



almond facts

NEWS, VIEWS AND INDUSTRY INSIGHT

MARCH-APRIL 2018



Crave
Victoriously

Almond
Blossom Festival

Game-Changing
Innovation

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Blue Diamond, the world's largest processor and marketer of almonds, exports to 90 countries.

Almond Facts, established in 1922, is published bimonthly by *Blue Diamond Growers*, 1802 C Street, Sacramento, California 95811, phone: 916.442.0771. Address all correspondence to the Editor, *Almond Facts*, P.O. Box 1768, Sacramento, California 95812. Advertising subscription rates provided upon request.

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Mark Jansen
President & CEO



A Culture of Innovation: Stepping Out of Our Comfort Zone to Achieve Goals

Spring is upon us! As work continues in the orchards and you assess the progress of the trees after bloom, *Blue Diamond* wants grower-owners to know our thoughts are with you. It was, yet again, another challenging bloom as almond growers did their best to protect orchards from overnight freezing conditions, rain, wind and hail. It is too early to estimate what the impact will be on the 2018 crop, but rest assured the cooperative will continue to do what we can to ensure family farms are sustainable during these uncertain times. I am confident the almond market will remain strong as reports show that global consumption is increasing and shipments are growing consistently.

To keep up with these demands, *Blue Diamond* is thinking big and putting innovation at the forefront. In late February, we launched a new snack nut campaign, *Crave Victoriously*, to inspire consumers to embrace their snack cravings. The campaign comes at a time when snacking has become more prevalent for Americans and we want consumers to know that *Blue Diamond Almonds* has the tastes they crave in a superfood. The new television commercial aired on TV and online in early March and the

campaign can also be seen in point of sale displays throughout retail stores in the U.S.

We also celebrated cravings through flavor discovery with a new branded snack nut line of *Blue Diamond Crafted Gourmet Almonds*. This new product line is the latest example of *Blue Diamond's* dedication to offer consumers your high-quality almonds in four unique flavors that complement gourmet foods like cheese and olives. This is an exciting new genre for *Blue Diamond* as we find new and better ways to deliver the benefits of almonds to the world.

“*Innovation distinguishes between a leader and a follower.*”
—*Steve Jobs*

This innovative approach to our marketing and products allows us to continue leading the way around the globe. In Spain, we are growing and strengthening our brand with an innovative new line of yogurt products.

Closer to home, the *Blue Diamond* team is using an innovative marketing campaign to help highlight and communicate to consumers the benefits of our almondmilk. *Almond Breeze* is targeting specific consumer groups by creating ambassadors for the brand. These ambassadors include key registered dietitian influencers who bring a scientific background to understanding food and nutrition. The ambassadors visited our headquarters in



Sacramento and toured an almond orchard to learn more about *Blue Diamond's* products and processes. I would like to once again thank grower-owner Mike Doherty and his family for hosting the ambassadors at their orchard.

The impact of *Blue Diamond's* marketing is being recognized by more than just customers and consumers, but also fellow industry organizations. At the National Council of Farmers Cooperative's Annual Meeting, I was pleased to see *Blue Diamond Growers* acknowledged for their work over the last year. From our membership newsletter and website to advertising, marketing and social media campaigns, the cooperative is demonstrating

its ability to be a leader in the industry.

Blue Diamond's culture of innovation takes us out of our comfort zone and challenges us to look at what we are doing in different ways. I look forward to how the *Blue Diamond* team and our grower-owners will work together to achieve our shared goals and positively transform the almond market with value-added products. ◆

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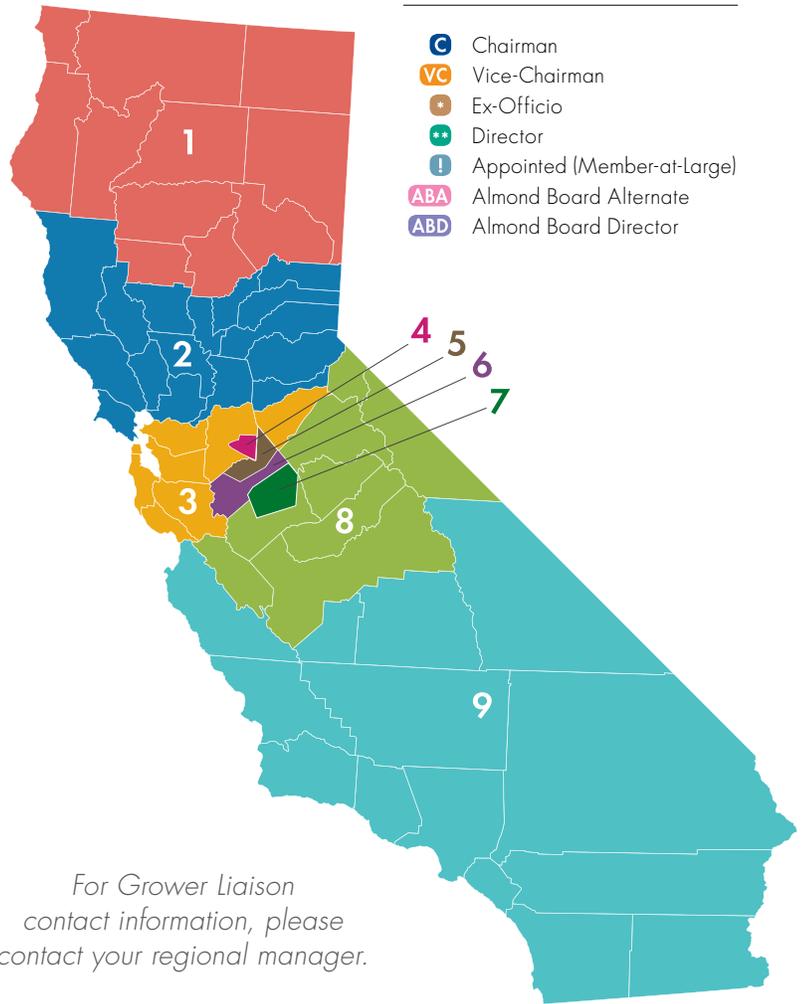
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- VC** Vice-Chairman
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- **** Director
- !** Appointed (Member-at-Large)
- ABA** Almond Board Alternate
- ABD** Almond Board Director



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- Joey Biscay
- Norman Pretzer **!**
- Bruce Chapman
- Gary Thompson
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- Kyle Balakian
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- Craig Fulwyler
- Jeff Parsons
- Gurcharan Dhillon **!** **C**
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- Karam Guron **VC**
- Jason Dhillon
- Ryan Clark **!**
- Kent Stenderup ****** **ABD**
- Clinton Schick *****
- David Snell

Military Dog Care Packages Include *Blue Diamond* Almonds

Blue Diamond helped make a difference in the lives of military working dog (MWD) teams by participating in the 75th anniversary of the nation's formal MWD program with donations of Smokehouse Almonds. The Military Working Dog Team Support Association (MWDTSA) is an all-volunteer nonprofit dedicated to supporting military working dogs and their handlers. Every quarter, MWDTSA sends approximately 200 care packages to MWD teams deployed in conflict zones overseas. Each 12" x 12" x 5" flat rate box includes supplies and treats for both the two- and four-legged service member. "We are grateful to *Blue Diamond* Almonds for the generous donation to our Q1-2018 care packages," said Nikki Rohrig, president of MWDTSA. "Because of organizations like *Blue Diamond*, we are able to fill these boxes with high quality products that handlers love. Thank you for helping us support both ends of the leash." ♦



Photo courtesy of MWDTSA.

Blue Diamond Travels to California Farm Shows

The *Blue Diamond Growers* Lounge made stops at California farm shows, including the Colusa Farm Show and World Ag Expo at the International Agri-Center in Tulare. The farm shows provide team members an opportunity to connect with grower-owners and others in the industry. ♦



Hometown Hero Greta Gerwig Receives *Blue Diamond* Boost

Sacramento native Greta Gerwig's latest directorial project, *Lady Bird*, received five Academy Award nominations, including Best Picture, Best Director, and Best Actress. Gerwig may not have won an Oscar, but the hometown hero was congratulated on her nominations with a box filled with *Blue Diamond* products, including grab-n-go varieties to provide a *Blue Diamond* energy boost. Her movie is a love letter to Sacramento, so *Blue Diamond* wanted to send a love letter right back. ♦



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Co-op Awarded Best Overall Entry for 56th Annual Almond Blossom Parade

Blue Diamond team members embraced this year's theme for the Almond Blossom Festival in Ripon and celebrated the history of the cooperative. The award-winning float was decorated in photos and commemorated milestones of *Blue Diamond Growers*. The team — along with friends and family — walked the parade route and gave spectators an opportunity to taste the goodness of *Blue Diamond* almonds. ♦





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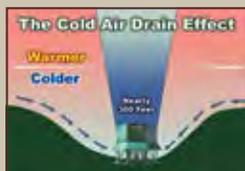
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Blue Diamond Represented in 2018 Almond Leadership Class



The Almond Board of California (ABC) unveiled its 2018 Almond Leadership Program class, selecting Clayton Whitehead, current member of *Blue Diamond's* Young Leader Program, and Micah Keith, *Blue Diamond's* Senior Brand Manager for refrigerated *Almond Breeze*.

Keith and Whitehead will spend the next year in a structured program that will prepare them to become leaders not just within the California Almond industry, but in their communities, as well.



The class will complete specialized training in a wide variety of topic areas, such as food safety, biomass utilization, honey extraction and nutrition research. Over the course of the year, they will have hands-on experiences in nurseries, almond orchards, a U.S. Department of Agriculture (USDA) research facility and other venues. ♦

Above:
Clayton Whitehead

Below:
Micah Keith



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Blueberry Lemon Muffins Recipe

Prep time: 15 minutes

Cook time: 18-20 minutes

Makes 10 muffins

Ingredients

- ½ cup sugar
- ¼ cup *Blue Diamond Almond Breeze* almondmilk
- ¼ cup canola oil
- 1 teaspoon vanilla extract
- 1 teaspoon lemon extract
- 1 teaspoon finely grated lemon zest
- 1 egg + 2 egg whites

- 2 cups *Blue Diamond Almond Flour*
- 2 tablespoons *Blue Diamond* gluten-free flour blend
- 2 teaspoons baking powder
- ¼ teaspoon salt
- ¾ cup fresh or ½ cup frozen, thawed blueberries*
- ¼ cup *Blue Diamond Sliced Natural Almonds* (optional)

Directions

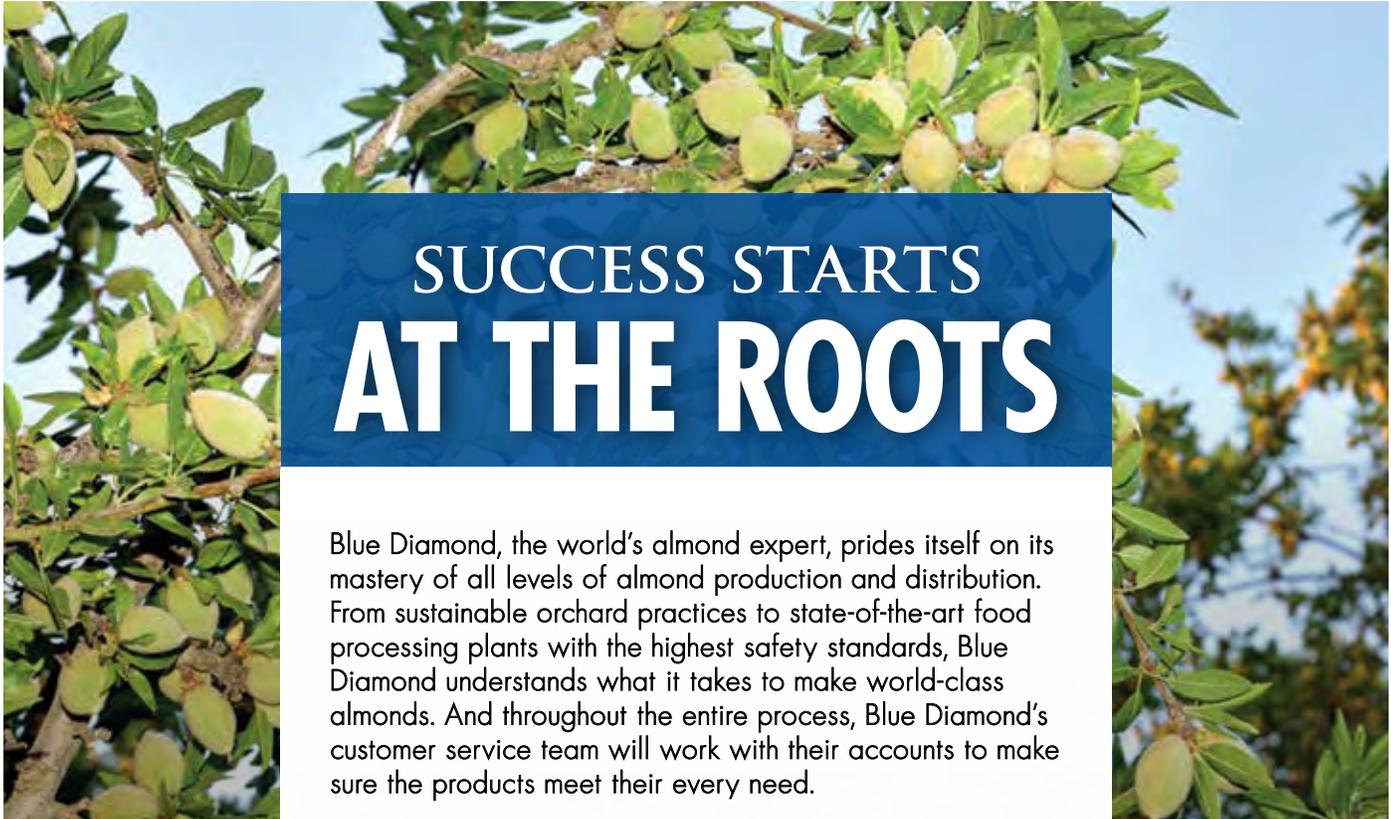
1. Preheat oven to 400°F.
2. Line ten muffin cups with paper liners or lightly butter.
3. Whisk together sugar, almondmilk, oil, vanilla and lemon extracts, lemon zest, eggs and egg whites in a large bowl.
4. Add almond flour, gluten-free flour blend, baking powder and salt, then lightly fold in blueberries. Spoon into prepared cups and sprinkle with *Blue Diamond Sliced Natural Almonds*.
5. Bake for 18 to 20 minutes or until a toothpick inserted into the center comes out clean.

**If using frozen blueberries, make sure to thaw and drain well to remove all excess moisture.*



Gluten-Free Flour Blend

- 2 cups brown rice flour
- 2 cups white rice flour
- 2 cups tapioca flour
- 1 cup corn starch
- ¼ tablespoon xanthan gum



SUCCESS STARTS AT THE ROOTS

Blue Diamond, the world's almond expert, prides itself on its mastery of all levels of almond production and distribution. From sustainable orchard practices to state-of-the-art food processing plants with the highest safety standards, Blue Diamond understands what it takes to make world-class almonds. And throughout the entire process, Blue Diamond's customer service team will work with their accounts to make sure the products meet their every need.

That process begins in an orchard owned by one of Blue Diamond's 3,000+ Grower Owners. Using a depth of farming experience, each Grower Owner integrates proven farming practices with new technologies. To take it a step further, some of these Grower Owners serve on industry committees that assist with the development of university agricultural research programs and orchard management best practices.

Due in part to this dedication, Blue Diamond has pioneered new methods and technologies like integrated pest management, digitized moisture management systems to conserve water, and analytical methods of soil nutrient management.



Global
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Blue Diamond Snack Almonds Inspires Consumers to Crave Victoriously

The launch of a new snack nut campaign, Crave Victoriously, inspires consumers to embrace their snack cravings. The campaign comes at a time when snacking has become more prevalent for Americans than ever. Snacking can bring moments of joy, but can also leave consumers with “snacking guilt” as they struggle with the conflict between whether or not they should eat the snacks they want.

“To crave is human. But they say you’re supposed to deny, control and fight your cravings. At *Blue Diamond*, we think differently,” said Raj Joshi, Senior Vice President of Global Consumer Division for *Blue Diamond*. “With *Blue Diamond* Almonds you can Crave Victoriously. With this campaign we’re putting a stake in the ground for conflicted snackers: ‘Don’t deny your cravings. Eat them.’”

Snackers don’t need to worry about sacrificing taste for a satisfying snack with *Blue Diamond*. The snack nut campaign, which rolled out nationwide in retail stores,

TV and online, hinges on celebrating cravings, flavor discovery, and the realization and revelation that our cravings’ conflicts can actually be a thing of the past.

“Proving to consumers that they can satisfy their snack cravings with our almonds is an important opportunity for our brand, and we’re excited to see the next wave of growth that comes from disrupting the ‘cravings are a bad thing’ mantra and showing consumers that *Blue Diamond* provides the flavors you crave in a superfood,” said Joshi. ♦

“To crave is human. But they say you’re supposed to deny, control and fight your cravings. At *Blue Diamond*, we think differently.”

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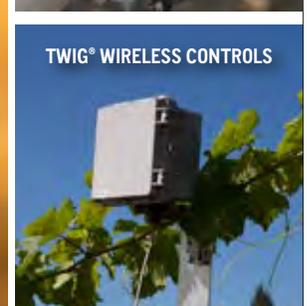
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Almond Breeze Yogurt Alternative Launch in Spain

Two years ago *Almond Breeze* milk alternatives were launched in Spain with our partner Feiraco, a Spanish dairy cooperative based in Northern Spain. Feiraco not only manufactures the products, but sells and distributes to all the key retailers in the country.



The success of the milk alternatives presented an opportunity to expand the *Almond Breeze* brand into new exciting categories where *Blue Diamond* can offer the benefits of almonds — a range of dairy free yogurt alternatives. Feiraco already produced

dairy yogurts for the Spanish market and worked with *Blue Diamond* to develop the *Almond Breeze* brand into the yogurt category. Both cooperatives worked together to produce a range of yogurt alternatives made from *Blue Diamond* almonds.

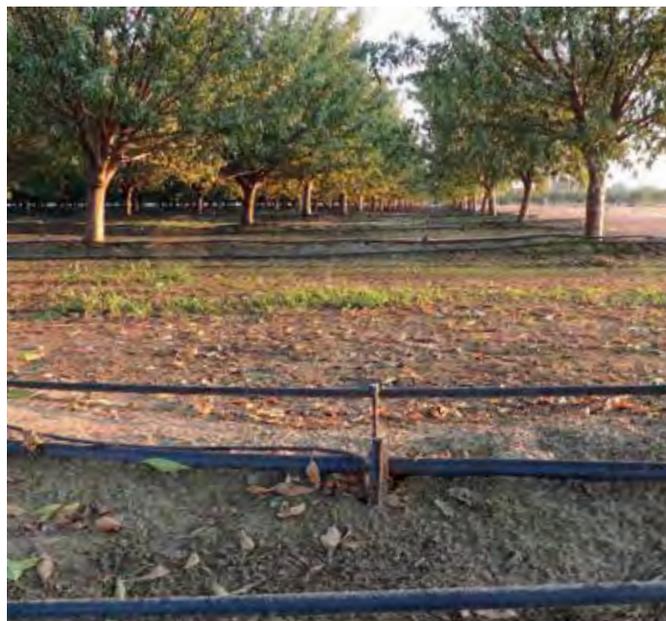
Made using only the finest quality almonds bursting with natural goodness, the yogurt alternative gives consumers a deliciously light and creamy taste with a subtle hint of nuttiness. The product is naturally low in fat, rich in calcium, and a high source of vitamins D, E and B12.



The *Almond Breeze* yogurt alternative is available in three flavors: plain, vanilla and forest fruits. ♦

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Blue Diamond Embraces Entertaining Category with Crafted Gourmet Line of Almonds



Created for any entertaining occasion, the new line of *Blue Diamond Crafted Gourmet Almonds* is the latest example of the cooperative's dedication to offering high quality California-grown almonds that deliver on flavor and taste.

What makes this new line of *Blue Diamond Crafted Gourmet Almonds* unique is the process. First, the almond skins are removed for a smooth texture and nutty crunch. The almonds are then roasted, seasoned, and cured with a blend of herbs and spices to create a rich and savory taste.

Blue Diamond Crafted Gourmet Almonds are available in four unique and trend-worthy flavors, including Pink Himalayan Salt; Black Truffle; Garlic, Herb and Olive Oil; and Rosemary and Sea Salt. The new line complements other gourmet foods like cheese, charcuterie and olives. They can be included in any grazing table creation or enjoyed on their own.



CRAFTED



“From the orchard to the table, special care goes into each bag of *Blue Diamond Crafted Gourmet Almonds*.”

"Gourmet foods are an exciting new genre for *Blue Diamond* and this is an example of our dedication to food innovation," said Raj Joshi, senior vice president of Global Consumer Division for *Blue Diamond*. "We were inspired by foodies and moments of celebration when developing this Gourmet line. People love finding new delicious foods and sharing them with friends and family. We hope this new line becomes a go-to addition for any special occasion, whether it's a dinner party, holiday, book club, or happy hour."

Blue Diamond Crafted Gourmet Almonds are a rich new addition to a *Blue Diamond's* wide range of more than 20 almond flavors.

"With high-quality ingredients, and an elevated new package and overall presentation, this is much more than just a new line of almonds," said Joshi. "From the orchard to the table, special care goes into each bag of *Blue Diamond Crafted Gourmet Almonds*."

Blue Diamond Crafted Gourmet Almonds are being sold at most major retailers and available at the *Blue Diamond Nut and Gift shops*. ♦

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California Gubernatorial Race Offers Opportunity for Almond Industry

The 2018 gubernatorial election will bring big changes to California politics, opening a critical window of opportunity for the almond industry to engage candidates and educate them on the value that our industry brings to the state and local communities. The industry faces several key challenges — on issues ranging from water use to greenhouse gas emissions — and our future could well be shaped by the choice California voters make in November.

After serving a historic four terms in office, Jerry Brown has announced that when his gubernatorial term limit ends this year he will retire from nearly 50 years of public service to live on his family ranch in Colusa County. His tenure will be marked by the willingness and ability to work with both parties in an era of extreme partisan politics. While his support for environmental regulations has created a challenge for agricultural and manufacturing industries, he has also been known as an advocate for farmers, including defending agricultures' use of water during the drought and for appropriating cap and trade funds to assist the FARMER program.

The new governor will have the authority to approve or veto legislative measures and power to act through executive order to direct the agencies that impact us most, like California Air Resources Board, Department of Water Resources, and the Department of Pesticide Regulations to exact regulations that could have a dramatic impact to our industry.

The election will be the state's first under new rules that allow the top two vote-getters, regardless of political party, to advance to a run-off. According to a recent poll by the reputable, nonpartisan Public Policy Institute of California, come the June primary, the top two

contenders to replace Governor Brown will be Gavin Newsom and Antonio Villaraigosa. Both candidates will need voters in the Central Valley. During the Democratic convention in Anaheim, whereby the most progressive in the party attend, no gubernatorial candidate received majority of the vote to win endorsement. However, the vote breakdown was telling that progressives stand with Newsom, as he received 39 percent of the vote, while Villaraigosa received only nine percent.

Newsom, the current Lt. Governor and former Mayor of San Francisco, has positioned himself as a progressive that will work to position California as a world leader on environmental issues. He is the founder of Plumpjack, a wine and hospitality company with ties throughout the Napa Valley. His campaign website asserts that he "will double down on the production of organic and sustainable food, and promote food security, particularly in low-income communities and, disproportionately, communities of color that lack access to healthy choices. It's ironic and bizarre that the San Joaquin Valley grows the food for the nation but poor communities there do not have an adequate supply of their own."

Villaraigosa, a former Assembly Speaker and Mayor of Los Angeles is positioning himself as the moderate Democrat in the race. He has focused his campaign on improving California's economy and business climate, while addressing the growing divide between those thriving in the new California economy and those who have been left behind. Villaraigosa's website outlines his regional approach to governance. "A policy that might make sense in Silicon Valley doesn't necessarily make a difference in Fresno. A regulation that is a small annoyance for a thriving business on the west side of



Los Angeles could be a job killer for an industry in the Inland Empire.”

The possibility of a runoff between two Democrats could potentially strengthen the position of the Central Valley, including the agricultural industry, in a November runoff. While the June primary will focus on messages and issues that resonate with the left, including Single Payer Health Care among others, we can expect a more moderate tone from both candidates in the fall campaign. The Valley may well be a deciding force in a November election, giving our industry an opportunity to put our concerns front and center in the fall campaign.

The Almond Alliance will be providing key updates on the campaign throughout the year. As we head into election season, we must take advantage of this year’s

unique opportunity to flex our political muscle and ensure that California’s next generation of leaders are in tune and sensitive to the key issues impacting the future of our industry, and the California economy. ◆



Andrea York,
Manager of
Government
Affairs,
Almond Alliance

Bringing Game-Changing Innovation to Ag Industry

The rise of innovative technology in agriculture is revolutionizing the farming practices of almond growers. Blue Diamond grower and Young Leader Gary Thompson is helping to bring growers this game-changing technology designed to make their lives better. Recently relocating from Arizona to California, Gary works as marketing director for the world's first and only autonomous orchard sprayer, and is responsible for the machine's website, social media pages, marketing videos, news interviews, and advertisements.



Meet GUSS, the Global Unmanned Spray System. Gary acknowledges that GUSS came about out of necessity and the sprayer's roots can be traced all the way back to 1982 when its innovative founder Dave Crinklaw and father Bob started an agriculture spray business called Crinklaw Farm Services, Inc., known today as CFS LP. Beginning with just two sprayers, driven by Dave and Bob, they averaged about 40 acres a day. After developing the industry's first three and four-row vineyard sprayers, mechanical vineyard pruners, and the Tree-See orchard sprayer, CFS LP now sprays an average of 5,000 acres a day during peak season.

“The ability to run 10 machines monitored by one person will help solve a lot of the labor challenges faced by growers.”

“When we started experiencing a shortage of labor necessary to drive our sprayers and had substantial increases in labor costs, it became apparent to us that we needed to adapt and change in order to thrive in this difficult business environment,” explained Gary.

It wasn't until 2014 that Dave Crinklaw decided technology was advanced enough to begin developing the concept

of GUSS. Gary admits that the autonomous sprayer, designed to drive itself in a very safe and precise matter, went through more than three and a half years of development and testing before it was deemed ready for action.

“The obvious benefit of GUSS is the labor efficiency,” noted Gary.

Here's how GUSS works. The autonomous sprayer moves continuously through the orchard, stopping only to be refilled. Vehicle speed, fan speed and application rates are set precisely into GUSS' software and remain consistent across the entire field. GUSS is equipped with a camera which live streams video to a control van operator.

“We are seeing big improvements in efficiency, accuracy, and safety with GUSS,” said Gary. “GUSS has less down time



than traditional manned equipment and protects employees, the environment and our food.”

The sprayer was introduced to the public in November 2017 and, while GUSS was originally planned for use by CFS LP to provide spraying services to growers all over California and Arizona, according to Gary there’s been a tremendous amount of interest from growers who wish to purchase these machines for their own use.

“Our vision for the future is to have fleets of GUSS sprayers in orchards and vineyards worldwide,” said Gary. ♦



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Migratory Beekeepers Meet the Challenges of the California Almond Bloom

The last few months were busy ones for the Bee Informed Partnership. Many of our Tech Teams provided valuable services to the migrating beekeepers during the logistically complex almond pollination frenzy.

The scale of California's almond production is astounding. According to the most recent census, California produces approximately 2.2 billion pounds of nutritious almond nuts. Commercial almond trees grow on about 1.25 million acres of land — an area equal to the size of the State of Delaware — and in order to produce nuts, almond growers rely heavily on the honey bee to pollinate their orchards. To pollinate the trees, almond growers contract with commercial beekeepers to bring bees.

While almond growers and beekeepers coordinate their efforts, all work at the mercy of Mother Nature, and everything is a tradeoff. Almond trees need enough chilling hours to yield a bountiful harvest; but honey bees, feeding on the leftover stores from the last season and what their keepers' provide, suffer if winter is too harsh. Cool, dry spells can delay the start and duration of the almond bloom; warm spells can move it forward. Too much or too little rain is bad for blossoms and bees alike. Growers and keepers can do little to defend against

Mother Nature but monitor their trees and hives closely and keep their eyes open for signs that help them predict the time of the bloom. Everyone involved waits anxiously for the almond buds to start to swell.

The growers eventually set a date they need the bees in the almond groves, but beekeepers need a few weeks lead time. Northern beekeepers need time to bring their colonies out of wintering yards or sheds for sorting and assessment — these colonies start with little brood but must still be big enough, preferably eight to ten frames of bees to be useful pollinators, a difficult feat in the middle of winter. Southern beekeepers also need to sort and assess their colonies, which are likely already growing and bringing in pollen in their region. Beekeepers across the country need time to work out the logistics of trucking routes, drivers and crews, and to load their colonies onto trucks and trailers for the mechanical migration.

This year's bloom was not without special challenges. The Central Valley in January was warm and dry, which caused the almond buds

to swell early. In anticipation of an early bloom, growers and brokers had beekeepers' phones ringing off the hook. Soon, beekeepers from Washington to Florida hurried their colonies to the Golden State, where other crews met them to unload into multiple drops per orchard (two colonies per acre on average). Then flatbeds fitted with feeding systems started making the rounds to each drop to sustain the bees until the blooms were advanced enough to be a stable source of nutrition.

Once the colonies are in California, the Bee Informed Partnership (BIP) was on site working with beekeepers from across the U.S.



*Almond buds swelling.
Photo credit: Anne Marie Fauvel,
The Bee Informed Partnership*



The BIP Tech Transfer Team Dan Aurell (TX) and Phoebe Koenig (MN) sampling colonies in the almond orchard. Photo Credit: Anne Marie Fauvel, The Bee Informed Partnership



to gather data from representative hives. The pre-bloom and initial bloom period is the BIP Tech Transfer Team's window of opportunity — they follow their beekeepers' colonies into the almond groves to provide valuable services in the form of colony health assessments. This year, BIP Tech Teams from Minnesota, Oregon and Texas met in Turlock, California, and from there were dispatched to sample their many beekeepers' colonies.

In a typical BIP assessment, Tech Teams document the overall condition of the hive and the status of the queen, note the quality of the brood, count the number of frames of bees, look for signs of disease, and test quantitatively for varroa mites. The teams send data and samples back to the BIP lab at the University of Maryland, where other BIP team members work to further analyze the samples and ultimately to prepare detailed reports. These reports help the beekeepers make better colony-management decisions during and after the bloom.

As the bloom progressed this year, temperatures dropped. By this time, however, many beekeepers had gone home, trusting their bees to do the

hard work of pollinating each flower. Yet in the cold, bees are slow to rise in the morning, and their flying time is limited, so they pollinate fewer flowers. If the bloom were to end suddenly, the beekeepers would be called back to feed and potentially retrieve their colonies but only when they are released by the growers.

The retreat is a little less hectic, but time consuming and logistically challenging nevertheless. Northern beekeepers are generally happy to let their colonies linger in their warmer-than-home climate, but Southern beekeepers are typically antsy to get their bees back home to make splits in more clement weather and diverse forage.

In the past few years, some growers have begun planting supplemental cover crops, mustard and radish seeds for example, to provide the visiting bees with a little extra nutrition during their stay in California. This concept could considerably benefit the bees during an extended stay and ease the logistics both before and after the almond bloom, however, it is currently applied on a very small scale compared to the scope of the almond industry. In the future, broader adoption programs

will be dependent on expanded cooperation between beekeepers and growers.

Many crops in the U.S. food system depend on beekeepers and the bees they manage for pollination. Among bee-pollinated crops, however, California almonds are by far the largest and most economically important. The relationship between growers and beekeepers is fragile; without income from almond pollination, many beekeepers may be out of business, and therefore would not be able to provide bees to pollinate other crops. The Bee Informed Partnership is proud to be a valuable resource to beekeepers and almond growers as they work together, and increase their understanding of each other, in a well-choreographed, sometimes frantic, but essential partnership, that leads to the largest production of almonds on Earth. ◆



Anne Marie Fauvel,
Tech Transfer Team Coordinator,
The Bee Informed Partnership

TIME TO CONSIDER

What an interesting winter and early spring. Warmer than normal temperatures in January increased the rate of almond tree development leading to an earlier than expected bloom. This proved to be unfortunate when a cold air mass dropped down from the arctic creating several nights below freezing temperatures leading to crop loss in many orchards. The cold temperatures persisted and then it rained, impacting bee hours and creating disease conditions for the remaining viable flowers. This was all on top of one of the driest years on record. A challenging start to 2018.

It is a common misconception that the tree will compensate for crop loss with an increase in set percentage of the surviving flowers. This is not exactly true. There is some mild compensation due to a slightly higher set percentage of undamaged buds (around two percent or so increase) as well as a gain from increased kernel size due to more energy directed to the embryo during the period of cell division. These two factors, however, are not enough to compensate for flower loss that may have occurred during bloom.

At this time, the impacts of the widespread freeze event and following weather conditions that occurred during bloom should be visible. To farm efficiently in 2018, the crop size should be estimated to determine which orchard operations are needed. This includes the amount of fertilizer, fungicide applications as well as other farm practices. Some farm practices, such as irrigation, will have to be maintained regardless of crop status to have a productive orchard for 2019.

Spring-time Nitrogen Management

Fertilization will be most impacted by reduced crop loads. New nitrogen regulations require a crop estimate to determine the seasonal amount of nitrogen to apply. Crop removal studies have indicated that around 65 pounds of nitrogen are removed with every 1,000 kernel pounds of harvest. Considering nitrogen application inefficiencies, 85 pounds of nitrogen must be applied to replace the removed amount. Further research has

indicated that multiple applications of nitrogen should be made through the season with 80 percent of the total budget being applied prior to kernel fill and the remaining 20 percent applied in the postharvest period.

The rate of spring fertilizer applications should be split to reduce the potential of plant toxicity and leaching from spring rains or over-irrigation. In coarser or soils with lower water holding capacities, smaller, more frequent applications should be applied. Young trees are more sensitive to toxicity. Rates for each application should be reduced to levels that are equal to one ounce of actual nitrogen per tree for newly established trees, and two ounces of actual nitrogen per tree for years two and three after establishment. Multiple applications may occur through the season to hit the targeted nitrogen budget.

Irrigation timing/Saturated Soils

In many operations, water is over-applied in the spring. This is due to the occurrence of rains, variable ranges of wetted soil profiles, weather conditions, and general lack of understanding of how much water trees utilize at this period. Prior to the first irrigation, it is best to make sure the soil profile is beginning to dry before applying water. This can be determined with the use of a shovel or auger, pressure chamber, or soil moisture sensors. If using the pressure chamber, irrigation should be considered if trees are 1.5-2 bars more negative than baseline. As an example, for the past three years (2015–2017) in a local research plot of mature Butte and Padre trees in a very sandy soil,

we applied the first irrigation the fourth week of April when stem water potential readings reached 1.5 bars more negative than baseline. By that time, the neighboring blocks were irrigated three times. We estimated that the grower saved \$15 per acre in a reduction in pump and water costs. The late rains of 2016 provided the water needed by the trees. Although this is not typical of every year, it illustrates the point of monitoring tree or soil water status in determining when to irrigate.

Over-irrigation in the spring can negatively impact tree performance. Annually, several calls regarding poor tree growth and "pale trees" are received. This is often due to saturated soils. Too wet of soils reduces the movement of oxygen into the soil, killing fine feeder roots. This impacts the ability for the tree to uptake water and nutrients, leading to micro-nutrient deficiencies, impacting nut set and tree growth. Later-season effects are also observed and include a limited rootzone, leading to severe water stress during hull-split and harvest. The problem is often compounded by fertigation or chemigation in attempts to manage the symptoms.

Pest and Disease Considerations for March/April

Disease concerns tend to run high in the spring as rains may provide environmental conditions conducive for infection. Sprays for shot-hole, anthracnose, jacket rot, and bacterial spot should be based on rainfall events. Summer diseases of rust and scab, however, may still be problematic and may require a treatment even in dry spring conditions. Treatment timings for scab is two to five weeks post petal fall, and five weeks post petal fall or later for rust. Anthracnose and bacterial spot proliferate in warm, rainy weather and may require multiple treatments prior to rainfall events. Bacterial spot treatments involve copper and mancozeb treatments and should be considered in orchards that have a history of disease. Please discuss the usage of copper with your PCA or Farm Advisor as almonds are sensitive to this element. Orchard history, cultivar, and irrigation systems should be factors in



Almond varieties that form large clusters of nuts are more prone to jacket rot. The fungi that cause jacket rot are problematic in wet years. The initial infection occurs on the dying jacket tissues which then moves to the healthy almond hull. FRAC 3 and FRAC 11 fungicides are not very effective in controlling jacket rot.

determining the need for treatment. More information can be found at the UCIPM website or in the January/February Time to Consider column.

Insect concerns include San Jose Scale (SJS), Peach Twig Borer (PTB), and Leaf-footed Plant Bug (LPB). With the warmer spring, male emergence for SJS and the biofix for PTB may be earlier. Therefore, the traditional "May Spray" timing may also be earlier. Timing of a growth regulator for SJS control should be 400 DD after the male flight. A spring treatment for PTB should be made 400-500 DD after the biofix. Keep in mind that the PTB timing often overlaps with the spring flight of NOW. If timed properly, this spray could provide early season control for both pests.

Keep an eye out for LPB. These bugs are difficult to kill, and damage is erratic and hard to predict. Research does suggest that over-wintering populations are reduced by below freezing temperatures. In years with mild winters, such as this past year, populations tend to be higher. Sprays should be timed once adults are first detected, not once damage occurs. Try to identify an area in which the insects have aggregated. Once they disperse, be on the lookout for the LPB in the orchard. Damaged nuts do not show symptoms for several days to weeks after initial feeding.

Please keep in mind that there are more pests that affect almonds during this time period. More information can be found at ucipm.ucdavis.edu.



Clear gumming exuding from the hull of the almond may indicate feeding by leaf footed plant bug. If scraped away, a small hole should be visible piercing through the hull into the developing kernel.

Weed Control

Over the past several years, however, we have seen an increase in summer emerging weeds that are either glyphosate-resistant or are variably controlled with this herbicide (e.g. lambsquarter, threespike goosegrass, and junglerice). If present, try alternative broadspectrum "burn-down" products such as glufosinate or paraquat. Alternatively, a "two shot" pre-emergent program could also be considered to stretch residual weed control into the summer. If a spring applied pre-emergent product is used, it must be applied when there is enough rain or irrigation to aid in its incorporation. This may mean that it is applied with the last rains of the spring or in micro-sprinkler or solid-set irrigation systems. The highest label rate may not be needed to provide effective control at this time of year which may help reduce costs. More information can be found on the IPM page under weed management.

Be careful with post-emergent herbicide spray applications. Winds tend to be variable in the spring which makes it difficult to apply material in a timely fashion. Calibrate equipment, check nozzle orientation

and overlaps, and replace nozzles as needed to help maintain proper spray particle size to maximize coverage and minimize drift. Utilize surfactants, water conditioners, and drift control agents to increase efficacy. Be cautious when spraying around young trees as some herbicides can cause damage. Generally, I suggest that spring herbicide applications be made before cartons are removed from two year old trees.

Irrigation System Maintenance

Within five years, most irrigation systems are not distributing water to the standards in which they were designed. This loss of distribution uniformity can be due to many issues, but generally is a result of poor maintenance. Micro-systems should be evaluated and tuned-up in the spring before the water use increases in the summer. This usually involved performing many maintenance practices regularly. Check out the website <http://micromaintain.ucanr.edu/> for more information.

Final Thought

Operations that are successful in achieving consistent, high yields are spending about 60 to 80 percent of their effort in managing their irrigation system and applications. This includes taking soil, weather, and water quality variability into account when irrigating. If yields aren't at levels that you are expecting, spend time reviewing your irrigation schedule, soil types, and system performance. Make sure that the proper amount of water is being applied for the time of the year. Perform the needed maintenance to make sure the highest distribution uniformity possible and utilize the various soil amendments to maintain rates of water infiltration. ◆



David Doll,
UCCE Nut Crop
Pomology Advisor

The Results Speak for Themselves.

“Shasta® has incredible production! It is a well-sealed nut with low worm damage. I like the idea that it might not need as many bees and it shakes easy.”

Seth Merritt, Pixley.
Currently farms Shasta®.



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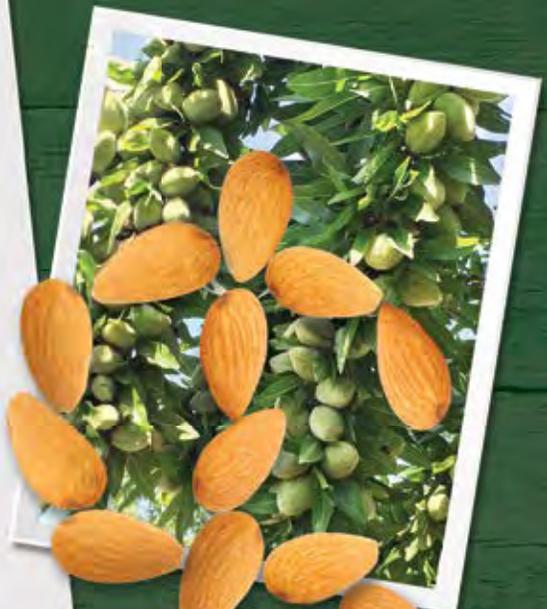
BA2 var.(PP#28,466)

self-fertile almond Test Block Trial Data*

6th leaf — 110 trees/ac,	2760 lbs/ac
6th leaf — 140 trees/ac,	3515 lbs/ac
6th leaf — 135 trees/ac,	3694 lbs/ac
5th leaf — 110 trees/ac,	2500 lbs/ac
5th leaf — 140 trees/ac,	3055 lbs/ac
4th leaf — 110 trees/ac,	2332 lbs/ac
4th leaf — 135 trees/ac,	2177 lbs/ac
3rd leaf — 110 trees/ac,	1132 lbs/ac

*Production figures do not guarantee individual results

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Taking Control of Botryosphaeria in California Walnut Orchards

Botryosphaeria are a group of fungal pathogens that have been well-known for decades in the California pistachio industry, with initial discovery in 1984 and significant production loss to the disease in the late 1990s. However, Bot pathogens have emerged as a growing challenge to walnut tree health and yields in California in the past three to four years. In walnuts, Bot can easily spread from tree to tree by wind or water, and spores germinate with a quarter-inch of rain or as little as 90 minutes of exposure to water.

The disease has a multi-season impact on orchards. Bot infects and damages the current year’s fruit, and also the fruit wood that will produce fruit the following year.

“In some mature walnut orchards, **we’ve seen yield declines of 25 percent or more in the first year**, with additional declines the second year and potentially devastating impacts to the health of trees in the orchard,” said Chuck Gullord, a technical sales representative for Bayer.

Botryosphaeria spores germinate and enter the tree through existing wounds or scars, such as those from pruning, leaf and fruit drop or bud scars. Research conducted by the University of California in 2014 found that untreated wounds can be susceptible to infection from Bot fungi for extended periods. For example, pruning wounds in medium to large branches can be **infected for at least four months** after the pruning cut is made.

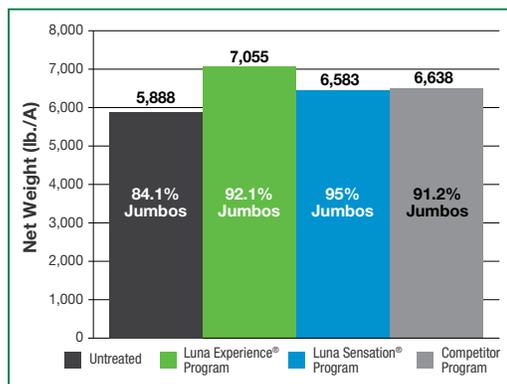
*“Walnut trees with scale infestations are **60 to 70 percent more** prone to Bot infection.”*

Chemical control programs are highly effective in controlling Bot fungi as well as scale and other damaging insects that allow disease to spread.

While walnut scale damage has historically not been considered a significant economic threat to walnut production, the lesions on trunks and old branches caused by scale are a key entry point for Bot infection. Walnut trees with scale infestations are **60 to 70 percent more prone to Bot infection.**

Bayer provides several solutions for walnut growers. Luna Sensation® and Luna Experience® fungicides are highly effective in controlling Bot fungi, and Movento® insecticide provides effective control of scale and other major insects and mite pests.

Identification of Bot infection in walnut trees can be difficult compared to identifying the disease in pistachio and other trees, because other diseases such as Walnut blight show similar symptoms. The symptoms can also be confused with frost damage or winterkill in some circumstances.



Yield (lb./A) and percent jumbos in a university/grower large plot trial at Modesto, CA, 2014. Andy Alderson (Modesto Junior College) and Dr. Themis Michailides. Tulare variety, planted 2004. Applications on 4/16, 5/15, 6/25, 7/25 and 10/30. Harvest on 9/29. Plots: 11 rows, 2 rows harvested per plot.

In addition, walnut trees in a university/grower large plot trial treated with Luna Experience® and Luna Sensation® programs delivered 1,167 and 695 pounds per acre of increased walnut yields compared to untreated controls.

IMPORTANT: This bulletin is not intended to provide adequate information for use of these products. Read the label before using these products. Observe all label directions and precautions while using these products.



NEMATODES: ROOT HEALTH & TREE LONGEVITY THREAT

| GROWERS CAN'T SEE |

UNSEEN BUT FIERCE ON ROOT HEALTH

Nematodes, microscopic roundworms barely visible to the naked eye, pose a serious problem for walnut and almond growers. Even with proper sanitation and fumigation practices, nematodes can still become an issue after setting new trees. Nematode populations can build up in the soil, attack tree roots and impact overall tree health.

NEMATODE THREATS TO ORCHARD HEALTH AND LONGEVITY



ROOT
DAMAGE



REDUCED
WATER &
NUTRIENT
UPTAKE



LOW TREE
VIGOR



DISEASE
TRANSMISSION



-345 Lb./A
REDUCED
CROP YIELD¹



A NEMATODE-CAUSED
TREE DEATH CAN CREATE

25 YRS
OF YIELD LOSS
IN YOUNG TREES

BEST PRACTICES FOR TREATING NEMATODES³

1. Sample for nematodes to determine the presence, species and number of nematodes through an experienced lab.
2. If possible, fumigate the soil prior to planting new trees. This will reduce the number of nematodes initially, but will offer only a temporary solution.
3. Applications of Movento[®] in established orchards resulted in a reduction of nematode populations. Movento does offer a nematode management tool that can easily be incorporated into a tree nut grower's cultural practices.



RESEARCH SHOWS

Applications of Movento[®] in established orchards helped result in:



SUPPRESSION OF
RING NEMATODES

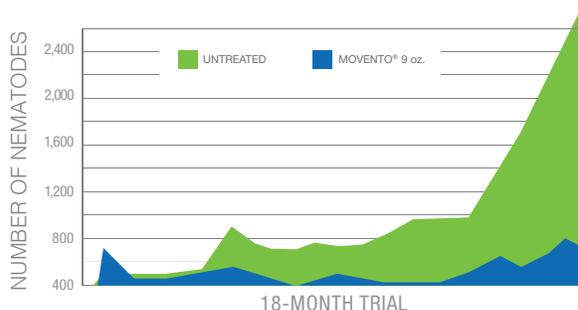


SUPPRESSION OF
ROOT LESION NEMATODES

Trial conducted by Gary Braness, Bayer CropScience, Kerman, CA, 2009–2011.

Two-year trials show

MOVENTO[®] SUPPRESSES RING NEMATODES BY 85%



Ring nematodes/500g sample in almonds (2009–2011)
(Butte & Padre pooled, n=24 trees)

Trial conducted by Gary Braness, Bayer CropScience, Kerman, CA.

EXPERTS SAY

“Established orchards saw better yield where Movento[®] was used to treat for high nematode pressure. The tree has a lot of vigor and doesn't stress as bad.”

According to Tim Weststeyn, a pest control advisor (PCA) with Crop Production Services in Vernalis, CA. He consults on 4,000 to 5,000 acres of tree nuts and is in his third year of treating established almond trees with Movento for nematode management.⁴

¹Average yield loss in lbs. per acre is based on *California Agricultural Statistics Review*, 2014–2015. California Department of Food and Agriculture.

²Nematodes: A Threat to Sustainability of Agriculture,” Satyandra Singh, Bijendra Singh and A.P. Singh.

³University of California – Cooperative Extension. Department of Agriculture and Resource Economics. UC Davis, 2012.

⁴“The Dangers of Nematodes,” *Growing Produce* – 2012.

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MOVENTO[®]



Moving Up the Irrigation Continuum to Move the Industry Ahead: A Water Use Efficiency Q&A with Spencer Cooper

Irrigation management is dynamic and ever-changing, both by nature of each season's varying weather patterns and the evolution of technologies to improve its efficiency. Irrigation management is unique to each farm and every stage of an almond tree's development. And, there is always room for improvement.

If anyone's committed to improving water use efficiency, it's California almond growers, who are some of the most innovative in the industry. Thanks to the adoption of practices like microirrigation and demand-based irrigation, California almond growers have reduced the amount of water needed to grow a pound of almonds by 33 percent over the past 20 years. It doesn't stop there. Almond Board of California (ABC), in partnership with respected experts at the University of California Division of Agriculture and Natural Resources Cooperative Extension, has rolled out the Almond Irrigation Improvement Continuum, a comprehensive manual of irrigation management and scheduling practices that meet growers at every stage of irrigation efficiency to improve their 'crop per drop.'



To take a deeper dive into the Continuum, and get the scoop on other irrigation-related issues, we sat in for a chat with Spencer Cooper, Senior Manager of Irrigation and Water Efficiency at Almond Board of California.

Q: Can you provide an overview of the Almond

Irrigation Improvement Continuum and the purpose it serves for growers?

SC: The Continuum looks at all five aspects of irrigation management:

1. Measuring irrigation system performance and efficiency
2. Estimating orchard water requirements based on evapotranspiration
3. Determining the water applied
4. Evaluating the soil moisture
5. Evaluating plant water status

The Continuum is broken up into three proficiency levels — 1.0, 2.0 and 3.0. Level 1.0 is focused on the fundamentals and foundation of irrigation scheduling and outlines the irrigation management practices within reach for all California almond growers. As growers move up the Continuum, it progresses into more technical operations regarding irrigation management and almond production. The Continuum was developed in a way that can really bring a grower along the journey through irrigation management.

Q: What are the main differences in irrigation management practices as one moves up the Continuum?

SC: The biggest change you'll see when moving up the Continuum is in the frequency of monitoring and measurement. For example, if you're looking at soil moisture, in level 1.0, you may be using the hand-feel method monthly with a shovel or auger to determine soil moisture, whereas in levels 2.0 or 3.0, you'd be using sensors to provide weekly or daily updates, which allows for real-time monitoring. In the applied water section, level 1.0 is all about understanding the system-designed application rate, and levels 2.0 and 3.0 involve



incorporating flow meters and back-calculating the information against orchard water requirements to offer a more accurate reading for water use efficiency levels.

There is a quote that goes, “you can’t manage what you don’t measure,” and that’s really where it starts in this case and is the big step in moving up the Continuum. When growers understand and embrace level 1.0, they quickly move up to 2.0 and 3.0 because, as you’ve gone through the Continuum, the change is in the frequency in gathering data versus the implementation of new practices.

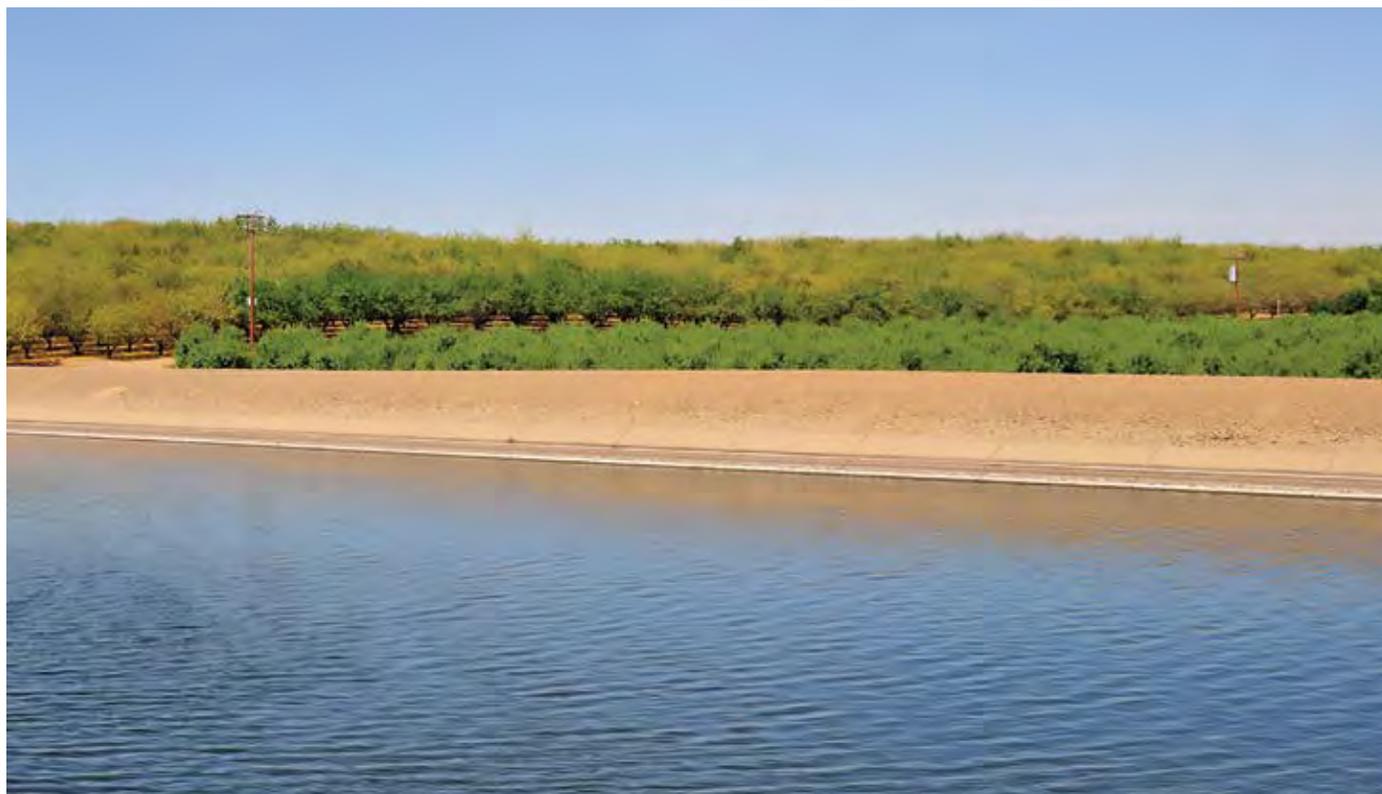
Q: What is the best way to determine when irrigation should begin in the springtime? What tools are available to help growers make this decision?

SC: There are a few different ways to help determine when irrigation should begin. Keep in mind, this also varies for every grower based on where they are in the Continuum. To begin, use weather data and look at effective rainfall and evapotranspiration rates to

calculate your soil moisture level (this would be more of a level 1.0 method). Alternatively, a more advanced method would be using a pressure chamber to determine plant water status, and then matching the data against defined thresholds to determine when irrigation should begin.

Q: What would you recommend is the best irrigation technology investment for a grower?

SC: The number one tool is a flow meter. This is the first big step in being able to measure and understand how much water is applied to the orchard. From there, the next best investment is in understanding set duration, which allows growers to not only see how much water was applied, but how long it took to apply that water. Unexpected events can occur at any time for an irrigation system, so having a monitoring system in place with sensors can help identify and provide alerts on a variety of issues. Beyond that point, it’s not really one technology or the other but one then the other. Irrigation system performance is key and something you should consider throughout the year.



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Q: What if you have different soil types on a single almond orchard? How can irrigation be controlled to be most effective in all cases?

SC: In an ideal world, your irrigation systems are designed for soil type because different soils have different water holding capacity. If there are different soil types in a single orchard, growers have to manage to the majority and, in these cases, irrigation management becomes a judgement call. The pressure chamber tool would be useful in this scenario because it can test the trees in different areas and see how well-irrigated each section was.

Q: How much can water use efficiency be improved by moving up the Continuum?

SC: Improvement in water use efficiency is site-specific. I've worked with growers who have seen massive improvements and others that have seen more minor changes. However, by advancing within the Continuum, growers may see benefits outside of their irrigation management. There are so many other variables that can be impacted when water management is improved. For example, improvements could be gained in enhancing overall tree health.

Q: Is there a return on investment from implementing new irrigation technology on an orchard? Will there be savings in the long run?

SC: Many of the growers I've met have seen a positive return on investment in new irrigation technology. There are so many different variables to consider, and when water use efficiency is improved, there are savings across a range of orchard functions. For example, in the springtime, there is a tendency to irrigate too early, but, by investing and utilizing a pressure chamber — which allows you to better monitor tree stress — there's potential to hold off on irrigation longer than originally anticipated. This trickles down to an overall savings on irrigation costs for the season. Savings can also come in other forms, such

as more efficient use of fertilizer from having more control of the wetted front. As growers move up the Continuum, a lot more data is acquired, which can help to pinpoint particular strengths or weaknesses of the season. This, in turn, helps to determine the best pathway forward.

Q: What do you find to be the thing growers struggle with most when it comes to irrigation management practices?

SC: Successful implementation of irrigation technology. Most growers understand that there is value in the data but they may not know where to begin or which technology is best for their farm.



Q: Why should an almond grower complete the Irrigation Management Module in the California Almond Sustainability Program (CASP)?

What's the value, and how does it feed into your work in prescribing best practices to growers?

SC: The benefits of completing the CASP irrigation module have both an individual impact for each farm, and one that impacts the greater California Almond industry. Filling out the Irrigation Assessment allows a grower to benchmark their current irrigation management practices, and it also allows a grower to take a step back and look at their operation from the 30,000-foot level. Every grower is going to see value at a different point in the process. For example, the question about evaluating application rate is important, because over time your emitters or sprinklers can wear causing the application rate to change. A 10th of an inch extra during each irrigation event during the season can add up quickly, resulting in increased costs.

On the other hand, CASP provides an outlet for the industry to share its story. The data gathered through self-assessments provides statistically significant information to help consumers, buyers and food companies better understand the responsible practices used to put almonds

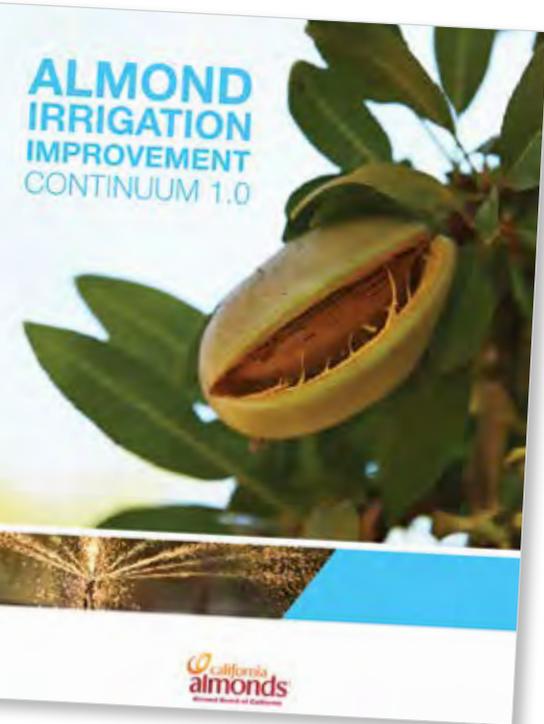
on their tables.

Nearly a quarter of California's productive almond acreage has been assessed to date.

Q: Where can I go to get started?

SC: The Almond Irrigation Improvement Continuum 1.0, which outlines irrigation management practices within reach for all California almond growers is available at Almonds.com/irrigation. The full manual is coming soon and includes the progression to 2.0 and 3.0.

To schedule an in-the-orchard visit or phone consultation for system-specific recommendations, email Spencer Cooper at scooper@almondboard.com. ♦



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