uptake form in the soil. CEC is a measure of a soil's capacity to hold cations on negatively charged soil components (e.g., clay particles, organic matter). A cation held by the soil's CEC is unavailable for plant uptake since it is not in solution. The addition of cations to the

soil (e.g., fertilization or liming) will allow the bound cations to exchange places with the added cations, thus "dislodging" the bound cations into the soil solution where they become available for plant uptake. However, the freed cations in solution also become subject to leaching if they are not taken up by the plant. Knowing your soil's CEC helps you to manage nutrition on your soils and avoid nutrient leaching.

Soil physical properties also are important traits in managing nutrition. Texture is a description of the percentage of sand, silt and clay particles in a soil. Generally, plant nutrients are held by the clay fraction of a soil. Thus, the higher a soil's clay content, the higher its nutrient holding capacity. Soils high in sand typically have low nutrient holding capacity because sand particles have low CEC. Leaching of nutrients also increases as sand percentage increases since water moves more freely in sandy soils and can easily leach the weakly held cations.

Soil structure is the arrangement of soil particles into aggregates. Soil structure creates large pores that allow good water drainage and soil aeration, but a highly aggregated soil also is susceptible to nutrient leaching. However, a lack of structure decreases water infiltration and can lead to runoff and erosion problems, which also can lead to nutrient losses.

Soil pH is a measure of a soil's acidity or basicity (alkalinity), and pH has a tremendous effect on the availability of plant nutrients. As seen in the accompanying figure, some nutrients like potassium and sulfur are available to plants over a wide range of soil pH. But others, like phosphorous and calcium, are available over a relatively narrow pH range. Most nutrients are optimally available in a pH range very slightly acidic to very slightly basic. Soil pH can be affected by the type of fertilizer you apply and your irrigation water. The pH of an acid soil is typically raised by the addition of lime — calcium carbonate, $CaCO_3$. A basic soil's pH can be lowered by the addition of elemental sulfur, which slowly oxidizes in the soil to form sulfuric acid.

Soil temperature indirectly affects plant nutrition by influencing root metabolic activity. If temperatures are too low for active root metabolism then nutrient uptake will be slow. Temperature also influences the activity of soil microbes responsible for organic matter decomposition and, thus, the release of nutrients.

Fertilizer Application and Timing

In California, avocados are typically fertilized from April through October to ensure active root growth, which maximizes uptake efficiency, and to avoid winter rainfall. Fertilizing outside this window, when soil temperatures are generally cooler, will result in poorer uptake and possibly increase the risk of fertilizer leaching. However, fertilizer timing decisions should be made on an individual grove basis and may even be different for different blocks depending on microclimates.

The general recommendation is to divide your fertilizer application into at least three applications during the April to October window. There is no harm in splitting your fertilizer application into more, smaller doses, especially on highly leachable soils (e.g., sandy soils, low organic matter soils).

All fertilizer applications should be based on leaf and soil analyses. For avocados in California, leaf samples should be collected in mid-August to September, sampling the most recently expanded healthy mature leaves from the spring flush on non-fruiting branches. This is a relatively stable period of leaf nutrient content in avocado. Comparing leaf analyses year-to-year allows you to see if your fertility program is providing adequate nutrition. If leaf nutrient values are declining or are deficient, then your fertility program should be increased in the coming season. Likewise, leaf nutrient values in the excess range indicate that your program can be dialed back.

However, you need to evaluate your leaf analysis and fertility program in combination with a comprehensive soil analysis. Perhaps your fertility program is adequate, but if your soil pH is high (e.g., 8.0) you may see deficiencies in many of the micronutrients and adding more micronutrients will do little to correct these deficiencies. Or you may find that your soil has a very low CEC, in which case you should split your fertilizer program into as many small applications as reasonable since your soil is unable to hold the nutrients and serve as a reservoir.

Lastly, you need to evaluate your irrigation system and practices in combination with your fertility program. Most California avocado growers apply fertilizer by injection into the irrigation system. When was the last time you checked the distribution uniformity (DU) of your irrigation system? DU is just what it sounds like; it is a measure of how uniformly your irrigation system is applying water to your tree. Is every tree receiving the same amount of water? A DU of 1 means that your system is 100 percent uniform; in general, you should try to have a DU of 0.85 or better. If the amount of water being applied varies from tree-to-tree, then so will the amount of fertilizer being applied.

Editor's Note: *This article serves as a baseline for understanding general plant nutrition. Over the next couple of issues of From the Grove, follow-up articles will discuss in detail macro and micronutrient nutrition of avocados, including the role each nutrient plays in the tree.*

Annual Meeting Reflects on 40th Anniversary & Forges Ahead

By Tim Linden and Marji Morrow

As the California Avocado Commission (CAC) celebrated the 40th anniversary of its establishment, the April 2019 CAC annual meetings for growers took a look at the Commission's history as it framed its future.

President Tom Bellamore, quoting from some of the pioneers in the early history of CAC, noted that while the industry has changed quite dramatically in the ensuing four decades, there also is much that has stayed the same. Topping that list is the main goal of the Commission, which is to increase grower returns. In the early days, the Commission's first president, Ralph Pinkerton, opined that no group looks ahead with more anxiety than the California avocado grower. Pinkerton noted that it was not a timid group, but one filled with members who have no issue speaking their mind.

Bellamore said the growers have charged CAC with the task of keeping expenses low while continuing to build programs to help growers both grow and market their crop. As a point of fact and an illustration of the Commission's effort in this regard, he revealed that the office rent negotiated soon after he took the helm in 2009 was exactly the same amount paid when CAC opened its doors 40 years ago.

Though the avocado category is clearly much different today – with total sales in the United States in the 2.5 billion pound range – Bellamore said the industry is reaping the rewards from the groundwork laid by the Commission in those 40 years. He noted it was CAC that started the research dispelling the nutrition myths about the avocado. CAC also launched the connection between the avocado and the Super Bowl, which has paid rich dividends to the entire industry. And it was CAC that first brought the avocado into national prominence with promotions featuring celebrity Angie Dickinson.

CAC also conceived of the avocado volume reporting sys-

tem (Avocado Marketing and Research Information Center – AMRIC), which has served the industry well for many years, and the Commission launched the ripe program that dramatically increased consumption.

CAC also worked diligently to make sure Mexico's entry into the U.S. avocado market occurred without peril to the California avocado industry. "It took 20 years for Mexico to gain full access to the U.S. market," he said.

He said that effort was part of CAC's issues management program that also included work on water costs, pest management and varietal development.

Always, Bellamore said, job number one was to grow the California brand and improve the plight of California growers. Toward this end, CAC helped write the legislation that established the Hass Avocado Board and made sure importers were paying their fair share to grow the market.

With the influx of imported avocados, Bellamore said CAC has shifted its strategy to position California avocados as the premium brand in the marketplace. By all accounts, this effort has been successful. Last year, California fruit achieved an 18 percent premium on average over the imports. Though it is an impressive premium Bellamore said, "I'm not happy with that and you shouldn't be either."

Though this year's California crop, which has been estimated at 175 million pounds, is the smallest in a decade and represents only about 7 percent of the 2019 total estimated U.S. sales, Bellamore said that should not be cause for worry. He believes the premium position will bode well for California growers and the April field price did bear that out.

Following Bellamore to the podium was Monica Arnett, CAC director of finance and administration. She explained the financial workings of CAC and how the staff uses its reserves to manage its cash flow and make sure it can fund programs 12 months of the year, even though revenues are concentrated in a much tighter window. In a short crop year like 2019, she said this is critical for CAC's continued success. This year, CAC has tapped into its reserves more significantly, but she said the financial scheme has allowed the Commission to keep the assessment rate stable for the past five years.

Following the annual meeting theme of looking both back and ahead, Arnett noted that the initial CAC budget 40 years ago devoted 75 percent of revenues to marketing, which is just about the same percentage allocated to those programs today.

Vice President Marketing Jan DeLyser took on the task of explaining how California can remain relevant in light of the fact that it only has a 7 percent market share this year. "The quality of fruit you grow works to our advantage," she said, adding it is the quality that has allowed California to become a premium provider.

This year, CAC is honing in on those consumers who seek

out California fruit and will pay the premium. While the marketing focus remains the same as it was 40 years ago, DeLyser said the tools being used have changed quite a bit. Now digital marketing, geo-targeting and the use of influencers on social media have largely replaced more expensive promotional campaigns. Wild postings that encourage people to take photos in front of CAC-branded imagery and post the selfies on social media have co-opted the drive-by freeway billboards of the past. And YouTube videos on social media are a better bet than network television advertising. She said these new efforts, which rely on technology and can be seen no matter where the avocado consumer is, can deliver results in a more efficient and affordable way.

"Targeting is imperative when you have a smaller crop," she said. "Some retailers are willing to pay the premium price and that is who we are targeting."

Industry Affairs Director April Aymami traced the beginning of the department to 1983/84 when the Rex Land Report concluded the industry had too many marketers. CAC established the Industry Affairs department to improve communications between the Commission and the industry stakeholders, which Aymami said is still the goal today. Industry Affairs is charged with collecting and disseminating crop statistics to help growers develop their own picking and marketing strategy. The Avocado Marketing and Research Information Center (AMRIC) was launched in 1984 to collect price and shipment reports so handlers and growers have access to real-time inventory and price data.

Because of a better crop estimating system, Aymami said forecasts have gotten much better, which is very valuable as the Commission makes decisions and analyzes programs. She noted that especially useful to the Commission and industry are the midseason surveys, which provide updated volume information at the most critical point of the season.

Aymami revealed that acreage has been holding steady for

the past few years around the 50,000 figure, but reports indicate that there could be an increase in the next few years.

Aymami said CAC has continually used many different tools to communicate with growers including the annual meetings, the Annual Report, the semi-monthly GreenSheet, and this quarterly magazine, *From the Grove*. Other important information is communicated through the grower website and the online decision support tools system. Additionally, meetings and seminars are held including workshops at the Pine Tree Ranch demonstration grove in Santa Paula.

Next at the podium was Ken Melban, vice president of industry affairs, who discussed CAC's efforts in the issues management realm. He shared a quote from a CAC chairman talking about frost and unseasonable heat in late spring and summer of 1979, as well as concerns about water supplies, labor and theft. Melban noted that each of these problems are still relevant today, but he also delved into some new concerns and discussed how staff is handling them. For example, in early April the industry survived a voluntary recall related to listeria. Melban revealed that both the packer and CAC responded in such a way that it kept the situation under the radar and did not result in a widespread industry crisis.

He discussed the history of CAC's food safety program, which started in 1990 with its Food Safety Crisis Response program. More time and energy is being devoted to that issue with the Food Safety Modernization Act and the 2016 Produce Safety Rule now a reality. Melban reminded growers that the California Department of Food and Agriculture (CDFA) will inspect large farms ($500,000+) in 2019, with small farms slated for inspection next year. He encouraged growers who get the questionnaire from CDFA to fill it out and demonstrate they are already involved in food safety programs, which could prove beneficial. As CDFA begins to identify operations for inspection, the agency may look to target those operations without a food safety program in place.

Melban said the phytosanitary issue of 40 years ago was the seed weevil. Pest concerns have changed over the years with the avocado seed moth now topping the list, but pest issues still remain front and center.

In 40 years export efforts have come full circle. Melban noted that in 1979, CAC worked on a plan to increase export sales to Asia, most notably Japan. Once again the sale of California avocados to Asia is on the table as CAC explores opportunities in that arena. He revealed that CAC has received a $200,000 grant for export market programs for South Korea and China. Export sales of California avocados to South Korea jumped from 7.5 million pounds in 2017 to 17.5 million pounds in 2018. More importantly, Melban said the average sales price was $4 more per lug than the domestic price.

Dr. Tim Spann, CAC research program director, noted that many different pests and diseases have bothered the industry

in the Commission's 40 years, which is why CAC has a robust production research effort. He said Pearson disease was a problem in the early 1990s, while the avocado thrip caused issues later that decade and the avocado lace bug has been a concern during most of this century's 19 years. While the polyphagous shot hole borer did not turn out to be as big a problem as first expected, Spann said, "If the avocado seed moth shows up, we are in trouble." That pest is on the Production Research Committee's radar and its development in other regions is being monitored.

Spann said the goal of production research has remained the same, which is to help California avocado growers remain profitable and productive. However, while the goals haven't changed, he said the approach has become more focused on grower outreach and education to put information into the hands of growers so they can utilize it. He pointed to the Pine Tree Ranch demonstration grove as one of those important outreach efforts.

He detailed efforts, over the last two years, to allow Gem fruit to be exported. Initially, the licensing agreement from the University of California prohibited exports but Spann said recent communications have revealed that the UC Regents will no longer object to exporting this relatively new variety.

Another change over the years has been the elimination of CAC funding for the scion breeding program. Spann said there are more pressing matters for the always-limited research budget but did note the breeding program has generated eight new varieties and six more are in the pipeline. CAC is no longer funding the effort but it continues through UC involvement.

He also touted the avocado online decision support tools, which is a CAC effort that helps growers with irrigation and nutrient management decisions. He urged growers to utilize these tools by logging on to the website at: CaliforniaAvocadoGrowersDST.com. He said the utilization of the tools will create a better database that will provide even more helpful information for growers moving forward.

CAC Kicks Off Season With Targeted Activities

For California avocado fans, the start of the California avocado season — when the fresh fruit can be enjoyed at its peak — is cause for celebration. Throughout March and April, the California Avocado Commission (CAC) fueled fans' eagerness and anticipation for the start of the 2019 season with a series of integrated season-opener activities showcasing the versatility, quality and impending availability of premium California avocados.

Through a combination of media events, press releases, quick-response social media posts, influencer outreach, blog posts, recipe distribution and email newsletters, the Commission was able to strategically reach targeted "Premium Californians" and avocado super users through multiple touch points, securing some of the Commission's highest recorded social engagements to date.

In partnership with Chef Mike Fagnoni, the Commission hosted a California Avocado Season Opening Anticipation launch event for 30 attendees including regional consumer and trade media members, local influencers, retailer guests and nutrition-based nonprofit organizations at Hawks Public House in Sacramento, CA. CAC welcomed guests by announcing the start of the California avocado season and showcasing the unique qualities of the premium fruit. Guests then dined on Chef Fagnoni's one-of-a-kind, four-course meal, which began with *Ciccioli Croquettes with a Cream California Avocado Salsa Verde* and *Ahi Tuna Poke Mixed with California Avocado and Maui Onion* atop crispy wontons. A light *California Avocado and Lemon Crème Fraîche Soup* was followed by a refreshing *California Avocado and Roasted Beet Salad* paired with a *California Avocado Tartine with Grilled Shrimp*. The meal closed with a *California Avocado Valrhona Chocolate Tart with Salted Dulce Whipped Cream and Almond Brittle*.

Chef Fagnoni entertained guests with a demonstration on how to safely peel and cut avocados while discussing his

The California avocado email newsletter provided consumers with inspiring recipes and information on the fruit's seasonal availability.

Hawks Public House co-owners Molly Hawks and Chef Mike Fagnoni joined CAC Vice President Marketing Jan DeLyser to welcome attendees to the California Avocado Season Opening Anticipation event in Sacramento, CA.

love for California avocados and local ingredients. He then answered their questions concerning how best to judge the fruit's ripeness and where they could locate his recipes.

To encourage these influencers to share their love for California avocados with their followers, the Commission provided a photography station complete with a light box set up so each guest could stylize their own shots of the California avocado recipes featured at the event. The attendees' social posts garnered nearly 52,000 impressions and more than 1,000 engagements.

To extend the reach of the California Avocado Season Opening Anticipation, a consumer-facing press release was distributed that featured two of Chef Fagnoni's California avocado recipes and encouraged consumers to look for their favorite Golden State fruit in stores. Media efforts also resulted in additional coverage including a broadcast segment on Sacramento's KXTV local news station and a print story in Sacramento's food and culture magazine, *Inside Sacramento*.

The Commission partnered with a variety of other influencers, including Blogger Advocates who developed unique recipes and corresponding content to highlight California avocados' versatility and educate their followers on the benefits of

Media, influencer and industry guests enjoyed a four-course luncheon where every dish highlighted premium California avocados at the California Avocado Season Opening Anticipation event.

Game of Thrones-inspired content achieved strong engagement on CAC social channels.

seasonal eating. To engage targeted consumers in California, the Commission joined forces with two popular artisan chef partners known for their culinary creativity. Chef Pink, of the Solvang/Santa Barbara region, and Chef Dolan, of the San Francisco Bay area, crafted avocado-centric recipes that celebrated classic California cuisine. The talents of these renowned chefs and their unique take on California avocado recipes were leveraged to secure local media coverage in their respective markets.

To complement the broad reach of CAC's chosen influencer partners, the Commission also created a series of engaging season-opener social media posts to share with California avocado fans on its own Twitter, Instagram and Facebook channels.

Instagram is a social media platform where artistic, creative photography reins. Thus, for this platform CAC created fun, animated Commission-branded stickers (illustrated GIFs) that social users could feature on their own Instagram photos. To make the stickers easy to find, the Commission uploaded them to GIPHY – a platform incorporated into the Instagram interface – where users can find the stickers using relevant key phrases such as "California," "Avocados" and "Coming Soon." The GIFs have been a hit with Instagram users having been viewed nearly three million times to date.

In early April, as *Game of Thrones* fans eagerly awaited the start of the series' final season, the Commission shared a *Game of Thrones*-inspired social media post asking, "Avocados or Dragon Eggs?" The themed posts had the highest level of engagement of any of CAC's social posts to date with more than 350,000 impressions, 36,000-plus likes, more than 800 comments and over 3,000 post shares and saves. A trade press release about this social activity received coverage in most major produce publications, garnering more than 219,000 impressions.

To round out the season-opener activities, the Commission shared a 2019 California avocado season update blog post encouraging consumers to "look for California avocados" and pairing the message with a link to the store locator on the CaliforniaAvocado.com website. The blog post served as the headliner for the Commission's April consumer email newsletter, which encouraged consumers to seek out fresh, in-season California avocados and featured usage ideas, versatile recipe ideas and avocado tips. The newsletter was distributed to more than 220,000 subscribers.

Animated Commission GIFs provided consumers with a fun way to engage with the brand and were viewed nearly 3 million times on Instagram.

Commission Updates Grower Video Profiles

California avocado grower Sal Dominguez has made his lifelong dream a reality, serving as a guardian of the fruit he loved as a child in Huascato, Jalisco and cherishing the opportunities California has granted him and his family.

In response to research indicating that consumers wanted to put a face with a place to the producers of their food, in 2008 the California Avocado Commission (CAC) launched its highly lauded California Avocado Grower Campaign. The campaign thematic — Hand Grown in California — featured the state's unique terroir, individual growers and California avocado growing practices.

In 2016, the effort evolved into the Made of California campaign with California by Nature thematic showcasing California avocados, iconic landmarks and the Golden State lifestyle in a new and exciting way. Keeping in mind that California avocado consumers still care about where their food comes from, who grows it and how it is grown, this past winter CAC filmed a series of new videos designed to satisfy avocado fans' curiosity about the "who", "where" and "how" of growing California avocados.

The Commission created five new videos, and a trove of photographs, showcasing unique California avocado grower stories and picturesque groves. For efficiency, the new videos were all filmed in the northern growing region. One video, entitled "Meet the California Avocado Growers," profiles the broader grower community. The remaining quartet of videos features Ventura County growers, including the Abbott family, Sal Dominguez, Rachael Laenen, Dorcas Thille, Gordon Kimball, Maggie Kimball and Andy Sheaffer.

The newly crafted videos are being used throughout the 2019 California avocado season to position California avocados as the world's most valued and desired avocados. The videos and photographs were integrated into a variety of marketing activities and online promotions, and shared with California avocado fans on the Commission's Facebook, Instagram and Twitter social channels as well as on streaming services Hulu and YouTube.

The videos also are housed on CaliforniaAvocado.com under the avocado101/grower-stories section of the website, which showcases what makes fresh California avocados — the only locally grown premium avocados — so special. This sector of the consumer website also features growers' favorite California avocado recipes and receives approximately 10,000 visits annually. It is where users routinely spend two minutes per visit on average — approximately 15 seconds longer than the website average.

By expanding its library of California avocado grower videos, the Commission can engage with a fan base eager to learn more about where and how their food is produced and leverage the unique competitive advantages of fresh, California avocados.

For the Abbott family growing California avocados is a way to build a community by doing the right thing — caring for the land and the fruit they produce in a terroir that is unique in the world.

Andy Sheaffer's not a quitter — after the Thomas Fire destroyed 120 acres (about 15,000 trees) of his California avocado grove, he removed, prepped and replanted trees remaining optimistic because he knows his fruit will always be the best you can get.

Three generations of Kimball's work side-by-side to preserve their California avocado legacy, build an enterprise for the next generation and grow the best avocados in the world thanks to the unique climate and soils of this state.

By sharing beauty shots of California avocados taken in local groves on its social platforms, the Commission calls attention to the fact that these premium avocados are the only ones grown locally.

By Eric Imbert
Researcher at CIRAD
Agricultural Research Center in France

Hass Avocado Production Prospects

Managing World Production Growth

(Editor's Note: This is a lightly edited version of a story that appeared in the September/October 2018 issue of FruiTrop, a European agricultural publication. It is Mr. Imbert's analysis of the world avocado supply situation as it relates to demand. While he sounds an alarm about increasing supplies, he notes demand is growing at the same rate and says increased promotion could further stimulate consumption growth.)

The avocado - a lucrative and fast-moving industry

The avocado is seeing rapid development, at the risk of perhaps in the medium term falling victim to its own success. The return of a summer crisis in 2018 on the European Community (EC) market is an alarm signal highlighting two vital points. Demand has limits and world production is progressing rapidly among suppliers to the counter-season market. This latter point, which concerns the summer season, should make us question the supply prospects during the winter season, hitherto low-profile, before a first accident possibly forces us to do so.

One million tons of additional exports from Mexico by 2030

The volume increases expected during the 2018-19 winter season are set to usher in more. This is what is revealed by analysis of the Hass worldwide cultivation area. Of course, South America has the clearest growth. Surface areas are continuing to expand at an impressive rate in Michoacán. The cultivation area, covering just over 166,000 ha (hectares) in 2018, has grown at an average tempo of approximately 10,000 ha per year for the past three years. It is, above all, the eastern and western fringes of the avocado region that are seeing the clearest progress, with the core areas seeing much more limited growth for lack of space.

Jalisco is not to be outdone, with surface areas already reaching 22,500 ha in 2018, and growing by nearly 2,000 ha per year on average for the past three years. It is, above all, the zones close to Ciudad Guzmán which are seeing the biggest progress. Hence according to a projection by the Ministry for Agricul-

Ton (t) = ~2,200 pounds
Kiloton (kt) = ~2.2 million pounds
Hectares (ha) = ~2.5 acres

ture, production should grow by more than one million tons by 2030, to nearly 3.2 million tons. A hypothesis that seems wholly realistic given the average yields in these two zones (9 to 10 t/ha in Michoacán and 15 t/ha in Jalisco), and the average rate of surface area expansion in recent years. According to this same study, the bulk of these additional volumes should be aimed at the international market (export potential 2.1 million tons as opposed to 1.1 in 2017-18).

Colombia, following exactly in Mexico's footsteps

Colombia is following Mexico's footsteps. According to the latest available professional estimate, the cultivation area already has reached approximately 17,500 ha, and is expanding at a rate of approximately 2,000 ha per year. The dynamic is tending to gather pace with the opening of the U.S. borders and the increasingly significant arrival of foreign investors (such as the Peruvian giant Camposol, which has just purchased 350 ha of land, and declared its intent to set up 2,000 ha of plantations in Colombia).

Growth in surface areas is particularly significant in the center of the coffee zone. The country's assets, such as its ideal geographic location for serving both the U.S. and European markets, and its wide production calendar, are attractive; although the lack of road infrastructures (link roads to the secondary network) and port infrastructures remains a weighty issue. Management of heterogeneity of maturity is another technical challenge to address in this country where some zones can boast multiple flowering, another common point with Mexico.

Chile's awakening?

Chile seems to be emerging from a gloomy spell, when persistent drought brought about a collapse in the cultivation area of more than 5,000 ha (not to mention plantations mothballed by severe pruning). The return of more rainfall and better profitability, thanks to the repositioning on the EC market and on the local market, seems to have caused renewed interest in the avocado. The trend is still limited. It is aimed mainly at the climatically most suitable zones with more abundant water.

Growth in surface areas gathering pace in the Mediterranean

The excellent level of Moroccan exports in 2017-18, and the high Israeli level expected this season, show that the Mediterranean cultivation area also is on the move. Surface areas are reportedly expanding at around 500 ha per year in Israel, with an acceleration in this tempo very likely according to some professionals (700 to 800 ha). Although interest in green varieties remains marked among some producers (especially Reed, with its high yield and value earned on the local market), the bulk of new planting involves Hass or Hass-like. At least half of the expansion is taking place in the south of the country, in the western tip of the northernmost part of the Negev Desert (especially within a radius of 20 to 30 km around Ashkelon).

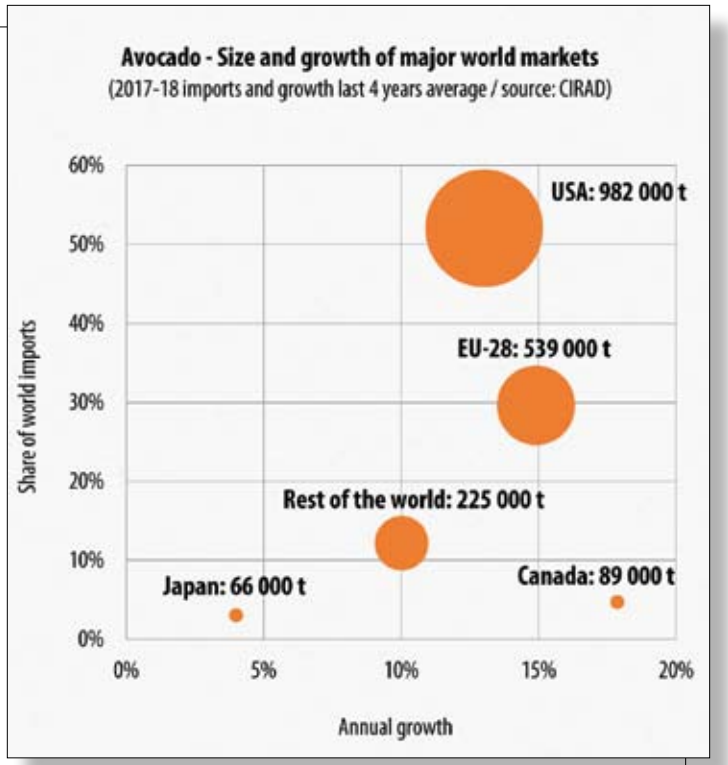
Similarly, there is a clear dynamic in Morocco, with surface areas expanding at around 600 ha per year, and with Hass now practically the only variety being planted under the development programmes. While plantations are

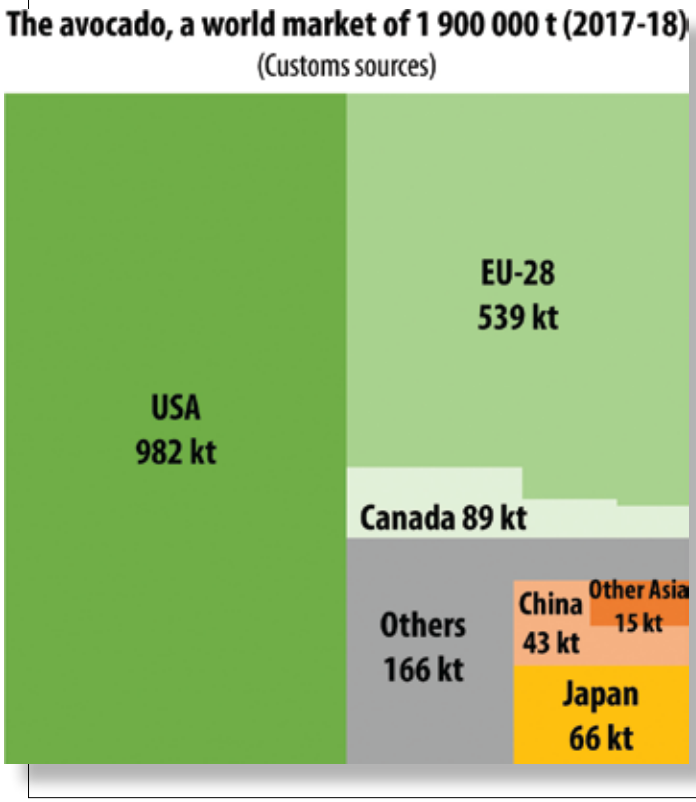
continuing to be set up especially in the traditional Kénitra/Larache zone, some also have been developed in the Azemmour region north of Casablanca. The dynamic remains for the most part driven by small to medium-sized producers, with technical support from big players in the sector.

Spanish cultivation area not all that static

Is the progress in avocado exports from Spain due solely to the country's developing role as a hub? Is the big picture being concealed? In part, since a fine analysis of the avocado sector shows that the cultivation area is getting going (approximately + 650 ha/year). The majority of the expansion in surface areas should not be sought in the traditional production center of Axarquía. For lack of sufficient land and above all water resources, expansion is reportedly only approximately 150 ha per year in this zone. This situation could change in the medium term, since the sector professionals have developed and are ready to finance a large-scale project that would double the cultivation area, using some of the water lost from the Rio Guadiaro. However, this project remains in political limbo, despite its economic and social advantages.

Hence other cultivation zones are currently expanding, in some cases at a fast tempo. Growth is reported to be around 300 to 400 ha per year in the River Guadiaro valley. Similarly, there are large projects under development in the zone between Huelva and the Portuguese border (+ 200 to 300 ha per year). Finally, a large number of small-sized facilities are being set up in the Valencian Community, in particular in the provinces of Alicante and Valencia (+ 150 ha per year). These zones have generally more abundant water and land resources, especially thanks to conversion from less profitable crops such as citruses. In some cases, they also are under sometimes borderline conditions in terms of climate, which is windier and more frost-prone. Time will tell as to the real potential of these new cultivation zones.





Growth in world production from all sides

The analysis presented in this article has shown that during the winter season too, the supply to the world market should become very significantly stronger. On the one hand, new giants are emerging. Professionals from Colombia and Jalisco within a few years have been able to build industries on the strength of a cultivation area comprising nearly 20,000 ha or more, and set to feature very prominently among the world's top exporters.

Furthermore, traditional market suppliers too have all seen renewed growth. Barring the exceptional case of Michoacán, which everyone could see coming given the extraordinary proportions of its industry and its growth, all the market suppliers appear to have fairly clear dynamics (more than 500 ha per year, even among the Mediterranean suppliers).

Finally, emerging industries are progressing not only in Portugal, but also in Ecuador or Guatemala. According to our projections, which cover producer countries supplying the counter-season market, the dynamic for which was presented in FruiTrop edition 256 (May 2018), the Hass world production

Avocado – Estimated average annual growth of the world production

	Surface areas (ha)	Annual growth (ha/year)	Average yield (t/ha)	Production growth (t/year)
Total	**337 050**	**20 725**	**11.1**	**229 065**
Winter season suppliers	**266 500**	**16 300**	**10.6**	**171 975**
Latin America	**224 800**	**14 000**	**10.7**	**149 800**
Michoacán	158 800			
Jalisco	21 000			
Chile	30 000			
Colombia	15 000			
Mediterranean	**29 800**	**1 750**	**10**	**17 500**
Spain	13 500			
Israel	9 200			
Morocco	6 000			
Portugal	1 100			
Others	**11 900**	**550**	**8.5**	**4 675**
New Zealand	3 800			
Australia	8 100			
Summer season suppliers	**70 550**	**4 425**	**12.9**	**57 090**
Latin America	**27 500**	**2 675**	**15**	**40 125**
Peru	26 000			
Brazil	1 500			
Africa	**22 450**	**1 900**	**9.6**	**18 240**
Southern Africa	17 500			
Kenya*	4 000			
Tanzania	950			
Others California	**20 600**	**-150**	**8.5**	**-1 275**

* Estimated surface areas based on exported volumes / Professional sources, official services

growth rate should be around 220,000 to 230,000 tons per year over the next five years.

A tight balance, which could quickly become precarious

As high as it may be, this rate remains exactly compatible with the hypothesis of worldwide growth in demand maintaining its current footing, i.e. 13 percent per year (the four-year average). Nonetheless, it must be highlighted that the world market is currently relying on just two mainstays, namely North America (USA and Canada) and the European Union. They have taken in 95 percent of the growth in world production over recent campaigns. Yet given the already high consumption levels reached in certain countries, threshold effects are bound to appear in the medium term. In Europe, the case of Scandinavia, which has been stagnant for several years, is symptomatic, whereas in the USA, growth is slowing down in California.

Asia – big markets, but for the future

Well yes, the world is no longer limited to Europe and the United States. While growth reserves for the local markets in producer countries have already been largely tapped with success, Asia represents enormous potential that is barely starting to be unearthed. However, export figures show that this rich vein is only very gradually revealing itself, and that it is hard to exploit, both because of its distance from the world's main production centres and the difficulty in introducing what is often an alien product. Besides Japan, which is no longer on the rise, the countries in this region absorbed approximately 60,000 tons in 2017-18, i.e. barely more than 3 percent of world trade. Furthermore, supplier countries with a small presence in Europe or the USA, such as New Zealand and Australia, also have ambitions on these markets, for which they have an obvious logistical asset. Nonetheless, this potential competition is for the future rather than tomorrow, given the still relatively limited size of these countries' cultivation areas (approximately 3,800 ha in New Zealand and 8,100 ha in Australia).

Promotion and prudence must remain the watchwords

Until the growth relays in Asia really get going, it would seem important to further step up the promotion actions, in order to make the most of the growth margins still available in the USA or EU. There are big margins, whether on under-consuming markets such as Germany, or others which are already big consumers but still far from maturity, such as France or the United Kingdom. The WAO's resources for stimulating the European market are still far too limited, as is attested by a budget approximately 20 times smaller than the Hass Avocado Board's (USA), for a population 1.5 times bigger. A parafiscal tax of a few eurocents per box earmarked for promotions seems more than ever like a good investment against any turnarounds in the market. It also appears clear that the "demand" dimension must now be much better incorporated into investment projects in new plantations. The current expansion rate of the cultivation area, of approximately 20,000 ha per year according to our estimates, seems to be a sound upper limit for the time being.

By Tim Linden

Strong Field Price Quickly Moves California Crop

Buoyed by a strong field price that rose sharply in March, the California avocado crop has moved from the groves to the packing shed and into commerce faster than handlers predicted in early spring.

"California fruit is moving much faster than we anticipated because of the much higher (field) prices," said Ross Wileman, senior vice president of sales and marketing, Mission Produce Inc., Oxnard, CA. "The majority of the fruit will be gone by the end of July."

Giovanni Cavaletto, vice president of operations, Index Fresh Inc., Bloomington, CA, echoed those sentiments: "The high prices are pulling the fruit off the tree," he said in late May, adding that the strong pricing in early spring was unexpected.

By his calculations, California will have shipped 40 percent of its crop by the end of May, but Index will still have the ability to market significant volume in June, July and into August. Cavaletto said with the strong field price, there is no reason for growers to wait and expose their fruit to potential risk. He said theft, wind and heat could each play a role in reducing a grower's on-tree crop. "Why risk it when the market is hot," he said, predicting that a strong avocado market should remain in place at least through June. He said Mexico had dialed back its shipments, and Index was estimating that there would be 6-8 percent less fruit on the market in June than there was last year.

Rob Wedin, vice president of fresh sales and marketing, Calavo Growers Inc., Santa Paula, CA, said this year's small California crop (only estimated to be 175 million pounds) set the stage for strategic marketing. "We took the approach that since it was a really small crop, we weren't going to pick any fruit at low prices."

He noted that high field prices in April led to more picking than anticipated with about 20 percent of the volume coming off the trees in that month That was followed by about 15 percent in May. Calavo anticipates marketing about 50 percent of its California volume in June and July with the final 15 percent coming off in August. He expects very little fruit in September and then only from the most northern groves in the state.

Besides the strong field prices, Wileman said many growers also were motivated by the heavy spring bloom. Growers, he said, wanted to get the fruit off the trees to make way for next year's crop. But for the growers that are waiting a bit longer, Wileman said the market should remain strong. He said Mexico is on the downside of its volume and "we are seeing some quality issues as their season (2018/19) winds up. There are more number 2s and more big fruit. We are seeing increased demand for the mid-range sized fruit."

Estimating the 2020 crop is a tricky proposition. "I like to reserve judgment until after the 4th of July," said Cavaletto, "but we sure have had a promising start."

He said several positive factors point to a big bounce back year in 2020. In the first place, 2019 was clearly an off year so everything being equal, the alternate-season bearing tendencies of the avocado tree predict a heavy 2020. In addition, there was a heavy bloom and he said significant rain this year created "super healthy" trees and groves.

Wedin agreed. He labeled the spring bloom as "fantastic" and said even the trees scorched by the July heat last year appear to have bounced back, showing no signs of lasting tree damage.

One casualty of the light set this year has been the organic avocado supply situation. The market price was above $70 per carton in May with no reason for it to come down at all. Wedin said organic supplies will be extremely tight for at least a couple of months. Mexico won't have any organic fruit again until its new crop in July or August and California has few organic avocados because of the overall decline in volume.

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