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Grower Profile 20

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From the Grove

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Organizational Readiness



Tom Bellamore

In 1994, when I was hired by the California Avocado Commission (CAC), the organization had already been marketing California avocados for 16 years. About 6,500 growers were producing avocados on 61,000 acres; some packed with cooperatives and others with independent packers, so half of the producer seats on the Commission's 29-member board were allocated to one category and the remainder to the other. There was much work to be done on the marketing front with annual U.S. per capita consumption of avocados at a meager 1.25 pounds. Competition was limited to exports from Chile, which were chiefly counter-seasonal. Prospects for the entry of avocados from Mexico loomed large as the U.S. Department of Agriculture issued an Advance Notice of Proposed Rulemaking that year, commencing a rule-making process that would not conclude until some 22 years later.

Fast forward to today, in which

we have 4,000 growers producing California avocados on about 44,000 acres, a total area just slightly larger than the acreage base in 1978 when the Commission was created by statutory enactment. The last cooperative dissolved many years ago and the Commission has since dropped the co-op/independent grower distinction, but not until recently did the organization fully reshape itself to reflect structural changes in the industry. Now, following a series of legislative changes to the sections of the California Food and Agricultural Code that govern Commission operations, the organization is poised to begin anew. This streamlined version of the organization will be challenged, like never before, with keeping the California avocado brand relevant and meaningful in a burgeoning market, which could see total U.S. avocado consumption in excess of four billion pounds by 2025.

Not all growers have made the

journey thus far, and some are struggling — victims of regulation, drought, high water prices, labor shortages and urban encroachment. Of the 4,000 remaining growers in California, it is estimated that about half have less than 10,000 pounds of production annually. Beginning November 1, 2017, these growers will be exempt from payment of the CAC assessment. “Commercial” growers will be defined as those whose annual production — using a three-year rolling average ending with the prior marketing year — meets or exceeds 10,000 pounds. Bear with us as this change is implemented at the packer level for there are apt to be a few hiccups. And remember that the federal assessment levied by the Hass Avocado Board will still be collected at first point of sale when growers deliver their fruit to packinghouses, regardless of a grower's total production.

Also in November 2017, the newly-seated Commission board will consist of 19 members: two producer members from each of five districts, one alternate producer member from each district, two handler members and one alternate handler member, and one public member. Expectations are running high and many in the industry will be watching to see if the new, smaller



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Member/ Leo McGuire
Alternate/Ohannes Karaoghlanian

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Member/Art Bliss-**Treasurer**
Member/ John Lamb
Alternate/Robert Grether

District 4

Member/Jason Cole-**Secretary**
Member/Ed McFadden
Alternate/Bryce Bannatyne

District 5

Member/ Tyler Cobb
Member/ Rick Shade-**Chairman**
Alternate/Bradley Miles

Handlers

Member/Steve Taft
Member/Gary Caloroso
Alternate/Gary Clevenger

Member/Egidio "Gene" Carbone
Member/Robb Bertels
Alternate/Donny Lucy

Public Member

Nina Ames

To contact a CAC representative, please visit:
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board operates more efficiently and focuses with precision on the challenges presented by a dynamic marketplace.

It is no understatement to say that our competitors have been our curse and our salvation. Fueled by ample domestic and imported supplies, the U.S. avocado market will soon approach 10 pounds per capita consumption annually. California, on its best day, falls far short of meeting this phenomenal demand – demand which would not be there but for the presence of offshore fruit. The price we pay for increased market size is the volatility that accompanies diversification in supply. Simply put, the more suppliers in the deal, the greater the potential for a misstep that affects everyone. To date, the Commission has carved out a secure place in the market, even in small crop years when retail and foodservice customers might be tempted to see our volume as being of little consequence. Instead, we command a premium. Our competitive advantages continue to set us apart, but this is not a given. The new board must ensure that we never slip into “commodity” status.

The new board also must contend with finite resources, as did their predecessors. The difference is, the market-

ing challenge becomes more acute as California’s share of the total avocado market declines, and the board may no longer have the luxury of pursuing interests that have a questionable return on investment. Every dollar spent must advance the mission of the organization and improve grower returns. Decision-making should be facilitated by the new, smaller board size, but the stakes remain high and members will be under even more pressure to deliver results. In the coming years, each Commission program will be weighed in the balance and some tough decisions will have to be made.

Your board and management are already well down this path. Since 2009, efforts have been underway to stabilize the assessment rate, closely evaluate programs and maximize the marketing spend. When viewed on a graph, as the board did at its August meeting, the shift of resources over time from non-marketing activities to marketing, was unmistakably evident. If the California brand is to remain prominent in the years ahead, the trend must continue. The modernized Commission that takes its first breath in November offers the California avocado grower the best chance of success in the decades ahead. 🥑



Rick Shade

Planning for the Future

One of the duties of the chair is to write this column every quarter. I find that my best motivation is a deadline. Once I realize I'm up against a deadline, I start to figure out what to write about.

First things first: I will admit I was wrong. In my last column, during the summer, I predicted that California fruit would be out of the market by mid-July. My predictions aside, some stalwart California growers have held on to enough fruit to still be putting two million pounds into the market here in mid-August. I point this out not so much to say that I was wrong (I was), but to illustrate that good communication between the growers and the handlers have made this possible, and everybody is reaping the rewards. No matter the size of the crop, constant communication from the grower to the handler and back is critical to the continued success of the California avocado grower.

In other California Avocado Commission news and updates, your elected commissioners have been hard at work planning for the future of the Commission. Like every well-run business, the Commission has had a succession plan in place for top staff in case of emergency. As we looked around however,

we realized that in the not-too-distant future some of our key people will be seriously considering retirement. In order to keep operations running at peak efficiency and at the high level that we have come to expect, it was decided to start planning for the eventuality of staff retiring. Bright minds in the group realized that we needed to have some type of forecast of what the California industry would be like and what the market might look like in the future. Once we had an idea of what the future might bring, it was reasoned that we could then figure out what kind of leaders we would need.

The commissioners broke into two groups, forming one task force to forecast the future markets, and another task force to work out and put in place a reasonable, ordered succession plan for our top staff. With work that took several meetings over the summer to complete, the succession group has come up with a good, solid document. The forecasting group, too, has come up with a strong draft document. Instead of trying to cobble together a plan in a crazed frenzy when one of our key staff announces retirement, we have a plan that was thought out, discussed, debated and put in place with the luxury of

the time to do it right.

There is another side of the coin however. One that is not quite so easy to plan for. We also need to continue surfacing new commissioners. A fair number of us on the board have been around for a long time and are reaching legal term limits. If you have younger people in your operation, please start having them come to the meetings and become familiar with the Commission. Encourage them to run for seats on the board. They can start as alternates so they learn their way around the Commission and the personalities. Have them come to the meetings, listen, ask questions, learn, make suggestions. Very soon it will be their Commission and their business — it is never too early to start.

And just to make sure that everybody knows that the Commission is not all work and no play, I encourage you to come out and meet your fellow growers this fall. Our growers in the Morro Bay area have a wonderful Avocado and Margarita Festival in September. Additionally our growers in Carpinteria have the California Avocado Festival in early October. Both events are fun times that celebrate the wonderful crop that we produce. 🥑

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Commission Hosts Labor Seminars; Path Forward Remains Rocky

By Ken Melban
Vice President of Industry Affairs

In August, the California Avocado Commission (CAC) conducted grower seminars to discuss labor availability and immigration enforcement, and to explore possible options for a stable labor force. Speakers included Craig Regelbrugge, senior vice president for AmericanHort and co-chairman of the Agriculture Coalition for Immigration Reform (ACIR), and Jason Resnick, vice president and general counsel for Western Growers.

Regelbrugge, who is based in Washington, D.C., gave a report on the political dynamics and outlook for Congressional action (http://californiaavocadogrowers.com/sites/default/files/documents/Regelbrugge_Avocado-Labor_080217.pdf). During the first few months of the Trump administration there has been significant discussion about enforcing immigration laws and building a border wall. While there have been no reports of Immigration and Customs Enforcement (ICE) conducting raids directly in agricultural production operations, ICE is actively pursuing undocumented felons. Those activities have had a significant detrimental impact on labor availability in agriculture.

Efforts in Congress remain stalled. Two immigration bills have been introduced by Chairman Bob Goodlatte to the House Judiciary Committee, and indications are that an immigration bill could be introduced to the House sometime in September. The bills, in their current form, do not address the needs of agriculture, neither in creating a workable guest worker program nor in establishing a pathway for existing workers to receive authorization to work. Representatives from agriculture are already working hard to identify needed improvements, with a goal of getting the best possible legislation out of the Judiciary Committee and then improving it on the floor of the House.

A fix that works for agriculture must include:

- Improvements to the H-2A program that make it less challenging and burdensome
- A new “modernized” visa program element (probably separate from H2A) that allows for a more flexible employment arrangement (often referred to as a “portable” or “at will” visa) where a worker is able to move freely among job opportunities offered by



registered employers

- A practical and realistic solution for current workers to attain legal presence and authorization to work.

Any one of these above goals is lofty, let alone trying to tackle all three concurrently.

Looking forward to the 2018 California avocado harvest with a crop projected at around 400 million pounds (roughly double that of this year), there are only two current options. Growers can rely on, and hope, that the existing status quo will provide enough workers, or they can utilize the H2A program. Reports on labor availability for this year, in most instances, seemed adequate. However, with next year's crop potentially double the size of this year's and the ongoing uncertainty for workers based on enforcement activities, it's likely that next year labor availability will be a daunting challenge for many growers. This has led some growers to pursue the H2A program.

Resnick provided a detailed overview of the H2A program, both the administrative requirements and costs (<http://californiaavocadogrowers.com/sites/default/files/documents/H-2-A-CA-Avocado-Presentation.pdf>). The housing requirement costs make it very difficult for many growers to participate. In short, a farming operation must have the appropriate scale of operations to make the investment necessary to utilize the H2A program.

The CAC seminars included panel discussions with growers and labor contractors who are utilizing or considering the H2A program. The one consistent takeaway from the discussions was the need for the industry to work together. Growers, packers and labor contractors must cooperate and coordinate to ensure that all the crop is harvested.

Behind the scenes rumblings are that a "deal" between Democrats and Republicans may be possible on immigration legislation that addresses "Dreamers" (people brought illegally as children to the United States) in exchange for border wall

funding and E-verify. That alone won't be enough for agriculture. The Deferred Action for Childhood Arrivals (DACA) program, created by President Obama in June 2012, has allowed about 800,000 "Dreamers" to remain in the U.S. legally. Under DACA, "Dreamers" are provided temporary work permits and protection from deportation. At the time of this writing, President Trump had rescinded DACA but delayed enforcement for six months to give Congress time to address the issue.

President Trump has signaled he may be willing to cut a deal that allows "Dreamers" to retain legal status, but only if funding for a border wall is provided. On August 22, President Trump said, "Believe me, if we have to shut down the government, we're building that wall." The fringe elements of both political parties are digging in their heels. Those on the far right are firmly opposed to allowing the "Dreamers" to remain, and those on the far left will not support funding for a border wall. The stand-off continues.


Unfortunately, a legislative solution that addresses agriculture's needs for labor appears to be stuck in the abyss of this relentless political battle. It's critical a fix to the labor shortages in the agriculture workforce is part of any immigration reform legislation. Commission staff continues to work with Congressional members on the importance of finding a solution, as fast as possible. There is too much at stake for anything less. 🍌

CAC's United Plates of America Theme Pairs Avocados with Summer Holidays

When it comes to summer entertaining, avocados are increasingly a favorite on American party menus. This summer, shipments of avocados of all origins for Memorial Day festivities totaled 118 million pounds with similar demand for 4th of July celebrations at 117 million pounds. Americans' desire to enjoy avocado-centric dishes during the summer has grown, and the California Avocado Commission's (CAC) marketing team developed a cross-platform marketing plan to ensure consumers specifically associate *California* avocados with American summer holidays and choose the American-grown fruit as the centerpiece of their summer parties.

This year, as part of its American Summer Holidays promotion, CAC launched the "United Plates of America" theme — integrating summer celebrations and travel, California avocados and recipes showcasing the unique flavors, culinary themes and quintessential holiday dishes the United States — particularly Western states — are known for.

To build excitement around the promotion, CAC placed print ads in trade newspapers such as *The Packer* and *The Produce News*, along with digital ads in online sites such as AndNowUKnow and FreshPlaza. Trade press releases outlined the benefits of CAC's marketing support and encouraged retailers to display California avocados as part of their American Summer Holidays promotions. In total, more than 400,000 trade impressions were generated concerning CAC's American Summer Holidays, Memorial Day and 4th of July promotions.



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CAC ran American Summer Holidays trade print ads in publications such as *The Packer* and *The Produce News*.



Chef Ryan Lamon's Grilled BBQ Chicken Salad Stuffed California Avocados were featured in the Commission's American Summer Holidays press release.

In addition, CAC distributed a consumer-facing press release showcasing American Summer Holidays recipes created by Chef Ryan Lamon, including *Grilled BBQ Chicken Salad Stuffed California Avocados* and *Crab Cake Sandwiches with California Avocado Remoulade*. Retailers promoting California avocados were provided with copies of the Commission's United Plates of America recipe booklet featuring 18 unique summer holiday recipes, tips for selecting and handling California avocados, as well as a tutorial on how to create a California avocado rose. The booklets were shared at live in-store food events, through supermarket dietitian communication programs and as part of summer-themed displays.

California avocado in-store audio ads encouraged shoppers to check the label and choose American-grown California avocados for all their summer entertaining occasions. The ads aired in targeted retailers such as Albertsons, Fry's, Pavilions, Ralphs, Smith's, Stater Bros. and Vons.

On the consumer side, the Commission engaged with California avocado fans on social media by sharing summer-friendly California avocado recipes, educational content and a new store locator tool. Recipes ranged from a *California Avocado Key Lime Pudding* to a cool and fruity *California Avocado*



In-store demos at Stater Bros. showcased California avocados and tomatoes on crackers during Memorial Day weekend.



The United Plates of America recipe booklet, featuring 18 California-avocado regional recipes, on display at Gelson's.



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Can't decide which flavor you favor? Our **#UnitedPlates** recipes will help you out: bit.ly/2sENwEg bit.ly/2t7wlc4



As part of the United Plates of America theme, the Commission solicited input from its social media fans about their favorite regional recipes.

Melon Smoothie — demonstrating how easy it is to add California avocados to summer celebratory menus. Besides sharing eye-catching photos of refreshing California avocado recipes with fans on Instagram and Twitter, the Commission posted easy-to-follow recipe demonstration videos on YouTube.

Tapping into a summer road trip theme, CAC shared United Plates of America social media posts that sought fan feedback concerning favorite regional cuisines they've enjoyed while vacationing during the summer. The social media polls were supplemented with California avocado-centric recipe posts featuring fan favorites.

As the 4th of July approached, fans also enjoyed a series of holiday-themed posts on Facebook, Instagram and Twitter featuring patriotically-themed recipes such as *California Avocado Red, White and Blue Salsa*. The 4th of July-themed posts reached more than 104,000 social media users.

To generate excitement around the 4th of July, CAC swapped out online banner creative leading up to the holiday

with two different American Summer Holidays executions on the popular Food52, Tasting Table and PureWow websites. Nativo, which distributes brand content within publisher editorial streams, also ran two custom articles featuring California avocados: *Four Ways to Celebrate Fourth of July with California Avocado* and *Five All-American Ways to Celebrate with California Avocado*.

The Commission also provided California avocado fans with a new online store locator tool designed to make it easier for them to locate their favorite fresh fruit. Posts on Facebook, Instagram and Twitter reminded fans that California avocados were in season and then provided direct links to the store locator housed on the CaliforniaAvocado.com website. These posts reached more than 22,500 users.

All told, the CAC's summer marketing activities during the American Summer Holidays period (Memorial Day – 4th of July) garnered more than 23.5 million impressions across in-store, audio, digital and social media channels. 🥑



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By Ken Melban
Vice President of Industry Affairs

NAFTA Renegotiations, Round 1

As of this writing the first round of the North American Free Trade Agreement (NAFTA) renegotiations has just concluded, and at least publicly it seems there is not much to report specific to agriculture.

NAFTA came into force on January 1, 1994, among Canada, Mexico, and the United States, and, according to most reports, nearly one-third of all U.S. agricultural exports are to Mexico and Canada. The United States also relies on fruit and vegetable imports from Mexico to maintain year-round supplies. On the campaign trail presidential-candidate Donald Trump talked repeatedly about renegotiating or pulling out of NAFTA entirely. In May 2017, President Trump held to his campaign promise and formerly announced his decision to renegotiate NAFTA.

A total of seven rounds is planned for the NAFTA renegotiations, with the second round set for early September (which will have finished just before this article goes to print). As it stands now, just a few days after the first round was completed, there remains tremendous uncertainty and anxiety regarding the future of NAFTA. At a political rally in Phoenix on August 22, President Trump signaled a willingness to scrap NAFTA altogether when he said, “Personally, I don’t think we can make a deal. Because we have been so badly taken advantage of. They have made such great deals — both of the countries, but in particular Mexico — that I don’t think we can make a deal. So I think we’ll end up probably terminating

NAFTA at some point.”

For 2016, the largest U.S. agricultural export markets were China, Canada, and Mexico (respectively). If the U.S. were to pull out of NAFTA it would have significant impact on exports of major program crops like corn and soybeans, along with pork and poultry exports. A majority of these export commodities are produced in the Midwest, in states known as the Farm Belt that helped carry Trump to the presidency. Should the administration terminate NAFTA, the potential for political fallout is huge. While there is some speculation that President Trump’s comments were a ploy to apply pressure on Mexico and Canada, uncertainty remains.

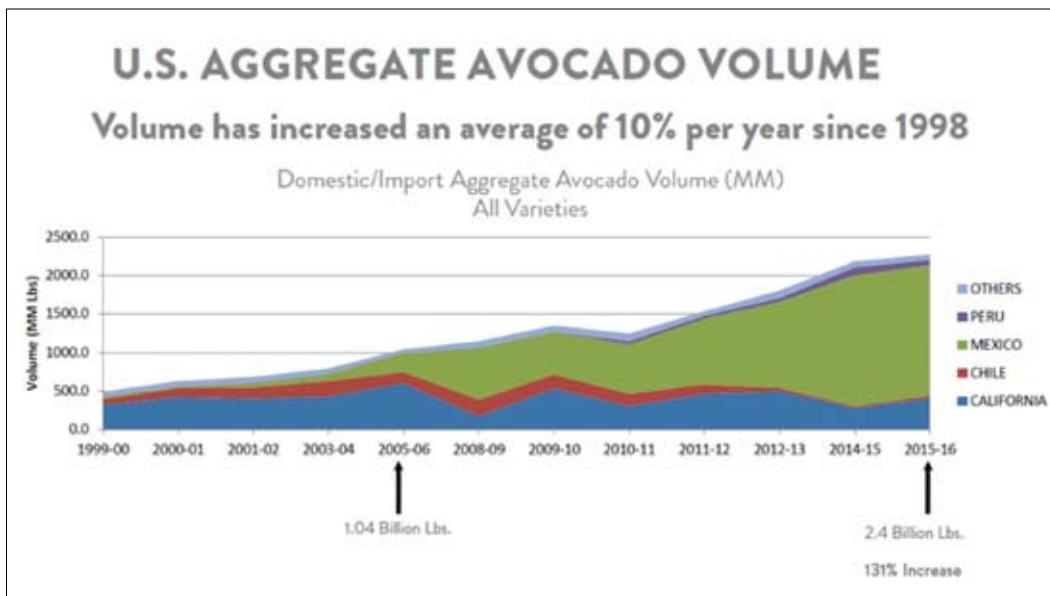
The Agriculture Technical Advisory Committee (ATAC) for Fruits and Vegetables, on which I serve, has taken a position of “Do No Harm” as it relates to agriculture and the NAFTA renegotiations. The consensus (in general) of the ATAC is that, overall, U.S. agriculture has benefitted from NAFTA.

For the California avocado industry, it’s worthwhile to look back at historical data that illustrates the increase in U.S. demand and the shift in supply sources. In 2000, U.S. demand was about 500 million pounds annually and California produced 321 million pounds — nearly 65 percent of the total. In 2006, U.S. consumption surpassed 1 billion pounds, of which California produced 600 million pounds. Jump now to 2016 when U.S. total volume exceeded 2.4 billion pounds. The California production for that year was 400

million pounds, about 16 percent of the total U.S. volume.

If you looked solely at those supply figures, you would assume California producers have suffered because of the increasing supplies from Mexico. However, even as avocado supplies from outside the U.S. have increased, California pricing has remained strong. With the 2017 California avocado season almost complete, the average price is \$1.59 per pound on California fruit — *the highest average price of all time*. During the past five years, California’s average per pound price is \$1.14 and for the last 10 years it is \$1.09 per pound. Even as supplies have increased to meet U.S. demand, California pricing has remained strong, defying the laws of supply and demand.

Although it seems unlikely the U.S. will pull out of NAFTA altogether, if that did occur it stands to reason that pre-NAFTA tariff levels might be reinstated. This may sound appealing to many California avocado growers at first blush, but other factors must be considered. At the California Avocado Commission’s August Board meeting, the NAFTA renegotiations were discussed along with the question of what, if anything, the Commission should ask for during the renegotiations. Over the last few years some in the industry have questioned whether dumping into the U.S. has occurred and speculated that grower subsidies were being provided in offshore producing countries. The Commission monitors for potential unfair trade activities and has found no

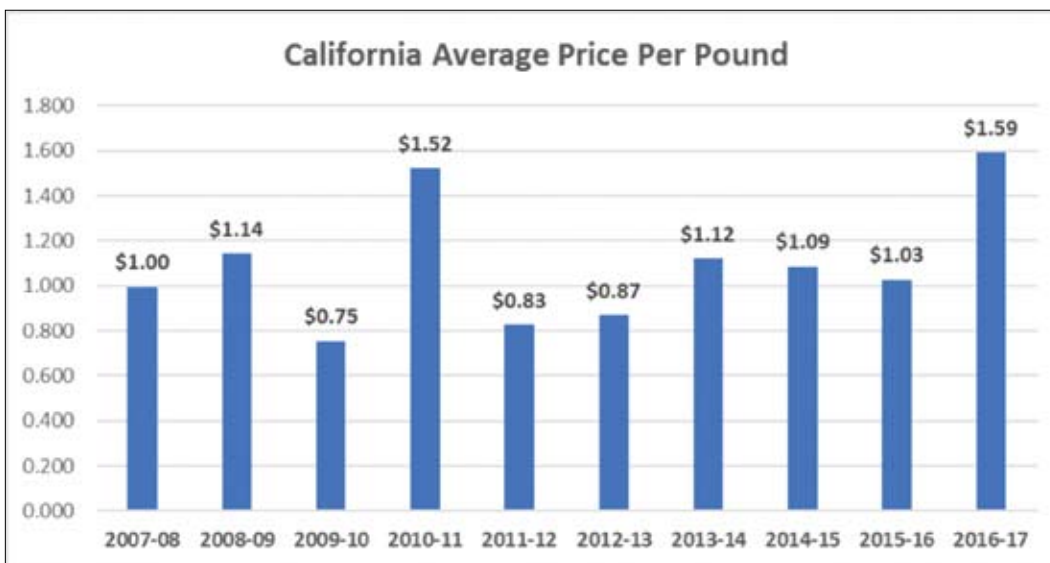


evidence of any unfair trade practices. Granted, the cost to produce avocados in California is greater than in most other offshore producing countries, but free trade agreements do not “level the playing field,” they open trade channels.

So, the question then becomes: what could be pursued in the NAFTA renegotiations? Ideas ranged from placing a tariff on imported avocados to controlling imported volumes, or even providing a guaranteed price to growers. Of the options, a tariff seemed to be the only legitimate consideration. The Board discussed the tariff, and the

consensus was it would be difficult to achieve based on likely opposition from other commodities. In addition, concern surrounding possible unintended consequences was voiced. Would retailers try to leverage a tariff against California and drive pricing down? Could other trading partner countries reciprocate a tariff on the U.S.? Would U.S. supplies be diverted elsewhere, resulting in an undersupplied U.S. market? Would this lead to periods of market instability and possibly negatively impact consumer demand? While all this is speculative, the potential for harm to the California avocado industry must be considered.

Ultimately, as the Board reflected on the California industry’s strength and position in the growing U.S. avocado market, it was determined that a “Do No Harm” approach was the best course of action. Through the ATAC, the Commission will continue to work with the current administration on the NAFTA renegotiations to seek a modernized NAFTA by updating the provisions in the areas of Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT). The Commission will track the NAFTA renegotiations and when possible provide a voice for the industry. 🥑



Genetic Engineering:

What it Means and Why You Should Pay Attention

By Tim Spann
Research Program Director



Modern corn (center) is the result of millennia of selective breeding that started with two grasses, Teosinte (left) and gamagrass (right), culminating in a new species that only exists because of human intervention. Credit: Nicolle Rager Fuller, National Science Foundation.

On June 13, 2017, the University of California, Davis, in cooperation with the Agribusiness Committee of the California State Bar Business Law Section, hosted a workshop entitled, “Genetic Engineering in Agriculture: Science, Policy and Law.” Although there are currently no “genetically modified” avocados in existence, and there likely won’t be for some time, the industry has been considering technologies such as marker-assisted breeding, so understanding the laws and public perceptions surrounding these technologies is important.

What Is “Genetic Modification”?

Perhaps no scientific concept is more hotly debated, or misunderstood, in the popular press today than that of “genetic modification,” commonly referred to by the colloquialism “GMO” (genetically modified organism). Scientifically speaking, genetic modification is a very ambiguous term.

Every sexual crossing (plant or animal) or random mutation results in a genetic modification. And man has been using this to our benefit ever since the agricultural revolution started 12,500 years ago. What is really being referred to by the moniker “GMO” is genetic engineering.

Genetic engineering “is adding, subtracting, or adjusting genes in the lab that change a trait in the resulting plant, animal or microbe. It satisfies the very definition of engineering—the application of science and mathematics to affect properties of matter or the sources of energy in nature to be made useful to people.”

Perhaps no greater example of genetic modification exists than what we know as corn. The modern corn plant (*Zea mays*) does not exist in the wild, has no wild equivalent and cannot exist without being managed by man. Modern molecular analytical techniques have allowed us to understand that corn was developed through the selective breeding of two grasses: teosinte—a grain plant with very small vertical kernels—and

gamagrass. To look at teosinte and gamagrass and think that these two plants can be crossed, back crossed and selected for over thousands of years to yield an entirely new, unrecognizable species seems like science fiction, but it is simply the result of genetic modification and time.

Modern genetic engineering technologies simply allow scientists to do what man has been doing for thousands of years on a much shorter time scale. A perfect example of this can be found in cattle. Angus beef cattle have been bred for optimal muscle production, and along the way they have lost the trait for horns (known as “polled”). Holstein dairy cattle have been bred for optimal milk production, and they still possess the trait for horns. Horns are not desirable in dairy cows since the cows can injure each other and workers with the horns, so veterinarians perform a procedure known as disbudding to kill the horn bud on calves. Although considered a humane practice, disbudding does cause discomfort to the calves.

Using modern genetic engineering technology, scientists can move the polled trait from Angus to Holstein cattle without altering all the other Holstein traits that breeders have worked for more than a century to develop. Although Angus and Holstein cattle are sexually compatible and can be crossed by traditional means to move the polled trait into Holsteins, traditional breeding would bring in many other undesirable traits from the Angus line. Breeders would then spend many years, likely decades, and a lot of money to remove the undesirable traits while trying to preserve the polled trait they want. Thus, genetic engineering could accomplish in a short time, and more cost effectively, what traditional breeding would take decades to do.

Why Is Genetic Engineering so Controversial?

Although there is no easy answer to the question of why genetic engineering is so controversial, it is likely because the technology has unfortunately been closely linked to agrochemicals such as glyphosate (Round-Up®). One of the first uses of genetic engineering that gained wide-spread adoption was to genetically engineer crops to be resistant to herbicides. Agronomic crops such as corn, soybean and canola have all been engineered to be resistant to glyphosate and other common herbicides. This allows farmers to spray entire fields, resulting in better weed suppression and greater crop growth. However, it also

means that the crop that is ultimately destined for human consumption or animal feed has been treated with the herbicide and it can lead to more rapid resistance to the herbicide among weed populations.

As a result, genetic engineering has become all but synonymous with Round-Up® resistance and is inextricably linked to Monsanto and other large agricultural biotech companies. This is unfortunate since most genetic engineering research is being done in the public sector—by universities and the United States Department of Agriculture (USDA) —and is targeted at issues that, if not for the dark cloud of herbicide resistance, would probably be viewed favorably by most people.

Genetic Engineering: Herd Immunity for Plants

One of the ideas that commonly comes up when discussing genetic engineering is that if genetically-engineered crops are grown, conventional crops will go away. In fact, the opposite is true and is exemplified by human immunization.

We commonly use vaccines to prevent debilitating diseases in humans, but for various reasons not everyone can receive a vaccine. However, by protecting a large enough portion of the population from a given disease, those who cannot be vaccinated also are protected. This is known as herd immunity—the resistance to the spread of a contagious disease within a population that results in a sufficiently high proportion of



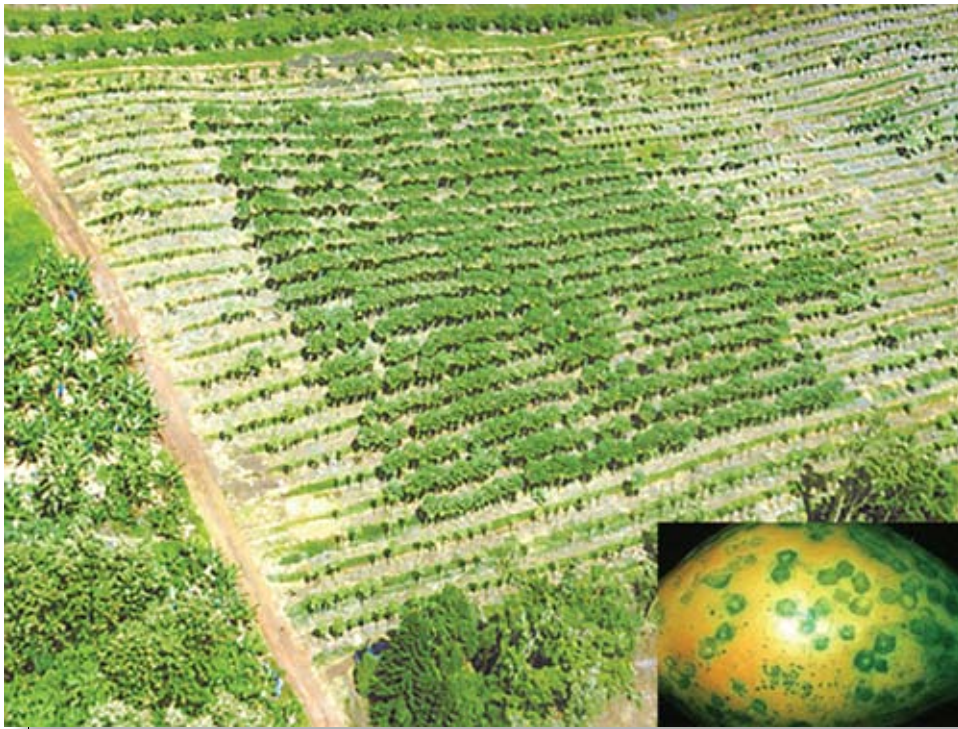
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A field trial from the Puna region of Hawaii showing a solid block of papaya ringspot virus-resistant 'Rainbow' growing well while the surrounding susceptible 'Sunrise' is severely infected with papaya ringspot virus. A papaya fruit affected by papaya ringspot virus (inset). Credit: Dennis Gonsalves, USDA U.S. Pacific Basin Agricultural Research Center.

individuals who are immune to the disease. Thus, planting a disease-resistant, genetically-engineered crop on a large scale can allow other farmers to continue to grow conventional varieties of the same crop disease free.

This concept has been proven in Hawaii where papaya ring-spot virus had all but ended papaya production in the state by 1995. Dr. Dennis Gonsalves, USDA Agricultural Research Service, developed two varieties of papaya — 'Rainbow' and 'SunUp' — resistant to papaya ringspot virus using genetic engineering. These trees went into field trials in the Puna region of the Big Island starting in 1995 and have proven to maintain resistance for more than 20 years. Today, because of the high percentage of resistant papayas being grown on the Big Island, the disease pressure has diminished enough for farmers to once again grow the highly profitable Kapoho variety (non-genetically modified) for export to Japan. In addition, papaya production has been able to return to Oahu where it had previously vanished due to papaya ringspot virus.

A similar scenario may be the greatest hope for overcoming devastating diseases in other crops, such as Huanglongbing (HLB; citrus greening) in citrus and perhaps even laurel wilt in avocado.

Regulatory Issues

Perhaps even more difficult than overcoming public perception is overcoming the regulatory hurdles to get geneti-

cally-engineered products into production. Often regulations have not kept pace with technology and are outdated. For example, genetically-engineered animals are regulated by the Food and Drug Administration (FDA) because they fit the FDA's definition of a drug: "articles (other than food) intended to affect the structure of any function of the body of man or any other animals." Thus, the Holstein dairy cow would be regulated as a drug if the polled trait were moved from Angus beef cattle using genetic engineering, but not if that same trait was moved by traditional breeding over many generations – even though the result is the same.

Plants are no less regulated than animals and are actually reviewed by three government agencies: USDA, FDA and the Environmental Protection Agency (EPA). The USDA determines if a plant is safe to grow based on its authority to



A bottle of salt with a misleading "non-GMO verified" label. Salt is a mineral containing no DNA and thus cannot be genetically modified since it has no genome.

regulate plant pests. For example, could the crop become a weed? Were any plant pests used in its development (for example, the coat protein from papaya ringspot virus)?

The FDA makes the determination whether a crop is safe to eat. That is, determining whether the genetically engineered crop is substantially equivalent to conventional varieties with respect to its nutritional value, allergenicity, etc.

The EPA regulates plants that have pesticidal properties. Are they safe for humans, non-target organisms and the environment?

All of this regulatory compliance comes at a significant cost. A 2007 study estimated the average costs for regulatory compliance reviews for a single crop ranged from \$7-\$15 million, and potentially took a decade or more to complete.

And new federal regulation will require all genetically-engineered foods to be labelled as such starting July 2018. The downside of this regulation is that it does nothing to curb the misleading non-GMO labelling that has become ubiquitous.

Virtually all of our foods, plants and animals, have been substantially genetically modified from their original form. In fact, many of our foods have no wild relatives. Modern genetic improvement techniques are extensions of breeding that make it more precise and more targeted, allowing us to achieve in a relatively short period of time what our ancestors achieved over thousands of years.

Our modern society allows for pests and diseases to spread among our world's agricultural systems faster than ever — HLB, laurel wilt, avian influenza, mad cow disease. Too fast for conventional breeding techniques to keep up and stay ahead of the threats. In fact, some of these diseases and pests are so devastating they could wipe out germplasm repositories — the very places we would go to look for traits to breed resistance — before we have time to assess the situation and react. We may not have a choice but to look to genetic engineering to solve some issues in the not too distant future.

Although there are currently no genetically engineered avocados, we must be mindful of new techniques and technologies that become available that could help us confront some of our industry's greatest challenges. Simultaneously, we must pay attention to regulatory issues and laws surrounding genetic engineering so that our ability to utilize these techniques and technologies is not compromised before we even start. 🥑



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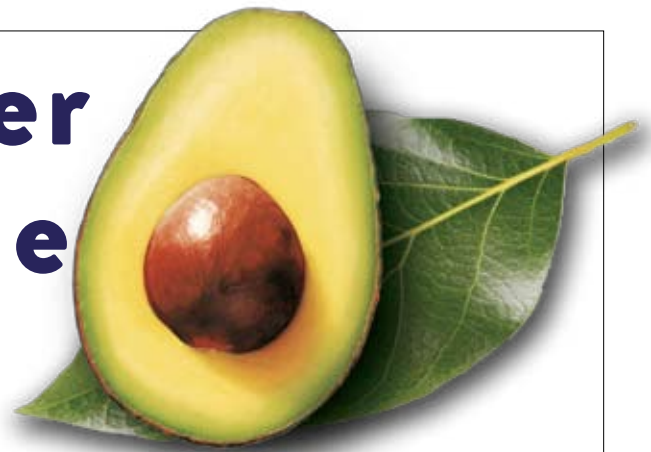
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Grower Profile



Back to the Future: Couple Return to Farming Roots

By Tim Linden

Lizzie MacKenzie and Fred Jackson both grew up literally in the shadow of avocado trees. They also were married under one several years ago. And now, after spending the last decade elsewhere, the couple has returned to their roots in North San Diego County and joined the ranks as California avocado growers.

“My parents bought an avocado ranch so they could live in a beautiful place,” said the 30-year-old Lizzie. “We want to do the same thing.”

As an only child, Lizzie grew up in the Vista/Bonsall area on a five-acre avocado ranch. Her parents made their living in the landscape business and treated their avocado parcel as more of a hobby ranch. Over a 20-year period they built their house on the ranch and tended to the avocados, coaxing the operation to pay for itself. For the most part, they have been successful.

Lizzie grew up on the ranch and has very fond memories of running through the groves and playing among the trees. After high school she went to the University of California at Santa Barbara and ended up staying in the area for 10 years. Along the way, she and Fred, a Fallbrook native also with avocado ranching in his family background, married and entered the working world.

In early 2016, they made the decision to move back down to the North County to be closer to family and try to recreate the bucolic environment in which they had grown up. They both have full time jobs, with Lizzie working in San Diego every day as a partner in a software startup called AppFolio, while Fred works at Hobie in their manufacturing facility in Oceanside. All along they have been contemplating entering into the avocado business with groves of their own.

Opportunity knocked when family friend and longtime San Diego County avocado grower Katie Wild started to scale

back her avocado holdings.

Lizzie said a seminal moment occurred in June of 2016. Katie gave the young couple an opportunity to purchase a 6.81-acre parcel. "At the time, we weren't ready. We didn't have all our ducks in a row," Lizzie said.

But the situation presented itself again a couple of months later and in mid-August the deal was completed. To Lizzie it was a huge step. Most of her college friends are still living in apartments in Santa Barbara and she's a landowner with avocado acreage.

But she said, it fits the couple's M.O. "We never follow the grain. We converted a bus into a house when we lived in Santa Barbara. Now it sits in our grove as our world headquarters."

A year later, they have survived their first harvest, have what they believe is an excellent crop on their trees for year two and have immersed themselves in everything avocado. Fred works four 10-hour days and spends every Friday tending to the trees and doing whatever work needs to be done. Lizzie has set out to learn the avocado business in the same fashion that she tackled the software industry. She reads everything she can get her hands on, took a class in avocado farming from extension specialist Gary Bender and is asking questions of anyone who will listen.

"I'm doing everything I can to learn about the industry. Who are the key players? How does it work? I'm trying to get involved in the community."

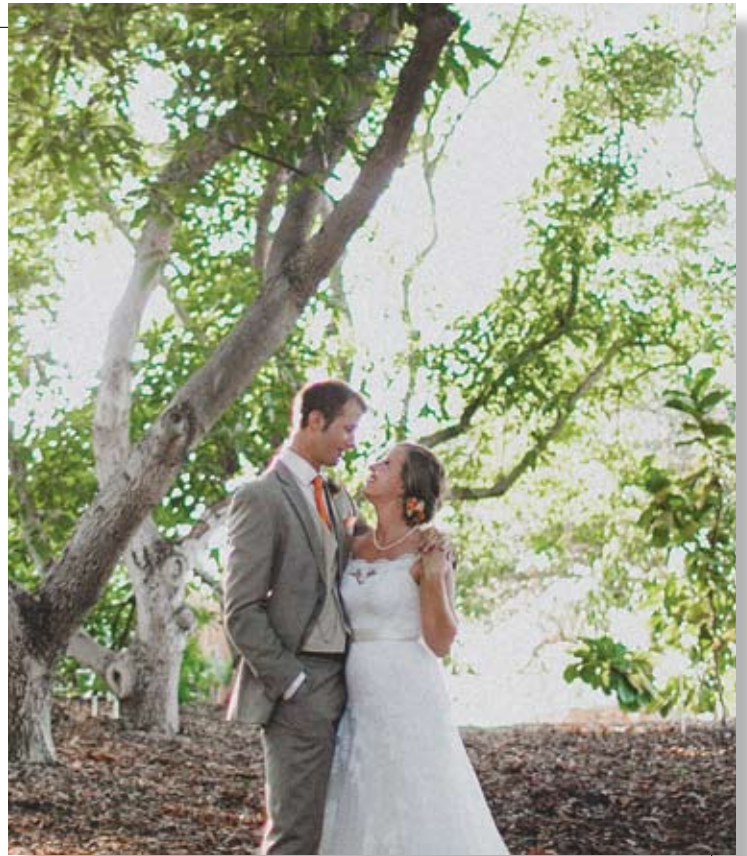
Toward that end she sought out the California Avocado Commission, attended meetings and talked to board members and staff. "What CAC is doing is awesome. I love the new marketing campaign and the effort on Instagram. They are doing a great job. I saw Jan DeLyser at the meeting and just had to go up and introduce myself."

Lizzie said for the most part, fellow growers have been open and more than willing to discuss their efforts and challenges. She said there are some that no doubt look at her as an upstart or one who doesn't quite belong. But those are few and far between and not representative of the industry as a whole.

The Jacksons have named their operation Avohill Farms LLC, and she admits that total tonnage harvested this year was a disappointing 9,000 pounds, after averaging 25,000 to 35,000 pounds most seasons under the previous owner. But this year was a small crop across the board and they were completing the transition to organic production on the acreage.

She's expecting a much better yield for the 2018 season. "I see it on my trees. I only have one year to compare it to but the trees look so full, so saturated."

There is no hesitation at all when Lizzie lists the chief challenge Avohill Farms faces in its quest to be a legitimate and profitable avocado operation. It was also the biggest looming factor on the negative side of the ledger when the Jacksons



decided to take the plunge a year ago. "Water. We know that water is always going to be the biggest challenge. Last year (after we bought) we got one scary water bill and then another that was okay and then the rains came. And we had no bills for quite a while."

The Jacksons do not expect to be that lucky this year. Currently, being millennials and tech-savvy, they are exploring technologies in the irrigation space that can improve their water efficiency and cut their costs in other ways as well. Lizzie said that while they will give organic avocado production a good college try, it will have to make economic sense. "If it doesn't make sense for us, we will take a more common sense approach to farming and sustainability."

She noted that the couple is continuing their day jobs and have low expectations in the short run for the acreage to produce them a living wage. "This is not our full-time occupation, but it is a way that we can live in a beautiful place," she said, adding that the Jacksons are expecting their first child and she loves the idea of watching that child grow up among the avocado trees as she did.

On the other hand Lizzie and Fred Jackson are not adopting the "hobby" concept. They are big admirers of the previous owner, who had about 150 acres of avocado groves at her zenith, and Bob Jackson, Fred's uncle, who also makes his living with groves throughout San Diego. "We are taking it one year at a time, but we called our ranch Avohill Farms for a reason," Lizzie says. "We do plan to have more than one!" 🥑

Colombia Granted U.S. Access but Few Shipments Expected Through 2018

While Colombian avocados officially gained access to the U.S. market in mid-September of this year, experts are expecting very little fruit to be marketed in the States this year or next.

Juan Camilo Ruiz Perez is currently a Colombian avocado grower but was the founding executive director of CORPOHASS, a quasi government agency developed to represent the country's avocado industry in discussions with the U.S. Department of Agriculture. In an email exchange with *From the Grove*, Perez predicted that avocado shipments to the United States will be minimal both this year and next. "Someone has opined that it is possible that a very small amount is exported before the end of the year, which would be sent by air. I think it will take a year or a little longer because: 1) not many producers are in the quarantine pest monitoring program, 2) because the producers (who are in the program) are not all free of them, 3) you must show for a year that you no longer have pests in your groves and that during the last year there have been no pests."

In late August, he shared a PowerPoint presentation that he was scheduled to deliver in Mexico in early September about the scope of the Colombian avocado industry. One chart

revealed that Hass avocado acreage has doubled in the past half dozen years and now represents about 14,000 hectares (34,000 acres). Another slide noted that Colombia exported close to 40 million pounds of Hass avocados in 2016, with virtually all of it going to Europe.

U.S. importers agree that shipments will not be robust right off the bat. Jim Donovan, senior vice president of international operations for Mission Produce, did say that his firm had signed an agreement with Colombia's largest avocado exporter and some shipments could occur this year, though he agreed the total volume would be small.

He does believe that significant shipments over time are possible, but it will take time. And he said Colombia has already begun shipping to Europe so, like other South American countries, export production will not be limited to the United States. Both Peru and Chile ship the majority of their export avocados to Europe and one might expect Colombia to follow suit, especially considering that market is already being developed by Colombian exporters.

Emiliano Escobedo, executive director of the Hass Avocado Board (HAB), would not guess as to how quickly Colombian avocados will be shipped to the United States nor how large the crop will become. Like others,

he said it will take time to develop that country's Hass crop and export capabilities. But he also said it has factors that could make it a significant player in the long run. "Colombia has the resources readily available including land, labor, water and climate."

Gahl Crane, sales director for Eco Farms Avocados, Temecula, CA, echoed the sentiments of many in noting that increased volume is advantageous as U.S. demand has shown it can easily outdistance supplies. "This is great for North America. We have a need for additional supplies."

He added that volume from Colombia will most likely be very light initially as Eco is currently in discussions with some Colombian exporters and is hopeful it will be able to import at least some fruit next year. He said both packing houses and individual groves must be certified for shipments to the United States and that cannot happen overnight.

Escobedo also expressed interest in new supplies from Colombia. "At HAB we have a vision for Hass avocados to be the number one consumed fruit in the United States. To do that we need to double consumption and supplies. We need new supplies from all sources." 🥑

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Handlers Bullish About 2018; Excited About California Crop

In late August, there were a few undeniable facts that caused virtually every handler who was interviewed to be very bullish about the 2018 California avocado crop.

In the first place, at that point there was very little California fruit still in the pipeline. There were still a few shipments taking place from the most northern district in the state but growers in every other production area had long since exited the market. So a 2018 crop currently being projected at approximately twice the size of 2017 caused these handlers to be extremely excited about next year's prospects as they will be marketing fruit from the Golden State deeper into the summer.

Of course that excitement was being buoyed by the fact that the August market price for avocados gave the state's nickname new meaning.

Gary Caloroso, regional business development director for Giumarra, simply said "No!" when asked if he'd ever seen an avocado market this high in his 20 years in the business. "It's amazing," he added. A 48 size avocado was being sold for an f.o.b. price of \$75 or more for most of August, with the same strong market expected at least into September. The market price for

a carton of 48 size avocados has been greater than \$50 – and sometimes much greater – almost every week for the past 15 months.

"We've moved almost 40 million pounds of fruit with a \$75 market," said Rob Wedin, vice president of sales and market development for Calavo Growers, speaking of a recent week. "That's unheard of."

It is these types of numbers that make handlers bullish about 2018. Sure, California is going to have a bigger crop and Mexico is expecting a larger one as well. Peru could send more fruit to the U.S. and Chile probably will also increase its exports to the United States market over the next five months. Colombia is expected to chip in a small amount in its first year of access to this market while Jalisco production is the wild card. Just no telling if that political situation will be resolved in time for that Mexican state's summer 2018 production.

But, regardless of where the volume comes from, Caloroso believes sales will be brisk. "We have no concerns about moving next year's California crop," he said. "Demand continues to outpace supply and we have lots of customers who want California fruit."

He could have added that many of those customers saw their shipments of California avocados diminished significantly this year because of the small size of the total California crop. "We are very excited about next year. It's good for us and good for the growers."

Wedin of Calavo echoed those same sentiments. He's a data guy and said that for many years the amount of avocados sold in the United States has been growing at about a 15 percent clip, which means a doubling of consumption every six years or so. "This past year (because of production declines in the United States and Mexico) we saw a 10 percent decrease in supplies and look what has happened to the market."

He said as California supplies significantly dropped in late July, the market just kept going up. "We've had no price relief."

Wedin doesn't expect there to be true promotable pricing until October, although he did note that even with high prices, retailers have continued to promote avocados throughout the spring and summer, which speaks loudly of the popularity of the fruit.

Phil Henry, president of Henry Avocado also marveled at the amount of fruit that has been moving at record-

level pricing. While California's crop was down significantly this summer, the United States still consumed 30-40 million pounds per week with demand exceeding supply the entire time. He said those a bit longer in the tooth might marvel at avocados selling for \$2.49 a piece at retail, but younger shoppers don't have the same points of reference and apparently do not think that's unreasonable. He puts himself in the camp that believes demand continues to outpace supply and that even with a 400 million pound California crop next year, sales will be brisk.

All of those questioned believe that marketing of the 2018 California crop will begin a bit earlier than this year – probably March – and last a bit longer – probably past Labor Day.

Wedin said that by the time California starts picking its crop, there will be a much different market dynamic than is occurring currently. He expects there will be promotional pricing throughout much of the fall, winter and spring and strong weekly sales volumes will reflect that. It's much too early to tell but the Calavo executive indicated that the sweet spot for California growers next season might be late spring and late summer. The June/July marketing period could be a bit more challenging with Peru in the marketplace and the potential that Jalisco could be there as well. "That (the granting of U.S. access to Jalisco fruit) will be something to keep an eye on."

Henry expects the 2018 crop to be of excellent quality and size because of the top-notch water it has received. Of course, there was the pure rain water delivered from the skies throughout the 2016-17 winter and spring, but he said project water also has been great because of the excellent snow melt. If good water means good fruit, it could be a great year. He added that a mild summer produced less drop so he be-

lieves that the trees are well on their way to delivering a large crop. Of course, like all growers and handlers, Henry's caveat is that there still is a lot of time before the crop is in the bins so other issues could still play a role.

By all accounts, the 2017 crop produced record field prices. While

those per pound prices will be tough to beat in 2018, Wedin is confident that twice the volume will not result in a 50 percent drop in field prices. Demand in both the United States and the world appears to be a very strong friend for the California avocado grower. 🥑

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Food52 Influencer and Chef Liz Pruiett's Green Goddess Dressing recipe and video garnered 101,603 video views and 7,431 engagements on Facebook and Instagram.

Leveraging Digital Content Partners to Drive Demand and Preference

Part of the California Avocado Commission's (CAC) ever-advancing marketing plan is to leverage the power of influential digital publications to create unique and engaging content.

This sponsored-content helps CAC connect with California avocado consumers and engage them more deeply with the brand. The content also communicates key California avocado message points such as availability, proximity to market and promotions like California Avocado Month (June) and the 4th of July.

During the 2017 season, CAC's partners produced engaging California avocado content in several different formats, including: videos, recipes, editorial articles and social media posts. In total, 35 custom content pieces were created with more than 378,000 engagements (comments or likes on

This season, CAC partnered with the following influential custom content partners:

- PureWow – a premium lifestyle site well known for its food editorial, photography and video content
- Food52 – an influential social media leader and foodie website with a very large following
- Tasting Table – a top performing foodie website with premium recipe and food content and videos
- HelloSociety – a well-respected Instagram influencer network with a very large Instagram follower base
- Nativo – an advertising partner that creates custom content and works with top lifestyle and foodie websites to aggregate and place that content across its website network



HelloSociety Influencer Lee Tilghman's Avocado Bowl was a top performing Instagram post that garnered 12,267 engagements.

social media, video views or link clicks).

CAC works with content producers who have audiences that align with the California avocado consumer. With the objective of increasing preference and loyalty for California avocados, these partners provide CAC with a unique and meaningful marketing opportunity that is specifically targeted to the California avocado consumer. As a result, in 2017 consumers spent one to five minutes on average with the custom content because they found it to be relevant, useful and interesting.

When content is developed, California avocado messaging is authentically woven into these partner websites and their influential stamp of approval provides a halo effect that can enhance the perceived value of California avocados. Users will spend more time with a video or reading a recipe or article than they would simply seeing a banner ad. By combining banner ads with article placements, CAC has seen stronger results that help drive awareness of California avocados in season.

CAC's custom, sponsored content program continues to grow and is an integral part of the Commission's optimized consumer marketing program. In conjunction with other online promotions such as online ads, influential blogger and registered dietitian ambassador activities, the CAC website, the CAC blog *The Scoop* and social media, these online promotions reach the consumer where they are spending their time, in an engaging way, during key periods of availability.

Building on the success of this year, CAC's custom, sponsored-content program will remain a critical component of the Commission's marketing program going into 2018. 🥑



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Vons lifestyle influencers and bloggers took advantage of numerous opportunities to capture photos of fresh California avocados for their blogs.

Vons Influencers Share Their Avocado Experience

When it comes to the California avocado experience — nothing makes an impact like a hands-on tour of a California avocado grove, topped with an outdoor California-avocado centric lunch and fresh guacamole contest.

On June 28, the California Avocado Commission (CAC) played host to six members of the Vons marketing, social media, digital and communications team, as well as 10 food and lifestyle influencers and bloggers who represent Vons, at the Orchard Hills California avocado grove located in Irvine, CA. The tour provided attendees — many of whom had never visited an avocado grove before — with a one-of-a-kind, behind-the-scenes look at the hands-on care needed to produce and harvest a premium California avocado crop.

CAC's Retail Marketing Director Connie Stukenberg and Peter Changala, vice president agriculture for Irvine Company Community Development, welcomed attendees with water bottles, hats and t-shirts under blue skies and sunshine. As



Guests enjoyed a catered outdoor lunch that featured California avocado menu items for every course.

attendees walked the grove, CAC Research Program Director Dr. Tim Spann and Changala provided high-level insights into the unique characteristics of Hass avocados and the hand-grown California avocado process, answering questions along the way. On one of the tour stops, attendees watched as crews picked the ripe fruit and then took a turn at harvesting a few avocados of their own. Throughout the tour, the attendees documented their experience with photos and social media posts.

After the tour, the group enjoyed a catered outdoor California-avocado-centric lunch featuring the fruit in every course. Attendees dined on a variety of dishes ranging from



CAC challenged Vons bloggers to craft their own California avocado guacamole recipe.



Dr. Tim Spann answers questions about growing California avocados while Vons influencers and bloggers capture highlights of the tour with photos.



Bloggers captured every step of their California avocado guacamole challenge and then shared their photos on social media channels.

Vegan Cauliflower and California Avocado Ceviche to Key Lime and California Avocado Shooters.

Following lunch, the bloggers and influencers put their culinary skills to the test — crafting fresh, unique guacamole from the assorted ingredients and spices available to them. The judges were so impressed by the off-the-cuff recipes that everyone was declared a winner!

Beyond the grove, the Vons influencer tour made a splash on the social media circuit. The bloggers provided added visibility for hand grown California avocados with blog posts that showcased photos from the tour and delicious California avocado recipes. Desire Eggin, of *The Funny Mom Blog*, provided her fans with a synopsis of the California avocado grove tour accompanied by photos of the ready-to-pick fruit hanging from trees. Daisy Chan, another Vons blogger, shared mouth-watering photos of the California avocado grove luncheon with her fans on the *Food Within Reach* blog.

In addition, one blogger influencer lauded the health benefits of California avocados on a San Diego TV segment while reminiscing about the grove tour. The influencer closed out the segment by sharing and preparing a Lime/Mango Guacamole recipe. 🥑

California Avocado Month Secures 41 Million Impressions

What began as “California Avocado Week” in 2010 quickly expanded to “California Avocado Month” by 2012. Five years later, the California Avocado Commission’s (CAC) California Avocado Month promotions have grown to become some of the most effective means of engaging with fans of the Golden State fruit during the height of the season.

The campaign is, in large part, a success because of the integration of diverse touch points the Commission establishes with its fans in stores, at events, and on social media and digital channels. The core of the campaign involves sharing content, recipes and fresh samples of unique California avocado dishes that remind consumers California avocados are an integral part of quintessential summertime meals, snacks and entertaining.

In the U.S., food halls that feature international fare and artisanal products are growing in popularity. To take advantage of this trend, CAC celebrated international cuisine with



CAC Chairman Rick Shade engaged with members of the media at the California Avocado Month kick-off event.

a California avocado twist throughout California Avocado Month. The Commission’s eight food and lifestyle blogger partners crafted unique California avocado recipes for a variety of summer occasions and shared them with fans on their social media channels. The Commission also partnered with a cadre of restaurants located within Grand Central Market — an L.A. food hall—developing California avocado menu items that paired culinary flare with California avocados. Horse Thief BBQ’s pitmaster Anthony Chin developed two menu items fusing Texas-style BBQ with Southern California flavor — *Brisket Sandwich with Smoked California Avocado Relish* and *Chicken and Kale Salad with Smoked California Avocado and California Avocado Dressing* — that were featured in public relations outreach promoting California Avocado Month. Belcampo Meat Co., DTLA Cheese and Kitchen, Golden Road Brewing, Morelianas, La Tostaderia, Olio Wood Fired Pizzeria, Prawn, Ramen Hood and Valerie Confections also celebrated California Avocado Month by showcasing the fruit on their menus.

To demonstrate the versatility of California avocados — and broaden awareness of their nutritional assets — the Commission’s Registered Dietitian partners took to social media with



California avocado growers Larry and Louise Ravera Balma with CAC’s April Aymami at the Hollywood Bowl performance that attracted 15,000 concert goers.

a series of educational and engaging videos and posts. Bonnie Taub-Dix (MA, RD, CDN) hosted a Facebook Live video event where she prepared California avocado recipes while sharing nutrition information and answering fans' questions. The video has secured 92,000 views to date. Manuel Villacorta (MS, RD) also entertained fans on Facebook, Instagram and Twitter by introducing creative ways to add California avocados to their diets and improve their gut health.

On Instagram, eye-catching photos tell a story. To engage with foodies on this social media platform, the Commission partnered with three HelloSociety Instagram influencers – Erica Coffman, Julie Lee and Lee Tilghman. Each of them composed beautiful California avocado food



California avocados in the dressing and on the salad made this Grand Central Market dish a crowd favorite.



Eye-catching retail displays, like this one that cross-promoted tomatoes and California avocados, encouraged shoppers to purchase their favorite local fruit during California Avocado Month.

images and shared them with their followers on the popular photo-friendly social media platform.

The Commission also engaged with fans beyond the realm of social media. On June 23, CAC staff took part in Grammy-award-winning artist (and California avocado grower) Jason Mraz's birthday celebration at the Hollywood Bowl. Fans gathered new recipes and California avocado information in the midst of a carnival atmosphere before going into the concert.

To ensure consumers checked the labels on fruit and purchased California avocados during the month-long celebration, CAC partnered with targeted retailers to host a variety of display and sales contests, demo programs, sweepstakes and recipe booklet giveaways. Gelson's, for example, hosted a Father's Day Avocado Festival complete with kid-friendly activities and prizes. Raley's locations in Northern California hosted a California Avocado Month sweepstakes, with two barbecue grills as prizes. Bristol Farms and Lazy Acres participated in a display contest and treated customers to fresh-made California avocado guacamole.

By engaging with retailers, influencers and consumers in-person and on digital channels, the Commission secured more than 41 million impressions. The public relations portion of the campaign reached more than 40 million while social content reached another 232,000 users. The Commission's Instagram campaign delivered more than 818,000 impressions and nearly 27,000 engagements. 🥑

Yield Characteristics of California ‘Hass’ Avocado Trees

By: Carol Lovatt, Yusheng Zheng, Toan Khuong, Salvatore Campisi-Pinto, David Crowley, and Philippe Rolshausen

Introduction

Production characteristics of ‘Hass’ avocado trees in California were determined using yield data from ~3,000 trees in commercial coastal and inland valley orchards from 1992 to 2012. The data set included total yield, fruit size distribution (pack out) and fruit quality for ‘Hass’ avocado trees on different but known clonal and seedling rootstocks in more than 15 commercially-producing orchards representing the major avocado-growing areas of California. The orchards were managed according to each grower’s standard cultural practices. Fruit was harvested between March and October at $\geq 20.8\%$ dry matter content. Climate data (maximum and minimum temperatures, relative humidity, precipitation and wind speed) and information on soil type and depth were included in the data set.

The objective was to identify relationships among yield parameters, including total yield, fruit size, fruit quality and alternate bearing, that were independent of rootstock and cultural practices and prevailed across the climate conditions and soil types of California’s avocado-growing areas or *conversely*, to identify those climatic conditions and/or soil types that promoted or limited productivity in specific microclimates or edaphic (soil-related) zones.

To our knowledge, this is the first large-scale, in-depth analysis of the California avocado industry of this type. The results of the first phase of our analysis are reported below.

Yield as Fruit Weight per Tree

Total yield. The mean yield for all trees in the data set was 112 lb/tree (12,320 lb/110 trees/acre). However, the

median yield was only 62 lb/tree (6,820 lb/acre). Thus, half of the trees yielded less than 62 lb/tree and half of the trees yielded more than 62 lb/tree. Based on the frequency of individual tree yields (i.e., the number of trees having a specific yield), 50 percent of the trees in the data set yielded from 22 to 154 lb/tree (2,420 lb/acre to 16,940 lb/acre).

The greater number of trees (y-axis) yielding less than 22 lb/tree (x-axis) relative to the number of trees yielding more than 154 lb/tree is clearly seen in Figure 1.

It is of interest that the data set included trees yielding more than 350 lb/tree. However, these trees were considered outliers since they represented less than 2.5 percent of the trees in the data set.

Yield of commercially valuable large fruit. Yields of both commercially

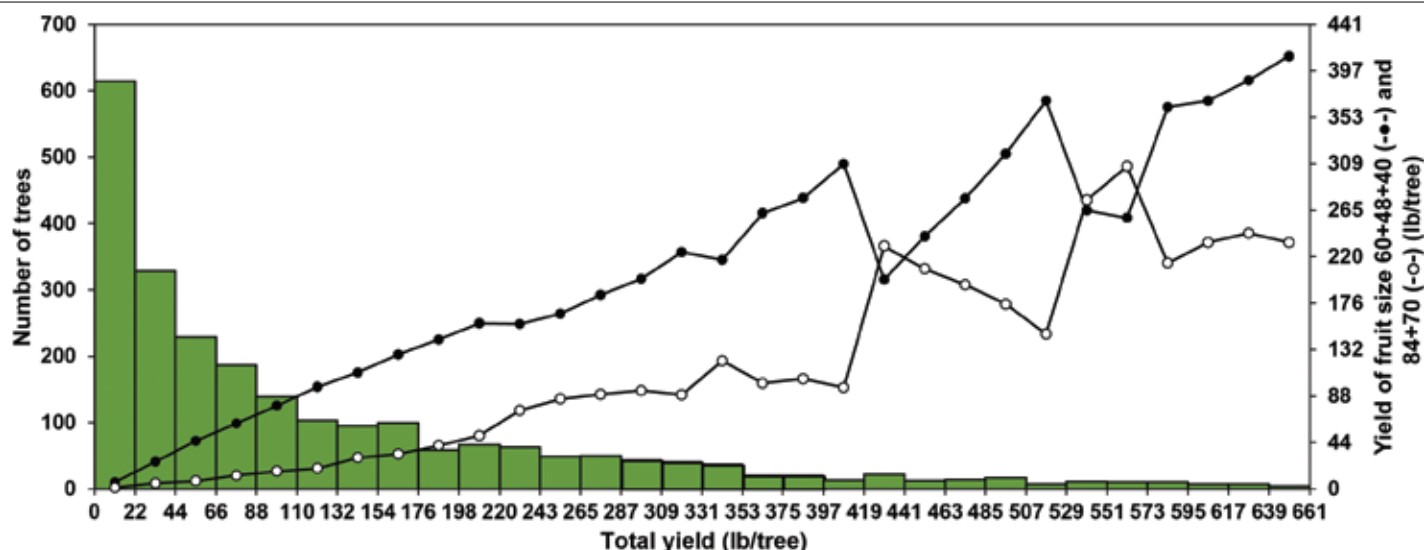


Figure 1. The green bars are the number of trees (left y-axis) in the data set having total yields of 0-21.99 lb/tree, 22-43.99 lb/tree, 44-65.99 lb/tree etc., (lower x-axis). Black circles indicate the average pounds of commercially valuable large (CVL) fruit (packing carton sizes 60+48+40) per tree and white circles indicate the average pounds of small fruit (SF) (packing carton size 84+70) per tree (right y-axis) for trees in each total yield category on the x-axis, respectively.

valuable large (CVL) fruit (packing carton sizes 60+48+40; 178-325 g/fruit) and small fruit (SF) (packing carton sizes 84+70; 99-177 g/fruit) increased as total yield increased (Figure 1).

To correct for prejudice caused by having significantly more trees at one site than other sites, an unbiased mean yield was determined. The unbiased mean yield was a respectable 95 lb/tree (10,450 lb/acre) with an unbiased yield of CVL fruit of 68 lb/tree (72 percent of the total yield).

It is noteworthy that CVL fruit were consistently a greater proportion of the total yield up to 419 lb/tree. On average, up to 419 lb/tree, 72 percent of the total yield was CVL fruit, with larger fruit (326-397 g/fruit) only 2 percent of the crop, and smaller fruit (SF) making up approximately 25 percent of the total yield.

Thus, even with a dramatic in-

crease in total yield (as lb/tree or number of fruit/tree) above the current production levels, California ‘Hass’ avocado growers are unlikely to experience a decline in the yield of CVL fruit.

Alternate Bearing

It should be noted that the majority of low yielding trees (< 22 lb/tree) in the data set produced low yields in response to adverse climatic conditions, including multiple years with freezing temperatures and one year of excessively high temperatures during fruit set. The fact that only 2 percent of the trees in the entire data set produced back-to-back yields of less than 22 lb/tree provides strong evidence that low yields, in the majority of cases, were not the result of poor cultural management practices or disease, nematode or insect pest damage. The adverse climate events resulting in low yields (off crops) initi-

ated alternate bearing.

Alternate bearing was a characteristic of the majority of the orchards in the data set. The severity of alternate bearing is estimated by calculating the alternate bearing index (ABI) for each data tree for each pair of consecutive harvests using the following equation: $ABI = \frac{\text{the absolute value of year 1 yield minus year 2 yield}}{\text{sum of year 1 yield and year 2 yield}}$ in which yield was defined as total lbs of fruit per tree. ABI ranges from 0 (no alternate bearing) to 1 (complete alternate bearing; crop one year, no crop the other year).

Only 17 percent of the trees in the data set had an ABI less than or equal to 0.25, 17 percent had an ABI greater than 0.25 up to 0.50, with 19 percent of the trees having an ABI greater than 0.50 to 0.75 and 47 percent of the trees having an ABI greater than 0.75 up to 1.0. Thus, over the period from 1992-

2012, 66 percent of the 'Hass' avocado trees in the data set were severely alternate bearing with 50 percent to 100 percent differences in yield from one year to the next.

The severity of alternate bearing was independent of orchard location and no avocado-producing area in California was more or less prone to alternate bearing over the 20 years the data were collected. For trees having an ABI from 0 to 0.75, the occurrence and severity of alternate bearing was not related to crop load. In contrast, trees having the most extreme ABI (0.75 to 0.99) tended to produce yields greater than the unbiased mean or median yields reported above in both the on- and off-crop years and thus had significantly greater two-year cumulative yields than trees with an ABI less than 0.75. These greater yielding trees did not suffer a reduction in two-year cumulative yield of CVL fruit, but produced significantly more small fruit than trees in all other ABI categories.

It is interesting that for trees producing on-crops of less than 110 lb/tree, the following off-crop yields were less than 33 lb/tree, becoming dramatically lower with progressively lower on-crop yields. In contrast, on-crop trees producing more than 110 lb/tree produced more than 33 lb/tree and up to 77 lb/tree in the following off-crop year. No off-crop yield following an on-crop year exceeded 77 lb/tree.

Fruit Quality

Stem end rot, discoloration of the mesocarp (edible portion of the fruit), vascularization of the mesocarp, and seed germination within the fruit were each rated 0 (absent) to 4 (high incidence of the problem) for two fruit per tree collected at harvest for each tree in our data set (~6,000 fruit). The fruit were ripened at 18 to 21 °C to "eating soft" and then evalu-

ated. Statistical analysis of the fruit quality data provided strong evidence that the quality of 'Hass' avocado fruit produced in California is excellent. The majority of trees in the majority of orchards across the majority of years produced fruit that were rated 0 or 1 for these disorders.

- For stem end rot, 83 percent of all fruit were rated 0, 14 percent as 1, with less than 1 percent rated a 3 or 4.
- For mesocarp discoloration, 80 percent of all fruit were rated 0, with another 15 percent rated 1; only 1.9 percent were rated a 3 and 0.3 percent were rated a 4.
- For vascularization of the mesocarp, 86 percent of all fruit were rated 0 or 1; only 1.4 percent of all trees produced fruit that were rated a 3 and only 0.2 percent of the trees produced fruit that were rated a 4.
- For seed germination, 72 percent of all fruit were rated 0, with 11 percent rated 1; 6 percent rated 2; 9 percent rated 3 and 2 percent rated 4.
- Whereas the incidence of seed germination within the fruit was very low, this disorder was more prevalent, but no factors were identified that influenced its occurrence.
- Across all orchards and years, vascularization of the mesocarp was weakly but significantly related to progressively later harvest dates and weakly, negatively related to leaf calcium concentrations — a finding that needs to be investigated further.
- The number of days after harvest required for fruit to ripen to "eating soft" was weakly, positively related with total yield (lb/tree) and weakly, negatively correlated with harvest date.

Effect of Climate on Yield

Extreme climatic events in any given year became the main factor controlling yield and fruit size. Freezes in 1990-91, 1998-99 (only parts of the California avocado industry), and 2006-07 (only 5 percent crop loss in Ventura, but 50-75 percent crop loss in San Diego, Santa Paula, Carpinteria, Santa Barbara and San Luis Obispo) impacted the yields of trees in the data set. Excessively-high temperatures for several days during fruit set in 2008-09 had a devastating effect on yield from San Diego to Santa Paula, impacting the yields of trees in the data set.

Effect of Soil Factors on Yield

Statistical analysis obtained by calculating the correlation coefficients for the relationships among yield parameters (maximum total yield or yield of CVL fruit or SF and fruit quality) and soil composition identified a positive relationship between the maximum total yield attained in an orchard and the percent sand in the orchard soil, with a concomitant negative relationship between total yield and percent clay in the soil; the relationship between total yield and percent silt in the soil was weak but also negative and significant. These results are consistent with the fact that the sand, clay and silt content of an orchard soil would have a critical effect on drainage and aeration and soil microflora in the orchard and therefore on root health and tree productivity. Research by David Crowley has shown that soil composition can become a factor that overrides the optimal nutrient status of trees in an orchard if not managed properly. These results emphasize the importance of soil type as one of the criteria for selecting a site for a new orchard. Soil depth was greater than 200 cm in 60 percent of the orchards and was not related to yield. Orchards having soils with a greater percent sand or a

greater soil depth were not clustered in one particular avocado-growing area.

Discussion

Despite problems of low yield, small fruit size and alternate bearing, the ‘Hass’ avocado dominates the global avocado industry. The average (unbiased) yield in California avocado orchards included in this research was at a production level acceptable to the industry, 95 lb/tree (10,450 lb/acre), with 73 percent of the yield CVL fruit (packing carton sizes 60+48+40). The problem is that 50 percent of the trees in the data set produced at a level well below the average at less than 62 lb/tree, the median yield (< 6,820 lb/acre). Further, the yield of CVL fruit remained at 72 percent of these lower total yields, reducing grower income. Although the frequency was low, there were trees within ‘Hass’ avocado orchards included in this research that produced very high yields and trees with the capacity to produce back-to-back yields greater than 154 lb/tree, which would translate to yields of greater than 16,940 lb/110 trees/acre. Each tree in the data set has a unique number that identifies the year, the site and any special treatment the tree might have received. The next step is to identify these high-yielding trees and orchards within the data set — as well their low-yielding counterparts — to retrieve detailed information that was collected as part of the original research on tree age, rootstock, aspects of cultural management, irrigation water quality, climate, soil characteristics and tree nutrient status (leaf nutrient analyses were determined according to the standard protocol in California for all trees in the data set). This information should prove valuable in identifying key determinates of yield that can be translated into useful strategies for increasing the median yield of ‘Hass’ avocado orchards in California and possibly elsewhere.

The results of the first phase of this research provided evidence that the proportion of sand versus clay in the composition of the orchard soil was a factor influencing total yield, with a high percentage of sand having a positive effect on yield and conversely a high percentage of clay having a negative impact. An orchard soil with a greater proportion of sand to clay would have better drainage and aeration, which would contribute to improved root health with consequent benefits on-tree productivity.

Whereas California ‘Hass’ avocado trees suffer from low yield, the industry has not experienced the ‘Hass’ “small fruit” problem reported elsewhere. Based on the results of this research, ‘Hass’ avocado yields can increase dramatically to approximately 419 lb/tree with no negative effect on the yield of CVL fruit preferred by the California industry. Whereas the yield of small fruit also will increase at the higher yields, the absolute yield of large size fruit does not decrease, only its relative proportion decreases. Further, California’s warm, dry Mediterranean climate and industry-wide high standard of cultural management result in fruit of excellent quality.

Alternate bearing was demonstrated to be a major problem for California ‘Hass’ avocado growers, with 66 percent of the trees in the data set exhibiting severe alternate bearing during the period from 1992 to 2012; ABI was greater than 0.5 to 1.0 indicating 50 percent to 100 percent differences in yield from one year to the next. Moreover, nearly half of all trees in the data set (47 percent) had an ABI greater than 0.75 to 1.0 over the 20-year period. The effect of alternate bearing on yield was dramatic — following an on crop, trees in all yield categories produced less than 77 lb/tree. Despite the severity of alternate bearing in ‘Hass’ avocado or-

chards in California, the results of this research identified trees with the capacity to produce consecutive yields greater than 154 lb/tree. A subsequent more detailed investigation of these trees may provide new insights for maintaining high yields annually.

Conclusions

To sustain the California ‘Hass’ avocado industry in an era of increasing production costs (land, water, labor, fertilizer, etc.) and greater competition within the U.S. avocado fresh fruit market, avocado growers must increase their yields of high quality CVL fruit per unit land. Taken together, the results of this research provide strong evidence that the yield of CVL fruit of excellent quality, and hence grower income, can be increased annually by increasing total yield per tree annually. The results demonstrated that yield of CVL fruit was positively and significantly correlated with total yield (lb/tree) over a very broad range of yields. However, with the severity of alternate bearing that characterizes ‘Hass’ avocado orchards in California, increasing total yield annually will require mitigating alternate bearing to reduce the occurrence of off-crop years, which had average yields of less than 77 lb/tree. It is anticipated that further investigation of ‘Hass’ avocado trees (orchards) having the capacity to produce consecutive yields greater than 154 lb/tree identified in this research will provide important insight into sustaining high yields annually despite alternate bearing. Understanding the yield characteristics of ‘Hass’ avocado trees under California growing conditions was the first phase in our research to increase yield of CVL fruit, improve grower annual revenue and sustain the avocado industry of California. 🍊

Avocado Black Streak Disease Revisited: An Unsolved Mystery

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Avocado black streak (ABS) has long been a disease of concern for California avocado growers – first reported as early as 1934 and later becoming a topic of research for George Zentmyer, Howard Ohr, and Ramon Jordan at the University of California, Riverside (UCR) during the 1970s and 1980s. They discovered that the disease mainly occurs on Guatemalan cultivars, including the market-dominant and mass-cultivated ‘Hass’ variety. There also have been reports from Florida in the early 1990s of the disease on Mexican and West Indian cultivars, indicating the disease affects all races. Interestingly, the budwood from symptomatic trees in Florida was reportedly brought in from California. Outside the United States, the disease was reported in Israel on ‘Hass’ in the 1980s.

The research performed by the aforementioned researchers at UCR found viral entities from diseased and healthy tissue, but they were unable to reproduce the symptoms when inoculating healthy avocados with the viral entities in greenhouse conditions. They ruled out bacteria as the cause since antibiotic treated trees still produced symptoms of the disease and the fungi recovered from diseased tissue also

were being recovered from healthy tissue. This enigmatic disease is still an unsolved mystery, likely due to the lack of robust research on the topic since the 1980s, and the apparent minor economic importance of the disease in the current day. The work presented here was done to revisit the potential involvement of fungi in cankers formed in trees exhibiting ABS symptoms and their pathogenicity in healthy mature avocados.

Symptoms

The most obvious symptoms of ABS are trunk and branch cankers that usually appear on the underside of large branches. The canker is made visible by the accumulation of dry sugar exudate present in small cracks in the bark along the canker (Figure 1 A-B). This symptom has recently been confused with similar white sugar exudate that appears after attacks from invasive shot hole borers. The cankers may range in



Figure 1: Symptoms of ABS showing sugar exudation from small cracks in the bark. Typical symptoms will appear on the underside of the branch in older branches (A) and occasionally younger branches (B).

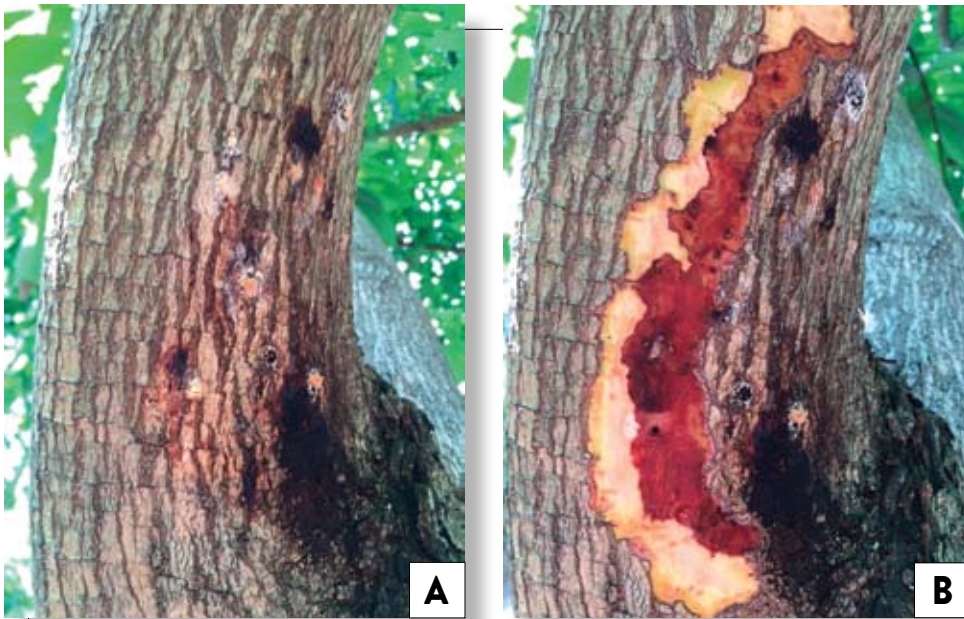


Figure 2: An older branch exhibiting ABS Symptoms (A) and the resulting canker (B) developing underneath the bark.

size from a few centimeters to the entirety of a branch or trunk. When the canker first appears, the resulting lesion under the outer bark is reddish brown and is usually limited to the phloem but can extend past the vascular cambium into the xylem tissue (Figure 2 A-B). Besides the obvious cankers present, symptoms including chlorosis, early bloom, branch dieback, leaf blotching, zinc deficiency, wilting of foliage and rapid death of new growth may occur. There are currently no known treatments to effectively treat this disease after symptoms are observed, although there are management strategies, such as good fertilization and irrigation practices, aimed at preventing stress in the host and reducing occurrence of this disease.

UCR Survey and Pathogenicity Tests

In 2015-2016, we conducted surveys in five avocado groves within San Diego County and Orange County where black streak symptoms were reported. Symptomatic and asymptomatic tissue samples were obtained from three to five trees within each

grove and isolated on culture media to recover fungi and bacteria. The most consistently recovered organisms from the survey included *Lasiodiplodia* spp., *Neofusicoccum luteum*, *Diplodia mutila*, and *Phaeoacremonium* spp. (Figure 3) with the former three hailing from the Botryosphaeriaceae, a family of fungi

with species known to cause Botryosphaeria canker and stem end rot in avocado. *Phaeoacremonium* spp. have not been reported on avocado but are widely studied in phytopathology and are known to cause grapevine decline.

To determine the pathogenicity of the isolated fungi and attempt to reproduce symptoms of ABS, two isolates from each fungal species were used to inoculate mature avocado branches, 20 branches per fungal species, at Pine Tree Ranch, Ventura County. Twenty trees in total were inoculated with the suspect fungi in January 2017 on the underside of the branches with a cork borer to make a 5mm diameter circular wound past the bark to the cambium where fungal tissue of the same size was deposited and allowed to colonize for three months. In March 2017, lesion lengths were recorded and wood samples were taken at the tip of the lesions to recover the fungi to fulfill Koch's postulates.

Lesion lengths for all fungi inoculated were significantly greater than

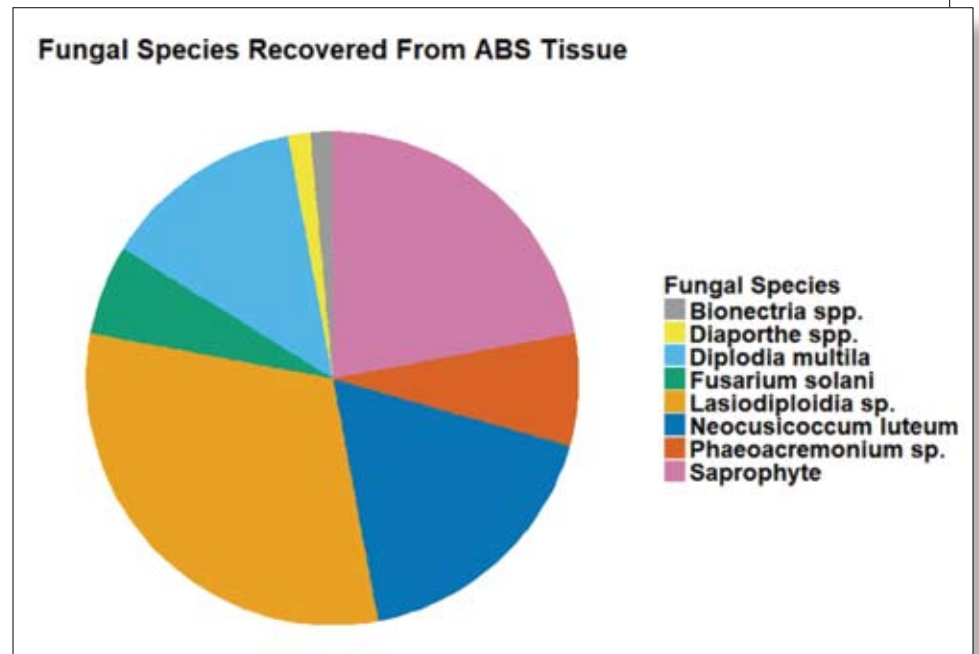


Figure 3: Proportion of species identified from woody tissue showing ABS symptoms on initial surveys done in 2015-2016.

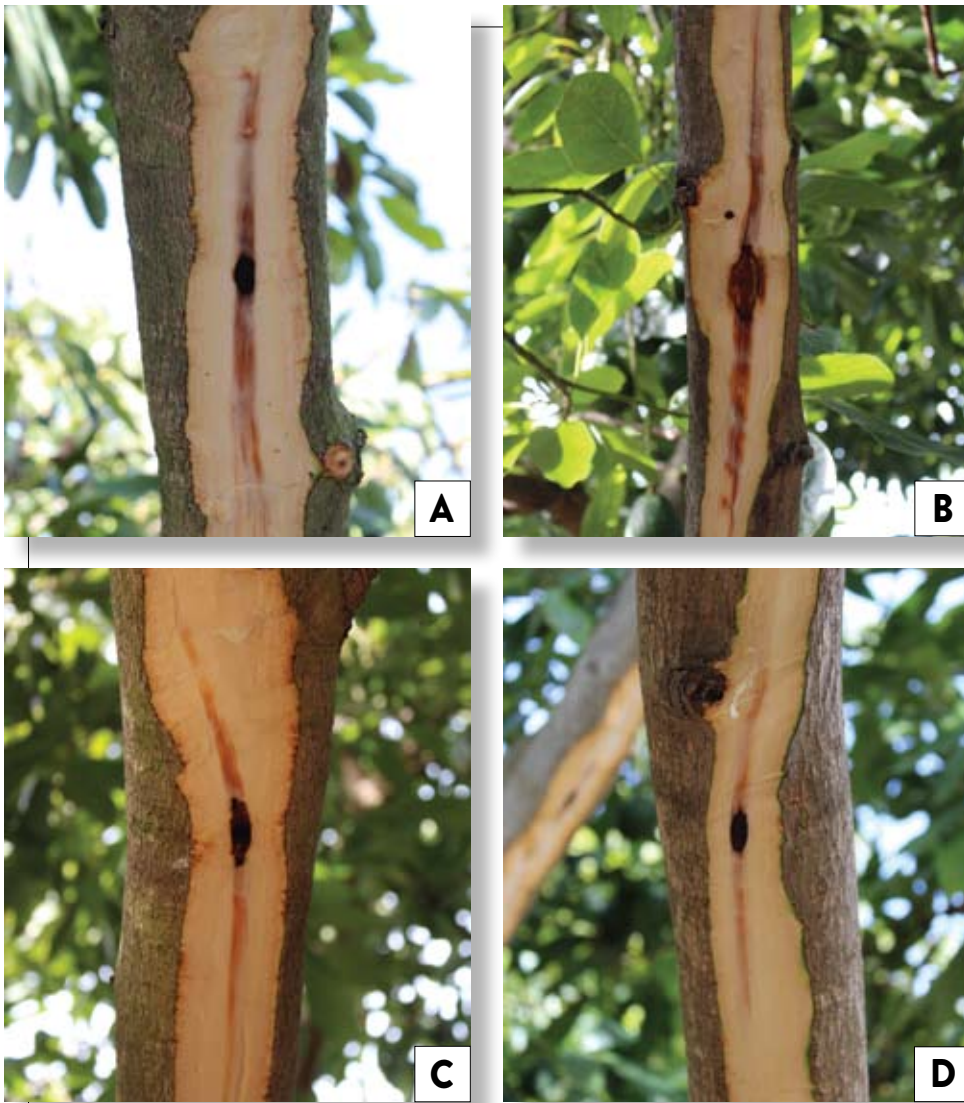


Figure 4: Lesions developed from treatments of fungi recovered from symptomatic black streak tissue. A. *Phaeoacremonium* sp. B. *Lasiodiplodia* sp. C. *Neofusicoccum luteum* D. *Diplodia mutila*.

the control. The damage resulting from inoculation of the suspect fungi (Figure 4) recovered from ABS tissue produce significant lesions and cause necrosis in the phloem and xylem tissue based on our method of inoculation. However, the developed lesions and necrosis are not consistent with symptoms of ABS, as there was widespread exudation along the underside in *some* but not *all* of the treated branches. Nevertheless, this experiment does show that *Lasiodiplodia* sp. and *Phaeoacremonium* sp. can colonize and progress through host tissue through open wounds. It would have been interesting to see the progression of the pathogens over a longer

period of time and the resulting damage and canker formation, but planned removal of the block for replanting prevented this.

Conclusions

Botryosphaeriaceae members are known to be latent pathogens in a wide variety of hosts – present, but not causing any observable symptoms when the host is in good health. This may explain why previous researchers working on ABS overlooked these fungi, since they also were recovering them from asymptomatic tissue as well as symptomatic. The unobservable symptoms in hosts already exposed to these fungi, how-

ever, can progress to form cankers and cause branch dieback upon physiological stress from environmental conditions. It is thought that environmental stress triggers symptom development of ABS, leading to formation of small open wounds and visible exudation of sugar. These openings can serve as entry points for secondary pathogens and opportunists, such as the fungi we have been recovering from this tissue.

Botryosphaeriaceae members in particular have been previously reported as latent pathogens on a diverse group of woody hosts, present on virtually all major plant organs. Physiological stress during ABS development could create opportunities for latent pathogens that already exist in the host, allowing them to become pathogenic in times of stress. Although the cause of ABS is *still* unknown, we can conclude from our surveys and pathogenicity experiments that *Lasiodiplodia* sp. and *Phaeoacremonium* sp. are examples of secondary fungi that can cause damage upon introduction into the host from open wounds formed during ABS disease development.

The causal agent of ABS was attributed to have potential viral etiology by Howard Ohr in 1981, but the agents driving canker formation are likely a complex community of fungi based on our survey results. It is a topic worth revisiting in order to investigate what pathogens are initiating ABS symptoms and what pathogens are contributing to the progression of the disease and resulting damage. Conventional methods of culturing from wood tissue are not able to represent *every* organism in the sample, which is why we plan to take a molecular approach to this issue looking for nucleic acid traces of fungi, bacteria and virus in the samples to investigate if there is any correlation in ABS and healthy samples to attempt to resolve the causal agent(s) of this disease. 🍌

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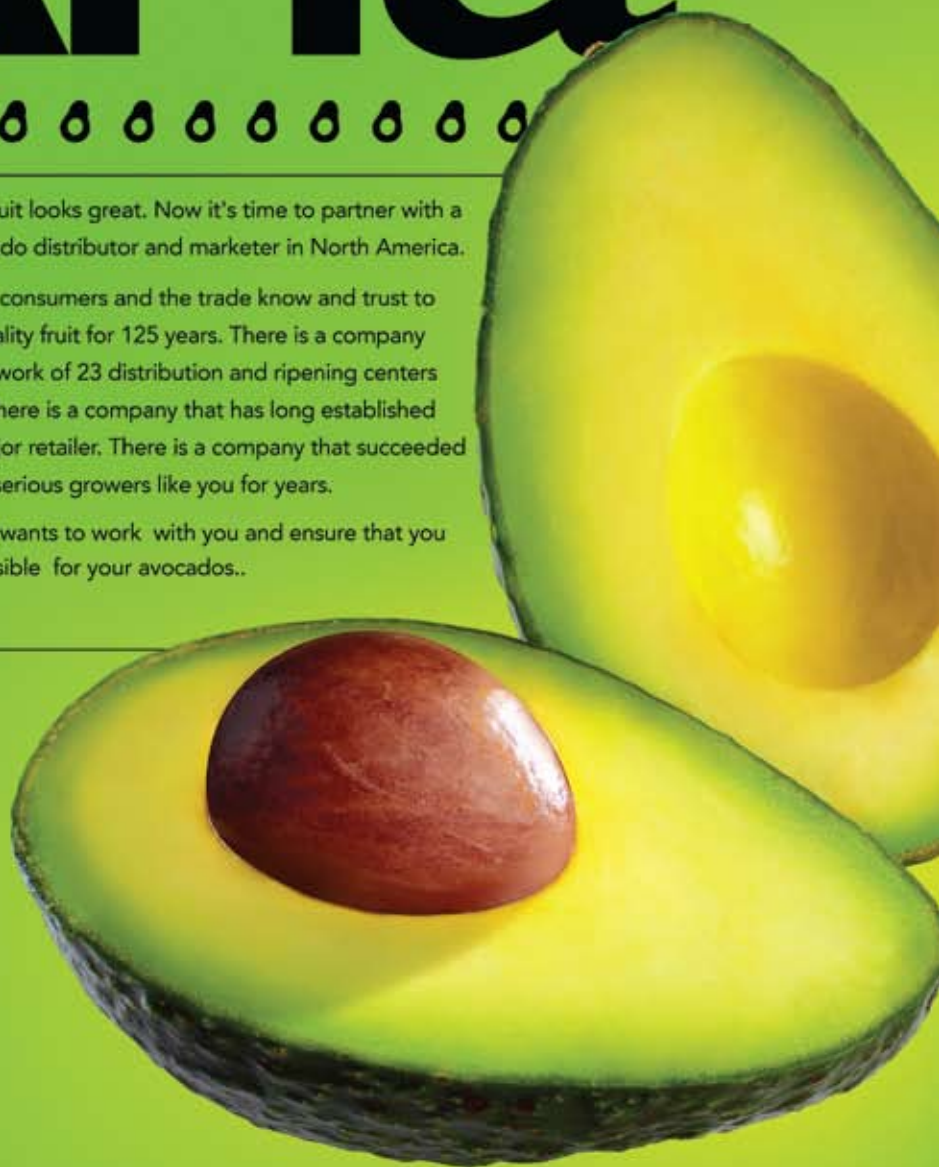
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