Power in Partnership

BLUE DIAMOND GROWERS

almond facts

NEWS, VIEWS, AND INDUSTRY INSIGHT

MAY– JUNE 2021

A Legacy of Sustainability

Blue Diamond Grower, Paul Danbom shares his secrets on sustainably caring for his diverse dairy, almond, and corn farm.

Meet Dr. Dan Sonke, *Blue Diamond*'s New Director of Sustainability

NEW! Tasty Little Cup™ and Baking Mixes Hit Grocery Stores

IPM Methods for NOW Treatment

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Features

ON THE COVER:
The Danbom Family, from left to right. Back row: Collin, Taryn, Paul. Front row: Lauren and Kylie.

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Blue Diamond, the world's largest processor and marketer of almonds, exports to over 100 countries.

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[1] Profit increase based on 2017 almond price/lb. and average yield/bearing acres with 8.3% increase in yield versus untreated over three-year trial, per trial data of five locations with a single application of Velum One at 6.5 or 6.85 fl. oz./A.

[2] Velum One applied at 6.5 oz./A, spring 2017, via drip irrigation. Trees planted in January 2017. Increase in green canopy pixels based on an average of two rows of untreated trees compared to an average of two rows of Velum One-treated trees.

PRESIDENT'S CORNER

Mark Jansen
President & CEO

In all areas of our cooperative, this past year has been marked by agility and perseverance.

From the co-op's point of view, one of our biggest challenges in managing through the crop was ensuring we had the capacity, resources, and markets to sell the almonds entrusted to us by our growers. I've shared that, last August, we launched an internal team member rallying cry "Rising to the Challenge: The Big Wave" to maintain a focus on meeting those challenges.

In line with that momentum, I am pleased to report that market demand for the 2020 crop so far has exceeded expectations, with shipments tracking to 2.8 billion pounds. For reference, crop shipments in 2019 were less than 2.4 billion pounds. What's more, our carryover inventory is expected to dip below 700 million pounds which positions us well as we start planning to receive the 2021 crop.

The latest NASS Subjective Forecast estimates another unprecedented crop in 2021 — 3.2 billion pounds. While industry plantings have been increasing, from a bearing acreage of 1.242 million acres in 2020 to an estimated 1.330 million acres in 2021, the yield predicted in the Subjective Forecast, 2,410 pounds per acre, represents the third highest yield in the history of the California almond industry. This seems unlikely. The expectation that the almond trees will need to rest after last year's record crop has led the industry to largely coalesce around a lower estimate.

Governor Newsom has issued drought emergency declarations for most of California's counties, a distinction that helps facilitate private water transfers. It's refreshing to see that this drought conversation around water is not focused solely on agricultural usage which tends to position farmers negatively in the media. Regardless, we anticipate water stress on trees to impact yields.

Another drought highlights the importance of demonstrating and communicating that *Blue Diamond* almond growers are excellent stewards of the environment. In particular, I'm encouraged to see increasing participation in the California Almond Sustainability Program (CASP). Member enrollment has increased by over 250% since we introduced the Grower Incentive Program in December, translating into more than a 450% increase in acreage now included in CASP. It's fantastic that we are increasingly able to quantify our already strong grower story on sustainability.

With the COVID-19 pandemic, vast global shipping challenges, and the record-sized crop, I'm proud that *Blue Diamond* met key performance goals with no significant disruptions in operations. Our mission as a co-op has always been to maximize returns to our grower families to help them sustain their farms and preserve their legacies. As I reinforced during our recent Grower Liaison Committee (GLC) meetings, once again, we expect to finish the 2020 crop payments with a significant competitive advantage.

We recently kicked off planning efforts for the 2021 Annual Growers meeting. At this point in time, we are planning to return to an in-person format for this year's meeting on November 17, 2021. We will include a virtual/online component as well for those who aren't able to join us in person. More details on the exact timing and agenda will be provided as arrangements are solidified. Personally, I am very much looking forward to the opportunity to see many of our growers and industry partners in person.

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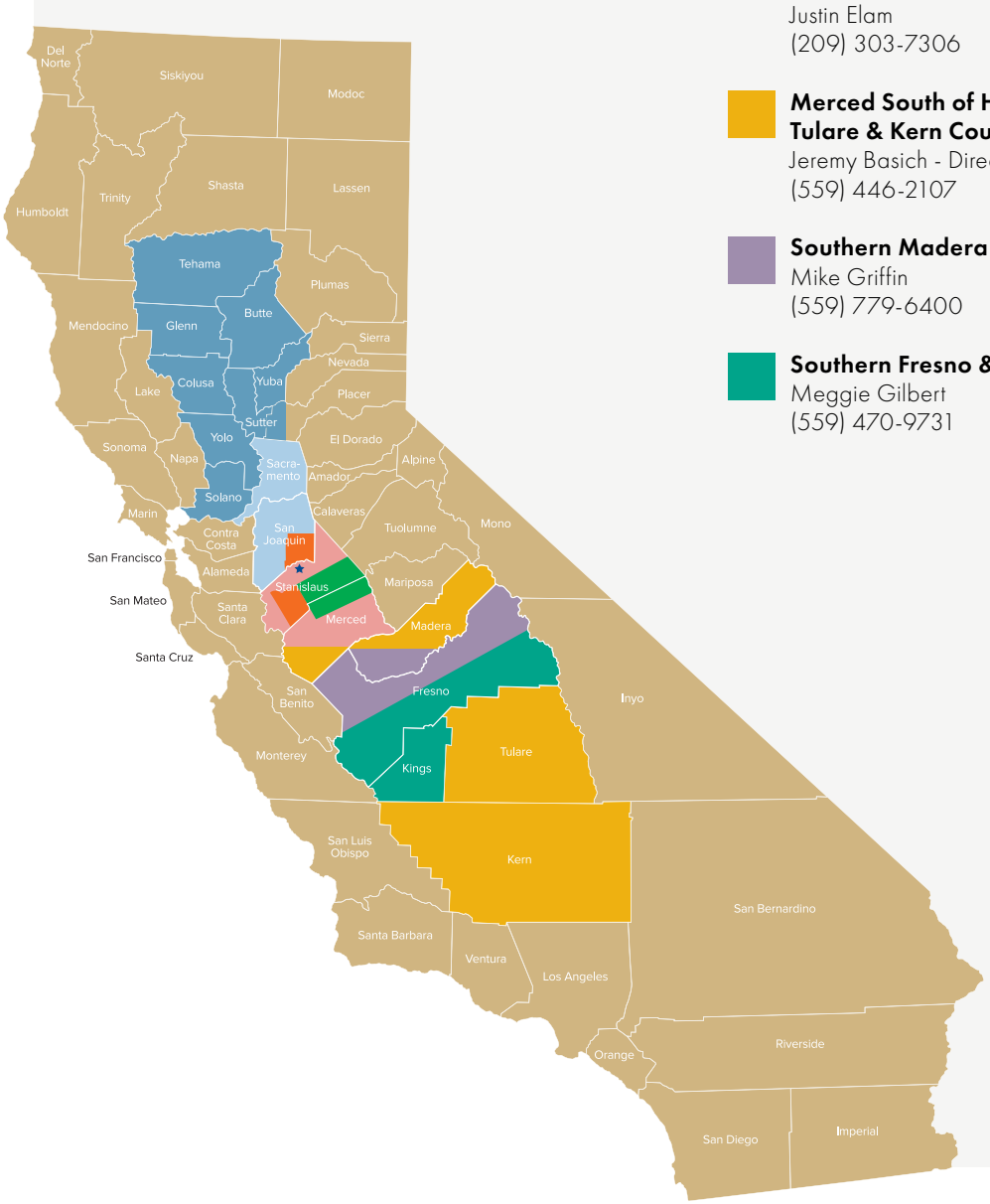

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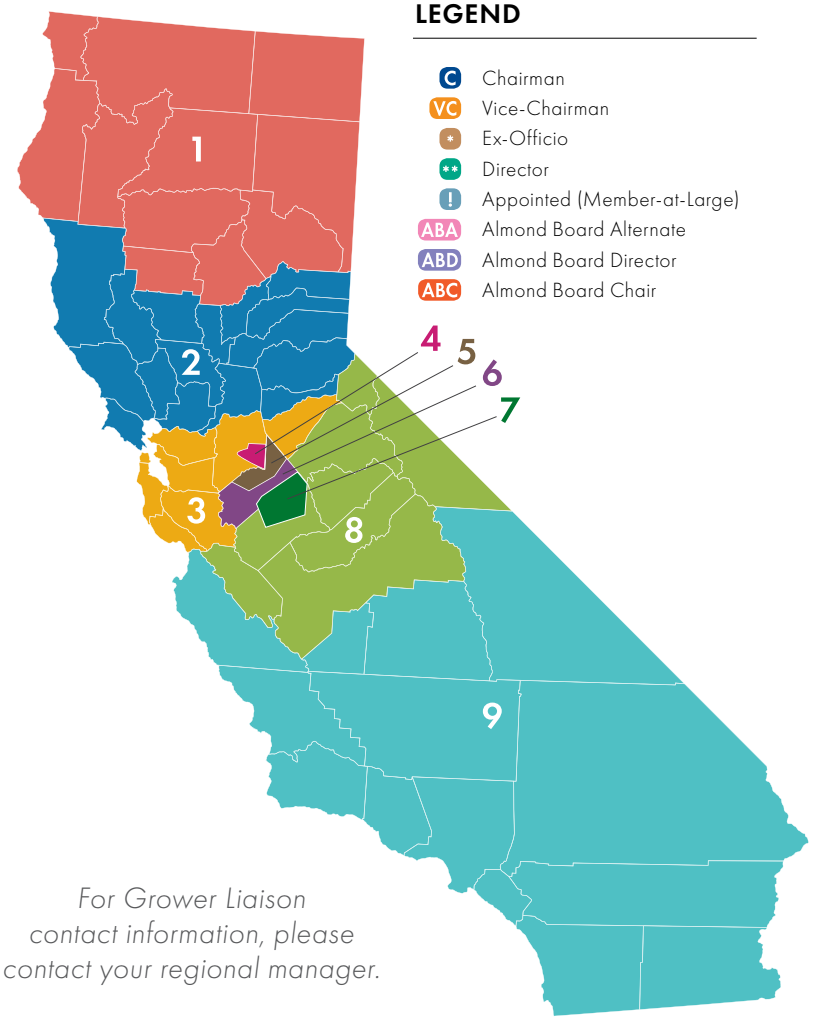

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For Grower Liaison contact information, please contact your regional manager.

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Clinton Shick (*)
Karamjit Jhandi (!)

Introduction of Dr. Dan Sonke, Sustainability Director

In April, Dr. Dan Sonke joined Blue Diamond as Director of Sustainability. Dan's family represents three generations of Blue Diamond almond growers in the Ripon area of California and he brings a wealth of experience and expertise in Sustainable Agriculture. Dan recently shared a bit of this background.

Tell us a little about your background and your family's legacy in almonds.

My family started out as dairy farmers. My mother's father got out of dairy and started growing almonds in the Ripon area around 1957. That's the house I grew up in — the same one my mother grew up in. That orchard is still in the extended family and my parents are still BDG members. We have three proud generations of *Blue Diamond* membership in our family.

Any favorite memories of growing up on a farm?

When I was about seven years old, my parents became *Blue Diamond* growers in partnership with an uncle. We were not only growers, but hullers as well.

As a kid, my brother and I would ride in the trucks from the huller to deliver our nuts to the *Blue Diamond* facility in Salida. In fact, growing up, the word "Salida" to me meant the *Blue Diamond* facility. I didn't know it was an actual town until much later in life. Every time we visited Salida, we would get lollipops from the receiving manager and be handed brooms to help sweep the nuts into the pit. It's a great memory for me. Then when I turned 16 and got my license, I got to drive trucks myself to Salida.

Blue Diamond Growers' new Director of Sustainability, Dr. Daniel Sonke.

When I first joined *Blue Diamond* in April and toured the Salida facility, I met Tim Fitzgerald, who has been in Receiving 43 years. As we talked, he told me, "If you were a kid and were handed a broom here, it was probably from me." I think it's fantastic that we have employees who have been with us that long and have made an impact on generations of kids like me.

How did you wind up in the Sustainability field?

I went to college at Dordt University in Iowa and majored in Environmental Studies. After college, I moved to Florida and worked in international agriculture and got my Doctorate in Integrated Pest Management (IPM) from University of Florida, worked with the statewide IPM program at the university and got connected with sustainability leaders around the nation which eventually brought me back to California.

I started working as a consultant developing sustainable agriculture programs for a large number of crops. The company I worked for successfully petitioned the Almond Board of California to fund what is now California's Almond Sustainability Program (CASP). I was the lead employee consultant who helped develop CASP along with Mel Machado and other BDG member relations staff and growers who were active on committees and in pilot workshops for the program. *Blue Diamond* was certainly a driver of CASP from the beginning.

What led you to *Blue Diamond Growers*?

Given my background and family legacy, I always wanted to come work for *Blue Diamond* and focus on sustainability. When I started hearing that *Blue Diamond* had a CASP incentive plan that was having a dramatic effect on building involvement in the program, it made me even more excited to join the team.

Blue Diamond has a great start to the Sustainability journey and I'm excited to build upon what's already been accomplished. It all starts with the story of our co-op. Our growers might be surprised to learn how much economic stability for farmers is discussed in Sustainability circles. *Blue Diamond* has a 111-year history of providing economic stability and higher returns for its members. The collective support that the co-op brings to both small and large farms is incredibly powerful, and that unique strength is living itself out in our CASP incentive program.

Dr. Daniel Sonke observing an almond tree.

Why is participation in CASP so important for *Blue Diamond*?
Customers and consumers are demanding that companies demonstrate sustainability, and CASP is the mechanism through which we will provide that validation.

But it's not just a needed message for customers, it's a strong message for policy makers and stakeholders as well. As we enter the drought this summer and people come to us concerned about how water is used, our CASP participation helps us demonstrate the responsibility our members are taking for how they use their resources.

The Gold Level of *Blue Diamond*'s CASP Incentive Program is where it all comes together in talking about sustainability. Not only do we have all nine modules of CASP represented but also Bee Friendly Certification and the Cool Farm tool assessment. So we get the full sustainability focus complemented by two areas of critical importance to us — bee health and greenhouse gas emissions — all being tackled by members who reach the Gold Level.

And I have to say, based on the calls I'm getting from peers around the country, the food world is taking notice of that fact that *Blue Diamond* is incentivizing our growers and rapidly building a broader base in CASP. It's attracting positive attention because not very many companies are doing this in the almond world, and it's considered the gold standard in the food sustainability spaces.

Dr. Daniel Sonke observing an orchard irrigation system.

People are waking up to the fact that *Blue Diamond* has made a significant move and they want to catch up.

What future topics are on your radar?

The Biden Administration is calling for the creation of a carbon fund for farmers, which some reporters are calling a "regenerative agriculture" or climate-smart agriculture fund.

So we know the conversation around regenerative agriculture is going mainstream and has already become the basis for customer conversations.

From what I've seen so far, *Blue Diamond* has the elements of a good regenerative agriculture story already underway. I'm excited to use my background and work with the growers on telling our story.

"And I have to say, based on the calls I'm getting from peers around the country, the food world is taking notice of that fact that Blue Diamond is incentivizing our growers and rapidly building a broader base in CASP."

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#WeAreBlueDiamond Social Media Activity

In May, *Blue Diamond* celebrated its 111th Founders Day, the release of new almond flour-based desserts, and took a closer look at our 2020–2021 community grant recipients. *Blue Diamond* supported Love Modesto's virtual rally and a Salvation Army breakfast while the Turlock site received its certification into the Green Business Network. It was truly a full and exciting May/June for *Blue Diamond* on social media!

BLUE DIAMOND INVESTMENT PROGRAMS

Current Investment Rates available as of June 1, 2021

Blue Diamond Growers offers members short-term and long-term investment programs.

The objective of these programs is to serve as a competitive investment alternative for our members and provide *Blue Diamond Growers* with a steady source of funds. The interest rates effective June 1, 2021, for the program are listed here:

	Short-Term Investment Certificate (STIC)	Long-Term Investment Certificate (LTIC) (Maturity Date of 6/30/2024)
Initial Investment Required	$1,000	$50,000
Interest Rate	1.00%	1.875%
	(Variable, subject to change)	(Fixed rate)

For more information, contact your local Regional Manager, or Member Services at (209) 545-6225.

This summary does not constitute an offer to sell or a solicitation to purchase investment certificates. We will provide a package of documents for the programs to those members who are California residents and who express an interest in participating in the program.

Summer Fruit Tart

Makes: 6 servings

Ingredients

- 1 egg
- 1 teaspoon of corn starch
- 1 teaspoon of maple syrup
- 1 cup of *Almond Breeze*® Vanilla Almondmilk
- Tart crust
- Strawberries
- Raspberries
- Blueberries
- Blackberries

Directions

1. To make custard whisk egg, corn starch and maple syrup together in a pan.
2. Slowly whisk in *Almond Breeze* Vanilla over medium heat.
3. Bring to a boil, whisking continuously, remove from heat and cool 5 minutes.
4. Pour custard into tart crust and top with fruit.
5. Refrigerate 30 minutes before serving.

Newest Members of the Almond Flour Dessert Family

Blue Diamond is deliciously excited to announce the release of its latest almond flour products: Tasty Little Cup™ (a gluten-free mug cake) and Baking Mixes! Both products are dairy-free, non-GMO project verified, Kosher certified, and hit grocery store shelves nationwide this May.

Tasty Little Cup™

Not only is the Tasty Little Cup™ scrumptious, but it is a healthier option than a traditional mug cake and comes in four flavors! And it couldn't be easier to make: Just add water and microwave for 60 seconds. The four Tasty Little Cup™ flavors are: Molten Chocolate Cake, Brownie with Diced Almonds, Chocolate Cake, and Confetti Cake.

Baking Mixes

These baking mixes yield a healthier dessert and have excellent flavor and great texture. And those who appreciate a simpler ingredient label will be pleased to know that each mix contains no more than ten ingredients. The four Baking Mix flavors are: Brownie, Chocolate Cake, Chocolate Chip Cookie, and Yellow Cake.

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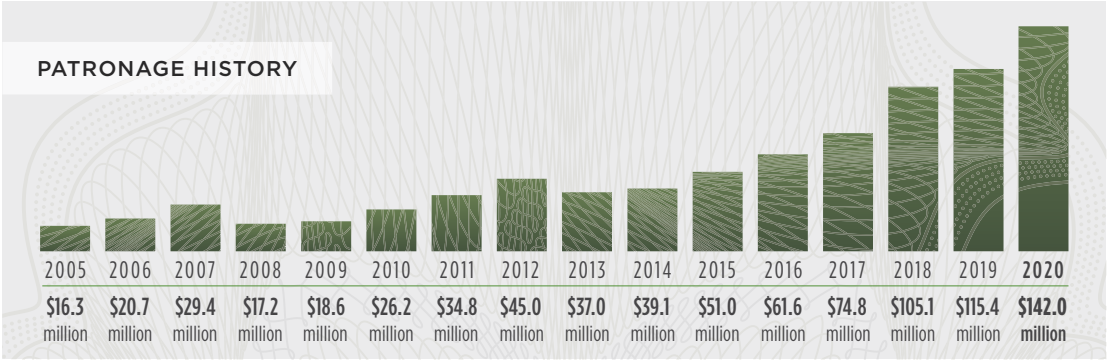

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Massive State Budget Surplus Creates an Opportunity for Ag & Water Investments

With California well overdue to take action and address water supply, climate, energy and other needs in our communities, Ag Council is advocating to support *Blue Diamond Growers* on multiple fronts within state budget negotiations.

An unexpected $75.7 billion surplus deriving from tax revenues and a prosperous stock market presents an opportunity for state leaders to strategically invest in critical unmet needs, including addressing immediate drought-related issues, while ensuring farmers can thrive into the future.

The budget surplus in California is a chance to leverage state funds with private dollars through partnerships to help both farmers and ag cooperatives like *Blue Diamond Growers* achieve the ambitious environmental and labor standards set by the State of California, as well as take vital steps to fund critical water infrastructure and help us better prepare for drought and Sustainable Groundwater Management Act (SGMA) implementation.

The following is an overview of key state budget issues Ag Council is advocating for as Gov. Gavin Newsom and legislators negotiate a final budget, which must be approved in the State Legislature by June 15 and then sent to the governor for his signature.

Water Conveyance

Ag Council supports the allocation of $200 million provided in Gov. Newsom's water, drought and climate package announced in early May. These initial proposed dollars are a good start to help begin to fund crucial projects, such as: repairing the degradation of the Friant-Kern Canal, the Delta-Mendota Canal and major portions of the California Aqueduct, all of which are losing water due to subsidence.

Special appreciation goes to Sen. Melissa Hurtado (D-Sanger) and other San Joaquin Valley legislators for championing this issue through SB 559 legislation to increase water supply for farms, provide clean drinking water, as well as alleviate pressure on California's overall water system.

Sustainable Groundwater Management Act (SGMA)

Ag Council, along with ag partners, is advocating for the inclusion of $1 billion to fund the implementation of the Sustainable Groundwater Management Act. Three areas are essential under the SGMA umbrella: planning, projects and multi-benefit land retirement.

First, funding is critical to further assist in SGMA planning at the local level. Second, projects such as widely effective recharge projects are excellent climate and drought mitigation tools. Those efforts must continue to be supported through state funding. The governor in his May Budget Revision and the State Senate are currently considering $300 million in these categories and we are urging more.

Third, given that SGMA may require the fallowing of almost a million acres of farmland, we support a multi-benefit land

retirement program to incentivize landowners to fallow land where needed and pivot to alternative uses for the land, which may include conservation, habitat, recreation, or other uses.

We appreciate Gov. Newsom for proposing $500 million for a multi-benefit land retirement program in his water, drought, and climate package. This is a positive start to this enormous effort that we support to ensure land is not haphazardly fallowed.

Food Production Investment Program (FPIP)

The May Budget Revision includes $125 million in general fund dollars for FPIP. This is positive news, and our association is urging legislators to support this funding level.

FPIP is an incentive-based grant program Ag Council helped create in 2017 during cap-and-trade negotiations with former Gov. Jerry Brown.

FPIP provides competitive grants for food processors, via the California Energy Commission, to replace high-energy consuming equipment with advanced technologies and equipment to lower energy use and costs associated with greenhouse gas (GHG) emissions.

As many of you know, *Blue Diamond* was awarded a grant through FPIP allowing the cooperative to reduce natural gas consumption and GHG emissions.

Ag Council also supports the following essential programs within Gov. Newsom's May Budget Revision:

Ag Burning Alternatives

- $150 million to fund agricultural burning alternatives and incentivize farmers to transition to activities, such as whole orchard recycling.

Pollinator Habitat Program

- $30 million for pollinator habitat and forage on working lands.

FARMER Program

- $363 million over two years for this effective ag equipment replacement program providing grants for farmers to replace heavy duty trucks, tractors, harvesters, and other ag equipment to reduce emissions and improve air quality.

Water-Use Efficiency

- $60 million for the State Water Efficiency and Enhancement Program (SWEEP) grants to help farmers implement the latest irrigation technologies to reduce water use.
- Ag Council is also advocating that food processors be allowed to access other water-use efficiency dollars within the $500 million in funding being proposed by the State Senate.

Drinking Water

- Gov. Newsom allocates $1.3 billion in state and federal dollars over two years for drinking water/wastewater in his budget plan. The funds go to protect drinking water, support local ground water supply projects and planning, water recycling, as well as cleaning up contaminated groundwater and other efforts. The governor also includes $300 million to small rural and urban water suppliers for drought contingency planning and preparedness projects.

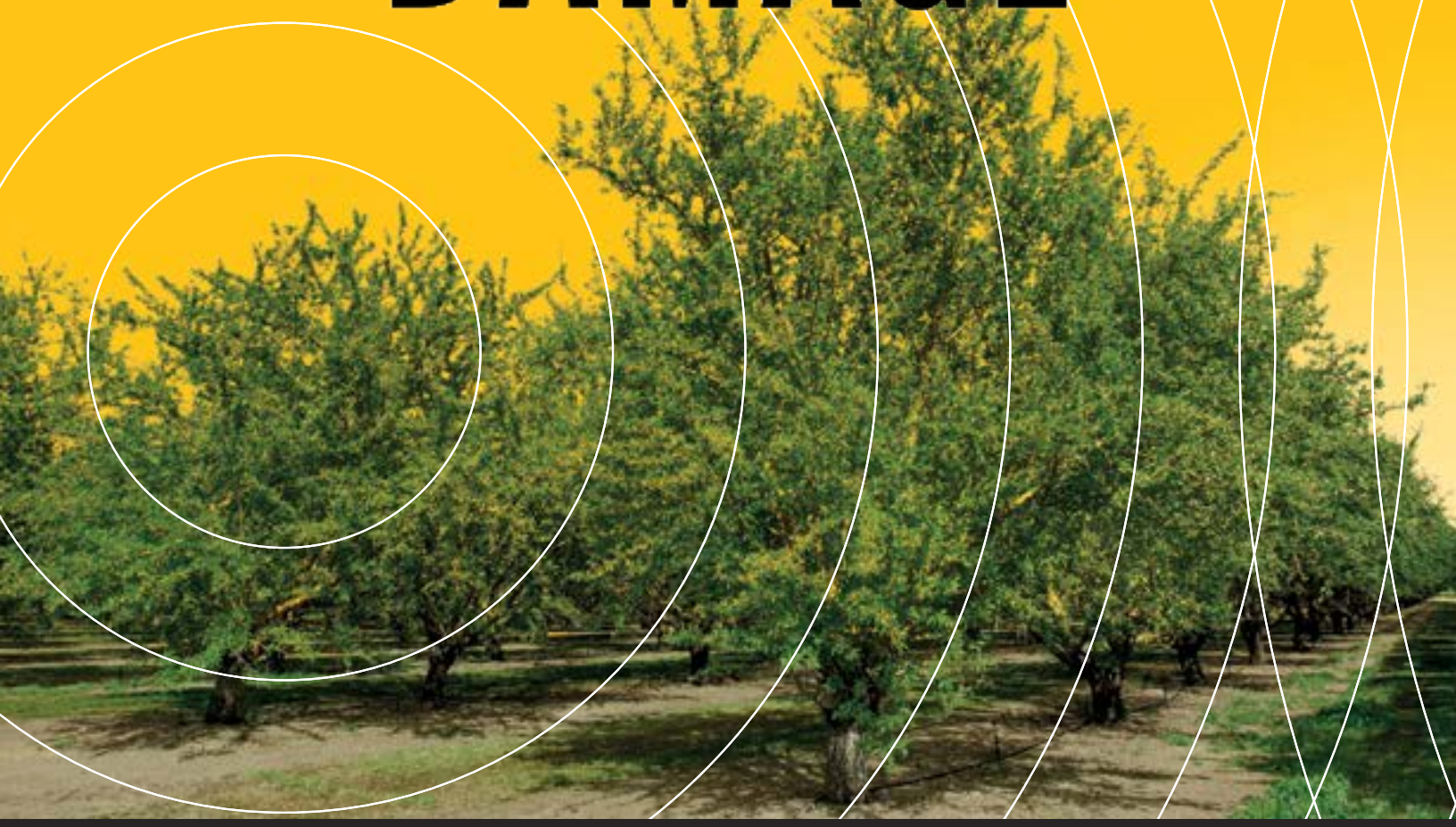
The needs are clearly vast, and with a significant state budget surplus, Ag Council's team is actively working to ensure our members like *Blue Diamond Growers* are part of the economic recovery, resiliency, innovation investments being decided upon during the state budget process.

We look forward to working on your behalf to seize upon opportunities and help secure a prosperous future for the agricultural community.

As always, please do not hesitate to contact me at emily@agcouncil.org with any questions or to discuss state policy issues. ◆

Emily Rooney,
Ag Council
President

STOP DAMAGE



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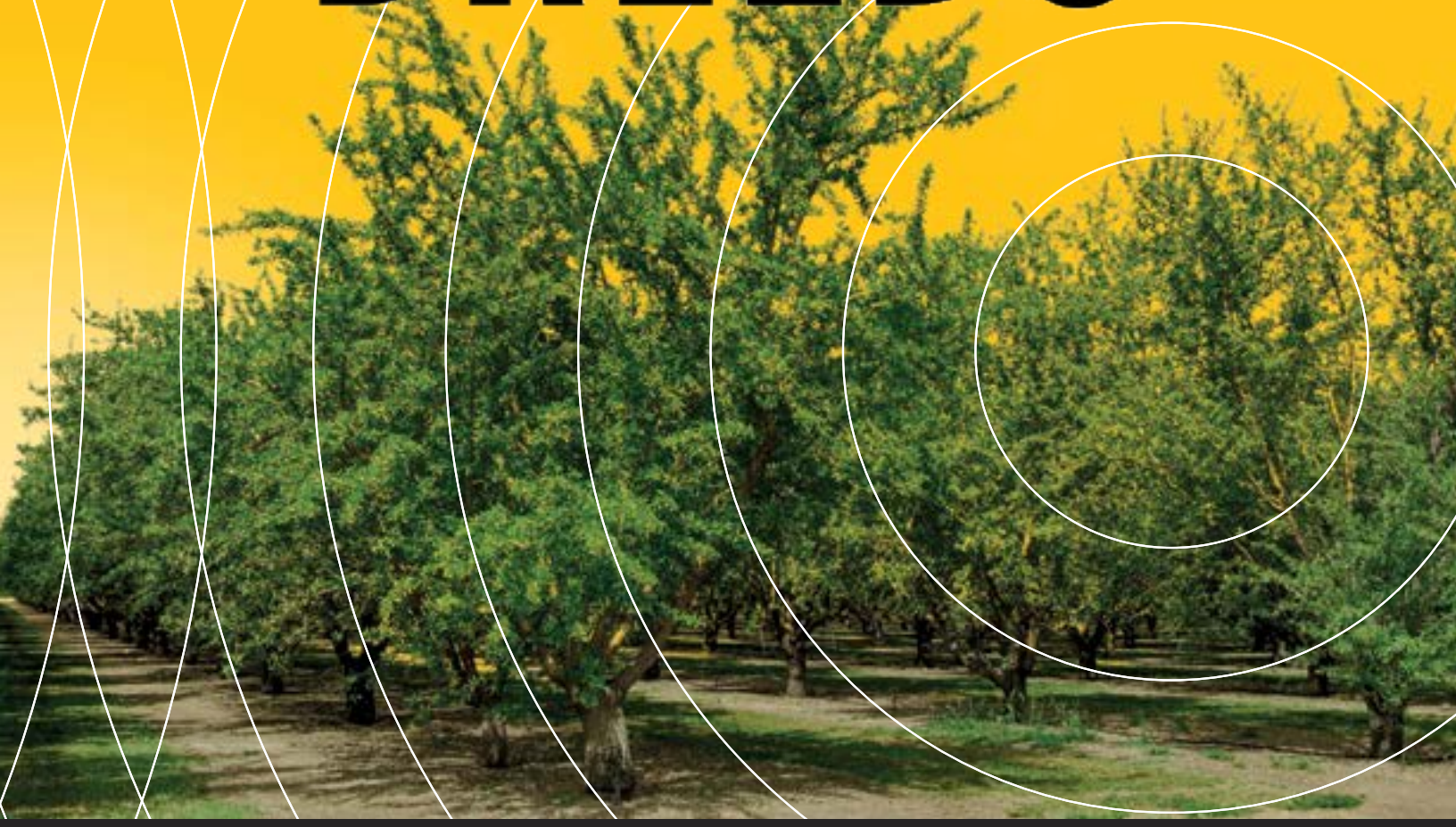

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A Legacy of Sustainability

Paul Danbom checking the progress of his crops.

Just five minutes from *Blue Diamond*, Turlock, sits a 500-acre almond, dairy, and corn farm with fascinating sustainability practices. Paul Danbom of Brindeiro & Danbom Dairy Farms, and a proud *Blue Diamond Grower* since 2014, shared how sustainability lies close to his heart because the land has been owned and farmed by his family for over 100 years and was passed on to him by his great uncle, James Brindeiro. Paul's dream is to sustainably care for his land so successfully that the farm would increase in quality by the time his children inherit it.

"The land was my inheritance. Giving my kids well-cared-for ground makes what I'm passing on worth more. It increases my legacy," said Danbom.

But even before he became a *Blue Diamond Grower*, Danbom and his uncle loved visiting the Salida Nut and Gift Shop to purchase their favorite candied almonds. They both admired the strength and stability of our co-op and Danbom appreciates how "*Blue Diamond* shines a light on our sustainability and shines a light that we are a California-based business with California ideals."

And those California ideals center around being a green business that stewards the earth, not just utilizes its resources. Recycling and good land stewardship is at the core of Danbom's farm.

"Something I'm really proud of is that we produce 7,000 gallons of milk a day, 275,000 lbs of almonds a year, and 10,000 tons corn silage a year, yet our operation only produces three cubic yards of unrecycled waste a week. Everything else is recycled," Danbom enthused.

> *"The almond farmer should be right at the center of the California 'green' ideal because you couldn't ask for a group of people who want to be more sustainable or more environmentally conscious than a California farmer."*

> *"Something I'm really proud of is that we produce 7,000 gallons of milk a day, 275,000 lbs of almonds a year, and 10,000 tons corn silage a year, yet our operation only produces three cubic yards of unrecycled waste a week. Everything else is recycled."*

This is chiefly because the farm does not rely on chemical fertilizer, but Paul employs a natural means to keep the land healthy. He creates his own organic fertilizer, which is composed of nitrogen-rich manure from his dairy cows that he feeds into a large separator to remove the water and then mixes the manure with green material composed of almond shells and shredded almond tree limbs from his orchard. This blend is then aged for several months before fertilizing his orchard.

This practice is especially useful as the dry season approaches because the compost and organic fertilizer builds the soil better than chemical fertilizer does; the organic materials help the soil hold onto moisture. Along with this, Danbom uses a double line drip irrigation system, which is one of the most efficient ways to water the trees because the water goes directly into the soil, not sprayed into the air.

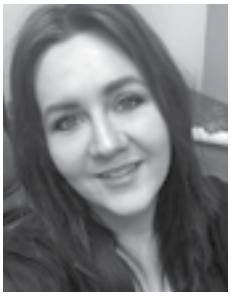
And Danbom hasn't neglected the honeybee, either. He lets the natural grasses grow in the middle of the rows during winter to broaden the bee forage selection. He also recycles the burlap sacks from the dairy to place over water buckets, so the bees have a steady water source (similar to *Blue Diamond*'s "Water for Honeybees" program).

Top photo: Manure separator hard at work at Danbom farm. Bottom photo: Paul Danbom notices how well the separator works; the manure is dry and ready to be mixed with green material.

Good, healthy soil shows signs of beneficial insect activity.

The harmonic symbiosis throughout Danbom's farm lies in his practice of waste reduction and the usage of materials on-hand. It's easy to see that most resources on a farm can have a secondary purpose. Paul fertilizes his almond trees with the cow manure and green waste, and the cows get to enjoy the maximum percentage of almond hulls their diet will allow. Not to mention, almond hulls are one of the lowest-cost cattle feeds a farmer can buy. Because of this, Paul shares the value of building partnerships between almond farmers and their local dairies regarding compost. Dairy farmers need to move the manure, and almond farmers need to fertilize their trees, so it's a great relationship.

"The modern farmer is a little bit of everything: a steward of land, a businessman, an accountant," Paul expressed. "So, the almond farmer should be right at the center of the California 'green' ideal because you couldn't ask for a group of people who want to be more sustainable or more environmentally conscious than a California farmer."



Jillian VanTassell, Communications Specialist, *Blue Diamond Growers*, Sacramento

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CENTRAL LIFE SCIENCES

Grower Spotlight: Chris Rishwain

The Soil Builder Mix in mid-April a few weeks before Blue Diamond Grower Chris Rishwain terminated it with a flail mower. Photo courtesy of Billy Synk.

This April I had a chance to catch up with *Blue Diamond* member Chris Rishwain to chat about the challenges of producing almonds and how cover cropping plays a role in his operation's success. Each year more growers than ever are adopting the use of cover crops for assistance with increasing the health and efficiency of their bees and soil. The Seeds for Bees® program awards growers free cover crop seed and access to advice to help them get the job done and know what to expect. Chris has enrolled in the program every year since 2018. Planting covers between the rows of trees or grapes won't solve your problems overnight, but even with drought conditions providing no more than five to seven inches of rain, your cover crop will begin improving your soils enough to return a net benefit in about five years. I am convinced in many cases a return is reached much earlier. Field tests indicate cover crops are decreasing sodicity (salt) and increasing infiltration in soil more effectively than gypsum. A high-quality seed mix doesn't have to be more than $30 per acre. Planting costs will set you back another $10–$15. If your land has required regular mowing of weeds in the past there is no added cost for flail mower work when terminating the cover crop. The exception being more frequent belt replacement on rotary mowers chopping up biomass. This biomass will become the organic matter that increases the water holding capacity of soil with its sponge like properties. The eliminated use of gypsum itself might offset the cost of planting cover crops. But is your gypsum also feeding bees? Now, let's hear from Chris.

Billy Synk (BS): Where did you grow up? When did you first start working in agriculture?

Chris Rishwain (CR): I was born and raised in Stockton. My grandfather started the business in the 1970s. My dad has been managing the orchard since the 1980s and I became involved in the business about four years ago.

BS: What is the name of your operation, how many acres do you manage, and what do you grow?

CR: J&R Ranches in Manteca. I manage approximately 150 acres of almonds.

BS: Where did you go to school? What other credentials do you have?

CR: I graduated from St. Mary's High School in Stockton. I have a business degree from the University of San Diego and a law degree from the University of San Francisco.

BS: What co-ops do you belong to? How have they assisted you in increasing the sustainability of your orchards?

CR: We have been a grower for *Blue Diamond* since the late 1970s. I've always appreciated the information that *Blue Diamond* publishes in *Almond Facts* that focuses on sustainability. However, it is also the grower meetings where I've learned quite a lot and also by speaking with vendors at those meetings whose products or services are geared towards sustainability.

BS: What does sustainability mean to you and in your operation?

CR: To me, when I think of sustainability I think of conservation of resources, whether it is water, fertilizer, energy, or Integrated Pest Management (IPM). However, learning about cover crops led me to Regenerative Agriculture, which focuses on improving soil health. By improving the health of the soil, the trees become healthier, which then reduces the amount of inputs required, including water to grow a crop. I've learned that cover crops are one of the best tools I can use to improve soil health and thereby use less resources.

BS: How did you hear about Seeds for Bees, and why did you start incorporating Seeds for Bees into your orchards?

CR: I had first heard about Seeds for Bees at a *Blue Diamond* grower's meeting about four years ago. Billy Synk from Project Apis m. gave a presentation about Seeds for Bees. I was not familiar with what cover crops were at the time, but I thought that the concept sounded interesting and worth looking into further. I did a lot of research about

cover crops after that meeting to learn more about the pros and cons of using them with almonds. I also went to a cover crop field demonstration day at the NRCS facility in Lockeford to see first-hand what the cover crops look like and ask questions with the staff. At that point, it became clear to me that cover crops can play an integral role in improving the conditions in our orchard in several ways, particularly with bee health and better pollination.

BS: Is the Seeds for Bees program easy to utilize? If so, why, and if not, what was difficult?

CR: The Seeds for Bees program was very easy for me to use. First, the application process is simple and quick. If I recall correctly, the application took about 10 minutes to complete. Billy also helped answer any questions I had about the program. Second, they provide the seed mixes for us which takes away the guesswork of me trying to figure out what varieties to plant. Third, they deliver the seeds to our orchard, saving us the time and expense of picking them up at the seed company. Finally, the cost of the seeds and shipping were both covered by Seeds for Bees. Therefore, my only out-of-pocket cost was to hire someone to plant the seeds. We have just finished our third year using the Seeds for Bees program and I highly recommend it. For those that would like to try it out, I suggest starting with a section of the orchard the first year. After the first year, it will be easier to scale it up if desired.

Daikon radish, canola, and pea feeding pollinators after the almond bloom dries up. Photo courtesy of Billy Synk.

BS: Have you seen any soil benefits since planting cover crops? If so, what are you seeing? Are you doing any testing or sampling to verify what you are seeing?

CR: Besides bee health, another primary motivation for me to use cover crops was to reverse soil compaction. I have noticed some improvement already with compaction and I'm hopeful that the continued use of cover crops in the future will yield even better results. There is also a lot more evidence of earthworm activity near the trees which is a good sign of improved soil health. As far as testing, there has been a slight increase in organic matter reported.

BS: How else does planting cover crops help you reach your sustainability goals?

CR: A major component of the sustainability movement is reducing the carbon footprint of businesses. Planting a cover crop in the orchard rows can help accomplish this by drawing down carbon from the atmosphere and placing it in the soil (where it belongs). Additionally, some of the cover crop varieties we plant are nitrogen fixers. That naturally produced carbon and nitrogen improves the health of our soil and thereby over time should decrease the amount of inputs we will need to grow our crop.

BS: What are some challenges related to growing cover crop in orchards? How did you overcome those?

CR: The only challenge I can think of was finding someone who can plant the cover crop for us in our initial year and

Seeds for Bees manager Billy Synk and Chris Rishwain evaluate nitrogen fixing nodules of legumes. Photo courtesy of Ben Goudie.

how much seed to plant. I decided to only plant about half of our orchard the first year and learn from that experience before I decide to scale it up further. Once the crop was planted, it was pretty much self-sufficient. We did not water the crop given that we have micro sprinklers, and their spray area does not reach the middle of the rows. The cover crop did not get in our way when we did our routine orchard maintenance throughout winter either. When it comes time to terminate the cover crop in spring, we mow it just like we normally would mow the middles anyway, to control weeds. All in all, the cover crop was very low maintenance for us.

BS: Besides providing nutritional resources for pollinators with cover crops what else are you doing to help bees?

CR: This year, we participated in the *Blue Diamond* and Project Apis m. "Water for Bees" program. *Blue Diamond* provided the water buckets to us so that the bees have a reliable and clean water source during the pollination period. Having a close-by water source for the bees was key, given the dry conditions we have had this year.

BS: Why is it important to you to help ensure a healthy honey bee population?

CR: As an almond grower, a healthy bee population is essential to help boost our crop yield and likewise many other agricultural products. If the bees can feed on the cover crops prior to the almond bloom, the improved health of the bees can strengthen and expand the hives for better pollination during the almond bloom.

BS: Do you have any pollinator related certifications? If so, did Seeds for Bees help you qualify for them? If not, do you plan to apply in the future?

CR: Not at this time. However, I do plan to apply for the Bee+ Scholarship and Bee Friendly Farming program through the Almond Board of California and the Pollinator Partnership.

BS: Do you think interest is growing in practices that are good for honeybee health among consumers, buyers, and retailers of almonds? If so, how does that influence almond growers and their management decisions?

CR: I think that consumers are starting to realize how important honeybees are to the food system and would like for their food to be grown in a sustainable way that supports them. They are starting to ask more questions about how their food is grown. The continual growth in the organic product market is evidence of this. So, if the marketplace were willing to pay a premium for sustainably grown almonds, I think that would get the attention of many almond growers like myself.

BS: What is one tool or resource you could not live without?

CR: The tool I use a lot is a penetrometer that tests the soil for compaction in our orchard.

BS: What is your favorite way to eat almonds?

CR: My favorite way to eat almonds is to pick them right off the tree during harvest when I'm walking through the orchard. You can't beat the flavor of fresh almonds. Otherwise, I like to soak raw almonds in a bowl of water overnight and eat them the next day. The *Blue Diamond* Habanero BBQ and Thai Chili flavored almonds are also a favorite in my household.

The 2021–2022 Seeds for Bees open enrollment period starts June 15th. Interested applicants are encouraged to apply by going to the Project Apis m. Seeds for Bees website at www.projectapism.org/seeds-for-bees.

Feel free to contact me, Billy Synk, at Billy@ProjectApism.org for any questions regarding the Seeds for Bees program, cover crops, habitat, or bees/pollination. ◆

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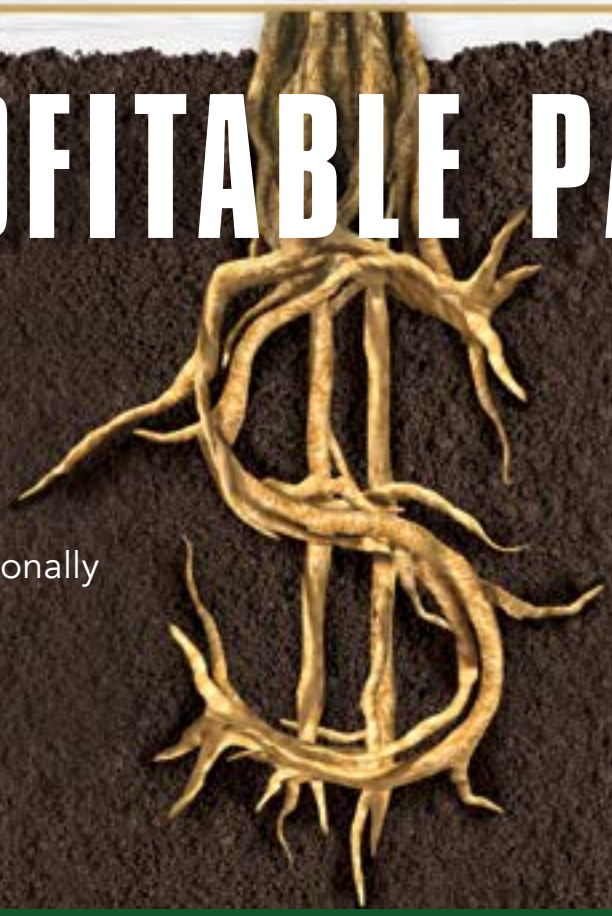

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THE BEE BOX

Dronings from the Honey Bees in the 2021 Almond Orchards

This year's almond pollination has already come and gone, and while weather conditions were conducive to good bee activity and almond nut set appears favorable, the final yield numbers won't be in for a while. It is also early in the season to assess how honey bees have fared this year; however, we can share some of our Tech Transfer Team Field Specialists' initial insights into the health of our 2021 honey bee pollinator workforce during the almond season.

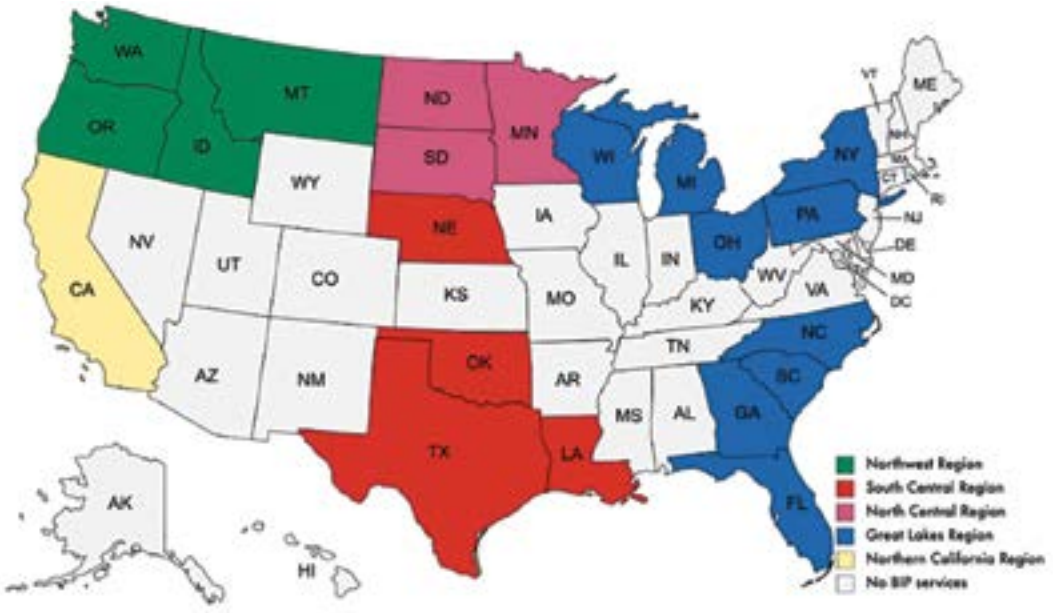

Figure 1. Map of BIP Tech Transfer Team Regions.

BIP Tech Transfer Team

Our Tech Transfer Team is composed of six Field Specialists, spread into five U.S. regions. Each of these regions work with approximately 20 commercial operations. The Field Specialists follow the bees into the almond bloom to inspect and sample colonies between late January and early March each year.

During each visit, the field specialists inspect and sample a subset of the operation, usually at least eight colonies per yard, in three to five yards. The standard colony inspection includes equipment in use, population size in numbers of frames of bees (FOB), brood pattern (one to five), queen status, Varroa Loads (by in-field alcohol wash), and any overt signs of diseases observation and categorical recording "present" (mild, moderate, severe) or "not present." Visual conditions or diseases include Chalkbrood, European Foulbrood, American Foulbrood, Parasitic Mite Syndrome, Sacbrood, Chewed Down Brood, Melted Down Larvae, Uncapped Pupae, Mite Frass, Entombed Pollen, Deformed Wing Virus, Chronic Bee Paralysis Virus, Dysentery, Shiny Bees, Trembling Bees, Crawlers, Dead bees at entrance, Wax Moth Larvae, Small Hive Beetle adult, Small Hive Beetle larvae, Varroa. After each visit, a report is sent to the beekeepers, providing them with the information they need to make data-driven real-time management decisions.

BIP Honey Bee Colonies in 2021 Almonds

The Tech Team inspected and assessed over 1,000 colonies in February, and although this represents only half a percent of colonies present in the California central valley at the time, it gives us a quick standardized snapshot of the BIP Tech Transfer Team participating beekeepers' colony health during this year's main event. Field specialists performed as many field Varroa alcohol washes and sent over 331 samples to the laboratory at the University of Maryland for Nosema load processing. During the same period, queen breeding operations tested 417 colonies for hygienic behavior, measuring the ability of honey bees to uncap and discard dead or diseased young bees in the making which informs their breeding decisions for the upcoming season.

Colony Health Highlights in 2021 Almonds

Colony Population Sizes in Frames of Bees (FOB)

> *"Population sizes were on the small side for the 2021 almond pollination."*
>
> — Matt Hoepfinger, California Field Specialist

Colony size, measured in frames of bees (FOB), is the most basic metric to evaluate if a colony unit is fit for pollination. Almond growers are very familiar with this colony health measurement of colony strength as it is a component of most pollination contracts. Note however, the BIP Field Specialists quantify frames of bees in the strictest definition of the term, looking at tops and bottoms of all boxes which usually results in a more conservative estimate than your typical grader.

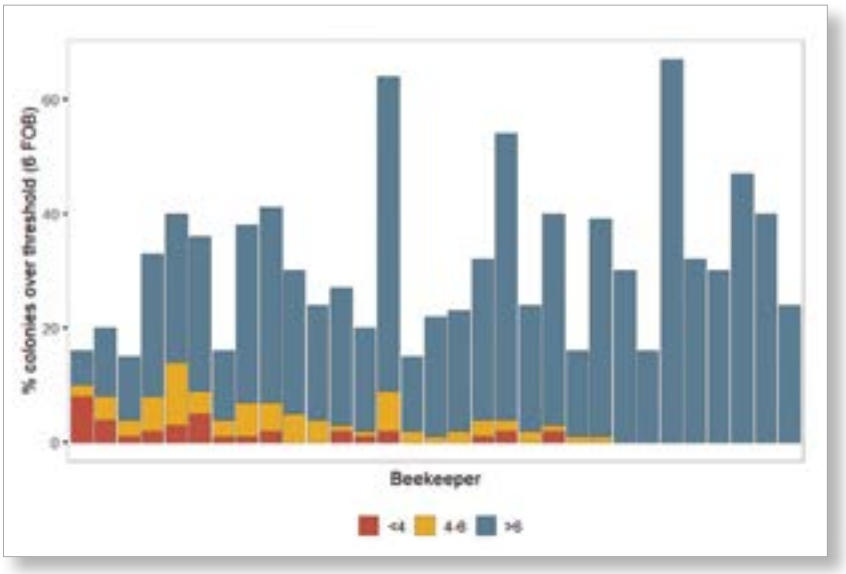

Fig. 1: Proportion of colonies with fewer than four frames (red), between four & six frames (yellow) and over six frames (blue) of bees for each of the 31 beekeepers sampled (with a minimum of 15 colonies sampled) during 2021 almond pollination.

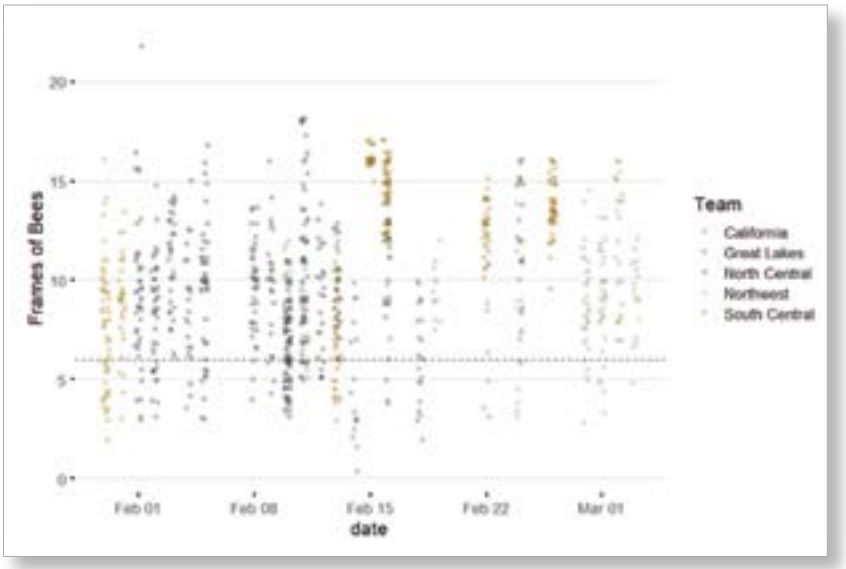

Fig. 2: Number of frames of bees recorded for all colonies sampled during almond pollination 2021. The dashed line represents the six frame of bees requirement, showing the vast majority of colonies sampled above threshold.

Beekeepers sampled ranged between 38% and 100% of their colonies ranking above the six frames of bees requirement (Fig. 1). However, overall, our BIP Tech Transfer Team participating members had an average of 9.8 frames of bees across all operations, regions of origin and time period sampled (Fig. 2).

Varroa Loads

Varroa destructor is a pernicious pest of honey bee colonies, not only do they feed on the bees fat body, they also transmit a variety of viruses. Varroa populations usually increase during the beekeeping season. Most beekeepers treat their colonies to keep Varroa loads below the standard industry threshold of 3%. To determine Varroa levels, our field specialists perform an alcohol wash on a sample of approximately 300 bees.

During almonds this year, Varroa loads were low overall. Varroa were found between 3% and 75% of colonies depending on the region of origin and the week sampled. 33 beekeepers were sampled during this period across the five regions. They had Varroa mites in anywhere between 0% and 90% of their colonies, but only four of those beekeepers had colonies over the 3% threshold. Some of the higher Varroa loads came from a few outliers from the North Central region, but that region was also the most heavily sampled. The average Varroa load for all samples (all teams) was 0.32 mites per 100 bees.

> *"Varroa levels were low overall but nosema spore counts spiked near the end of bloom."*
>
> — Ben Sallmann, Northwest Region Field Specialist

Nosema Loads

Nosema ceranae is a parasite of the honey bee gut. Often associated with the higher proportion of older forager bees, in the springtime and sometimes later in the fall, Nosema ceranae can affect a colony's productivity. Nosema often clears up with good weather and forage, so if colonies come out of the winter with high Nosema loads, a good almond pollination season may be part of the cure.

Many beekeepers do not request Nosema samples and those who do, typically have had issues with it in the past or perceive signs of its presence. This year, we had 23 beekeepers request some Nosema processing and most of them had at least some of their colonies over the standard threshold of 1 million spores per bee. Only 4 beekeepers had all colonies test below threshold. The average Nosema load for all samples (all teams) was 1.9 million spores per bee.

> *"Some beekeepers reported colonies coming home with more brood (new bees in development) than last year, may be due to generally favorable weather and prolonged access to almond pollen."*
>
> — Dan Wyns,
> Great Lakes Region Field Specialist

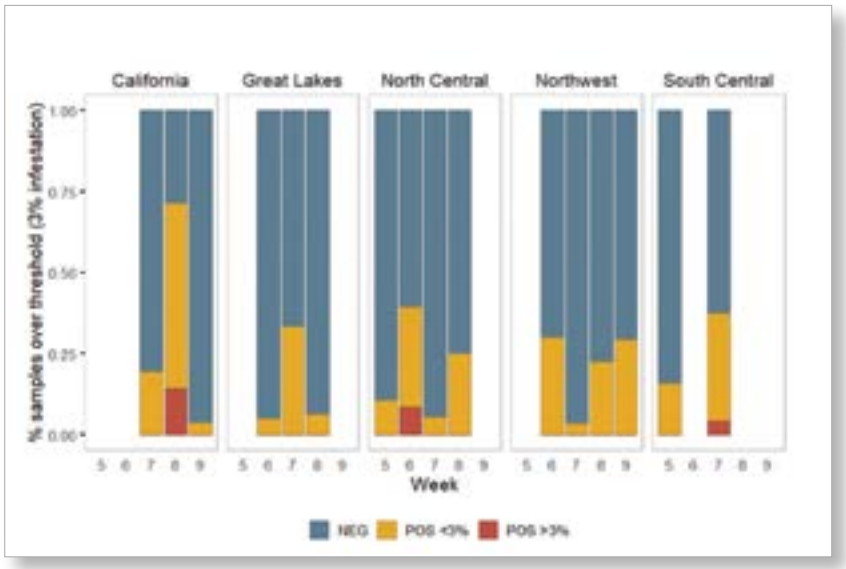

Fig. 3: The BIP Field Specialists assessed and inspected colonies across a five-week period. During those weeks, Varroa loads are compared between beekeepers from each Tech Transfer Team region.

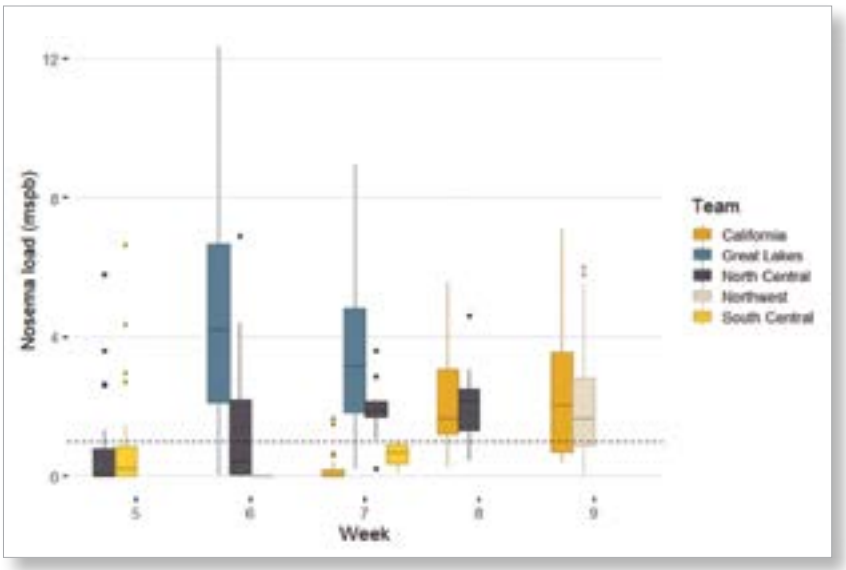

Fig. 4: Distribution of the Nosema loads of colonies sampled during almond pollination 2021. The color shows the grouping by team (origin). The dashed line represents the 1 million spores per bee threshold (331 colonies were measured).

In summary, this past almond season unfolded fairly predictably in terms of honey bee colony sizes, Varroa and Nosema loads. The biggest parts of the puzzle still missing are viral loads and pesticide analyses results. These results are still a few weeks away and our sample size will make it difficult for us to draw significant conclusions. Both of these colony health metrics would really enrich the overall colony health story we are trying to piece together from the beekeeping industry's perspective.

Anne Marie Fauvel, Tech Transfer Team Coordinator

Nathalie Steinhauer, Chief Science Coordinator

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THE ALMOND BOARD

Mating Disruption Can Improve ROI, Reduce NOW Damage

Navel orangeworm (NOW) damage often delivers the single largest pest headache for growers: NOW presence in the orchard can lead to an increased risk of aflatoxin residue and nut damage, which often translates to lower grades and ultimately lower payments to you, the grower.

Two recently published research studies show that almond growers who add mating disruption to their Integrated Pest Management (IPM) strategy to fight NOW may be able to both reduce the number of times they spray in a season and improve their bottom line. In most cases, the investment in equipment that interrupts the mating cycle of NOW moths more than pays for itself with quantifiable reductions in kernel damage.

Ins and Outs of Mating Disruption

NOW larvae overwinter in mummy nuts and become adults in the spring when they start reproducing. Each generation of adults is called a "flight," and typically there are up to four flights during one growing season. Historically, growers have timed sprays to the period when adults in each flight begin to lay eggs.

Mating disruption involves the use of pheromones that imitate those used by female moths to attract male moths. The pheromones can be introduced to the orchard via strips placed in trees (roughly 18 to 25 strips per acre) or by hanging dispensers (one per acre) that release pheromone from aerosolized cans. Some of the more sophisticated — and expensive — systems include camera traps and weather stations that are used to further refine the timing of the release of pheromone to when the pests are most active.

Senior Specialist in Pest Management at the Almond Board of California (ABC) Drew Wolter said mating disruption can provide an additional layer of protection for growers who rely on spraying.

"If you're just spraying, the chance of hitting every moth is pretty low — the moths are still mating, and they're still laying eggs," he explained. "Mating disruption allows you to reduce the population size at the first, second, third and fourth flight."

Research Compares Four Mating Disruption Systems

In 2017 and 2018, University of California Cooperative Extension (UCCE) entomologist and farm advisor David Haviland and his team conducted ABC-funded research that provides quantitative estimates of the impact of mating disruption on NOW management. The first study evaluated the impact of four different mating disruption systems on NOW trap captures and damage. The second study used nine sets of paired orchards, ranging in size from 40 to 100 acres, to compare the impact of traditional insecticide programs with and without the addition of mating disruption.

While evaluating the study results, researchers discovered the following key takeaways:

- All four commercial mating disruption systems led to a measurable decrease in kernel damage.
- The cost of mating disruption equipment was often more than offset by the increase in nut value — **on average, implementation of mating disruption cost $127 per acre, while the average crop value increases were $144 to $150 per acre.**
- Mating disruption paid for itself in orchards averaging 1% damage, primarily by qualifying growers for increases in per-pound premiums.[i]

In addition, researchers discovered a sharp reduction — as high as 94% — in the number of male moths caught in pheromone traps in orchards using mating disruption.

"That number is massive," Wolter said. "It means mating disruption confused males to the point that they didn't mate, which leads to a decreased population. Generation by generation, their population declines."

Haviland's research shows that mating disruption is effective across many almond varieties, reducing NOW damage by 65% and 78% in Nonpareil and pollinizer cultivars, respectively.

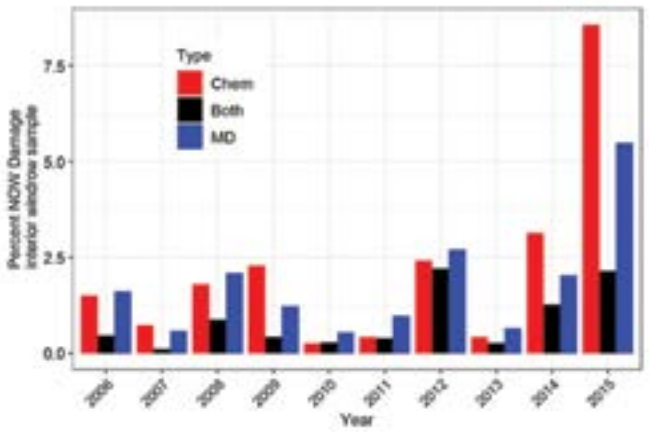
A full version of the study report and additional findings may be viewed in the February 2021 issue of the *Journal of Economic Entomology*.[ii]

"In general, NOW mating disruption in almonds can currently be viewed as an insurance policy against high losses from NOW," the report states. "These results suggest that adding mating disruption to an existing navel orangeworm management program can be a cost-effective way to reduce damage while promoting sustainable management practices."

Study Suggests Best Results Require Mating Disruption and Spraying

Bradley Higbee and Charles Burks authored the second NOW-related research study, which appears in the February 2021 issue of *Insects*[iii]. Higbee is a research and development manager at Trécé Inc., and Burks is a research entomologist for the U.S. Department of Agriculture Agricultural Research Service.

Their research was conducted between 2006 and 2015 in an almond orchard of more than 2,000 acres in Lost Hills.



This graph summarizes the research findings from Burks and Higbee's research.[iv]

NOW worm. Photo credit: The Almond Board of California

The orchard's varieties include Nonpareil, Monterey, Butte, Carmel, Fritz, Mission, Price, Ruby and Wood Colony. Intense winter sanitization, including machine and hand removal of mummy nuts and flail mowing, was practiced in all orchard blocks.

Higbee and Burks found that "blocks treated with both mating disruption and insecticide had lower damage than those treated with either alone in nine of the 10 years" those orchard blocks were studied. In many years, the kernel damage was cut in half.

"The fact that this study covers a 10-year span gives you a sense of the variability of high-pressure years and low-pressure years from navel orangeworm," Wolter said. "There was a clear difference in combining mating disruption with spraying."

Wolter said for growers who often spray for NOW multiple times a year, a sound mating disruption program has the potential to eliminate treatments. Current research shows mating disruption can reduce the number of male moths caught in traps by 93.5%.

"A proper mating disruption program is not intended to take away all spraying but could reduce the total number of sprays in a season," he said, suggesting spraying is especially important at hull split when nuts are most vulnerable to egg-laying moths.

In this study, doubling the number of mating disruption devices usually resulted in lower damage, but there was not always a statistical difference, which suggests that the

amount of pheromone needed to disrupt a particular orchard depends on the number of NOW in the orchard. Current formulations are different from those studied from 2006 to 2015, but the results of those studies underline the importance of not using less than the label rate even though trap suppression occurs at lower rates.

Consider Mating Disruption for Your Operation

A survey conducted by UCCE farm advisor Phoebe Gordon shows that nearly two-thirds of growers say they have never used mating disruption as part of their NOW management program, though most have employed winter sanitization (91%) and many have used pheromone traps (69%) to gather data on moth population in their orchards.

Wolter believes an effective NOW program combines monitoring with pheromone, PPO, egg and/or Peterson traps in addition to mating disruption and spraying.

"A sound NOW IPM program should have three fundamental in-season components," he recommended. "Between those three components, growers can track NOW flights and associated population size. Tracking NOW pressure, in turn, provides growers with a decision-making tool regarding if and when they should spray."

Blue Diamond Kern County almond grower Kent Stenderup began using mating disruption three years ago in his orchards and is convinced of its value.

"The practice continues to prove itself and we're adding acres as we go," Stenderup said. "The bottom line is our handler is happier and so are our books."[v]

The Almond Board is in the early stages of producing a short video with Haviland in which he will explain how mating disruption works and offer growers a chance to assess its potential use in their orchards. This video will be released this summer.

Navel orangeworm is one of the key pests industry members are dedicated to responsibly combat as part of the Almond Orchard 2025 Goal to increase adoption of environmentally friendly pest management by 25%. For more information on the 2025 Goals and to learn what practices within the goals may work for your operation, visit almonds.com/goals.

[i] According to researchers, "The economic analyses showed that increases in crop returns exceeded the costs of implementing mating disruption systems with the break-even point ranging from 0.86 to 1.06% of kernel damage." Read the entire study, published in the Journal of Economic Entomology, at https://doi.org/10.1093/jee/toaa297.

[ii] View the full study at https://academic.oup.com/jee/article-abstract/114/1/238/6063470

[iii] View the full study at https://www.mdpi.com/2075-4450/12/2/188

[iv]

[v] Learn more about Stenderup's experience with mating disruption in Episode 2 of the Almond Journey Podcast: https://www.almonds.com/almond-industry/industry-news/episode-2-kent-stenderup-navel-orangeworm-mating-disruption

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TIME TO CONSIDER

Summer temperatures are here and hull split is not that far off. Growing and protecting the crop are top priorities with harvest preparation and planning also important considerations.

ATV spreading bait. Photo credit: Franz Niederholzer

Heavy wildfire smoke is a wild card potentially impacting almond orchard management from now through leaf drop. Heavy smoke can significantly reduce light energy reaching the orchard. Depending on smoke timings, reduced solar energy reaching the orchard could increase slow nut drying and increase ant damage as the nuts sit longer in the field to dry. Heavy smoke cover can also reduce orchard water use. Last summer at Nickels Soil Lab in Arbuckle, daily ETo was reduced roughly 20% for much of late August and into September due to fire smoke. Careful attention to orchard water status and ant monitoring/management may be especially important this year and are discussed in this column. (Securing an extra supply of N95 masks will be important, too, if heavy smoke conditions occur this summer.)

Crop Development

Growers are paid for delivering good meat (AKA kernel) pounds. The total number of nuts and kernel dry weight per nut determines total weight of good meats. The number of nuts per acre is set by now, but most kernel weight

accumulates from May through July (see nut development graph). Starting now, it is important to manage the orchard to maximize kernel dry weight. Adequate irrigation and nitrogen are key inputs driving kernel growth and final weight.

Irrigation

I hope that your wells and irrigation systems are functioning as well as can be expected in a drought year. Understanding that water availability and quality vary from orchard to orchard, the following are points to consider. A free publication Drought Management for California Almonds is available as a 10-page pdf download at: anrcatalog.ucanr.edu/Details.aspx?itemNo=8515.

Irrigation is the most critical factor affecting payable yield in most almond blocks from the time this issue of *Almond Facts* hits your mailbox until harvest (and during/after harvest, but that's the next column). Because many orchards went into the season with less than a full profile across the whole planting, monitoring root zone or tree moisture is more important than ever to avoid sudden orchard water stress with the arrival of summer heat, stress that might be eased in other years by deep or row middles moisture that just isn't there this year.

To maintain good kernel fill, adequate irrigation is necessary through May using plant, soil or ET measurements to keep orchards in low to mild water stress levels. Crop water use estimates (ET), soil moisture sensors and/or plant moisture status are all effective tools. The gold standard for irrigation monitoring is plant moisture status measured as stem water potential (SWP) with a pressure chamber. This measurement includes the impact of saline soil conditions on tree water status. Crop water use estimates (ET values) and/or soil moisture monitoring data, while valuable irrigation management tools, don't integrate the influence of salinity into their output. A free publication on irrigation management with the pressure chamber is available at: ucanr.edu/datastoreFiles/391-761.pdf.

Once June arrives, keeping the orchard at SWP above -14 bars is the goal as the kernel fills and dry weight begins to

increase. Target SWP is -6 to -10 bars for low tree stress (just above baseline values) and -10 to -14 bars for mild tree stress. It may be impossible or excessively expensive to maintain the low stress levels listed (-6 to -10 bars), but mild water stress should not reduce yield. In young orchards, where possible, avoid extended periods (weeks) of SWP readings more negative than -14 bars as this will shut down shoot growth.

Should you practice hull split Strategic Deficit Irrigation (SDI), especially this year? In SDI, irrigation is reduced (not stopped) to allow a moderate level of stress (-14 to -18 bars) to develop during initial hull split and then the orchard is returned to full irrigation heading into harvest. This practice is reported to save water and not significantly impact yield. A key outcome of hull split SDI strategy is depleting soil water reserves to allow for tighter (shorter) hull split timing and ease of shaking. In a drought year, hull split SDI may not be necessary to achieve this and if tried under limited water conditions might cost growers in reduced kernel weight due to excessive water stress. I suggest a careful reading of David Doll's honest and thought-provoking post from last summer (www.thealmonddoctor.com/2020/07/19/regulated-deficit-irrigation-application/) to help growers and CCAs working with them to decide on the best course of action this year as hull split approaches.

Nutrition

Timing is critical to efficient nitrogen (N) fertilization in almonds. Nitrogen deficiency reduces flower formation this year and production next year. Too much N means excessive shoot growth, more wind damage risk, higher hull rot risk in the orchard and potential for excess N leaching as nitrate. April and May are the don't-miss months for N fertilization. By late May into early June (depending on the year) nut N demand eases and hull rot risk rises with increasing orchard N status.

Nitrogen nutrition and hull rot are related; the more N in the trees, the higher the hull rot risk. The target window for summer leaf N levels is 2.2–2.5% — adequate but not excessive. Hull rot incidence can increase rapidly with each 0.1% increase in leaf N over 2.5% N.

Nut fill. Photo credit: Franz Niederholzer

Should N be applied after kernel fill (late May/early June)? If the fertility program follows a "spoon feeding" approach using frequent, low rate applications to just match N need through the season while keeping orchard N levels low (2.3–2.5% leaf N), then continuing that approach into hull split should work without spiking hull rot. Orchards don't require much N after kernel fill compared to spring. For example, a 2,500 kernel lb/acre producing orchard only needs additional 20–30 lb N/acre in the tree between kernel fill and leaf drop. So, if an almond orchard N fertility program follows a plan similar to a "snack through the day" diet for a human, then snack on. If the program is more similar to a three square meals plus dessert diet, skip the dessert (late May/early June N application) to limit excessive orchard N levels and reduce hull rot risk.

Well water may contain significant amount of nitrate that should be included in fertilizer calculations. See the table in the March-April edition of this column or Table 1 in the Almond Board's new Nitrogen Best Management Practices (www.almonds.com/sites/default/files/2020-12/ABC_Nitrogen_8.5x11_vmags.pdf).

While N use in almonds peaks in May and eases in June, potassium (K) use continues at a steady rate until hull split. Keep up with (K) nutrition this year to maintain good yields next year.

Deficient (<1.0% leaf K in summer sample) orchards had less return bloom due to higher rates of spur death than orchards with adequate K (>1.4% leaf K) in UC research. Postharvest K fertilization in a K deficient orchard doesn't save those spurs and so does not improve crop next year.

If you cut back on K fertilizer last fall or this spring and are uncertain about orchard K status, don't wait for summer leaf level results. Check leaf K levels now, ahead of the traditional July sampling. If the leaf analysis results are falling dangerously low (approaching 1% K), consider fertigating with K before hull split to stave off deficiency and help keep yield potential up for next year. Talk with your CCA about a material and moderate rate that should keep the orchard above deficiency now, and then mark your calendar for the fall to check your summer leaf sample results and plan a K nutrition program for the 2022 crop.

Finally, set a date to check/confirm with your CCA about leaf sampling in July and hull sampling (for boron) at harvest. July leaf samples are the final report card for the season's nutrient program and should be done even if samples were taken earlier in the season. Harvest hull boron tests are particularly important this year, especially if a new irrigation water source(s) were used, to help plan your fall boron program. If you don't already, add chloride and sodium to the summer leaf analysis list, especially if irrigation water analysis shows either of these toxic elements present in significant amounts.

Pest Control

Delivering high quality nuts improves grower returns by increasing good meat weights and increasing price/kernel pound (processor incentive). Some practices intended to improve nut quality can be effective but are also relatively expensive, so identifying practices offering the best return on investment are critical to delivering the best net return to grower. Here's a list of summer pest management practices ranked from lowest to highest cost, so hopefully, the best return on investment (ROI). The point of this ranking is to draw attention to the high ROI practices, NOT to reduce the importance of the lower potential ROI practices that are critical parts of a successful pest management program. All pest management practices need to be considered in an IPM program as hull split approaches.

1. **Timely harvest** is, basically free (no added cost) NOW management. It should mean reduced NOW damage compared to later harvests. Timely harvest doesn't mean shaking before all the nuts have split. Once 100% hull split is reached (all nuts in the tree are at least at 2C stage — when the nuts split open with gentle pressure from each end of the nut) the crop should shake clean. The goal is to get nuts, especially Non-pareil, on the ground before or early in the 3rd generation egg-laying. Female moths cannot readily find nuts on the orchard floor to lay eggs.
   - Talk with your *Blue Diamond* rep about balancing potential crop damage and inshell production to maximize quality incentives and your income. Harvest isn't here, but it is time to prepare and plan for it.
2. **Ant management:** The longer nuts are on the orchard floor, the greater the risk of ant damage. In 2020, ant damage was up over previous years, based on conversations with PCAs and industry reps. This damage increase may have been linked to extended drying time on the orchard floor due to smoky skies. The fire risk is high this year.
   - Ant bait materials deliver inexpensive and effective ant control. Timing and use practices are critical to successful ant control.
   - Only protein feeding ants (pavement or fire ants) feed on almonds. Check orchards ahead of application timing to make sure that protein feeding ants are present. See monitoring details at: www2.ipm.ucanr.edu/agriculture/almond/Ants.
   - Bait active ingredients differs and so does timing of different products for best results. Clinch or Esteem Ant

Ant damage. Photo credit: Franz Niederholzer

Fire ants on an almond. Photo credit: UC Regents

Bait should go out early (four to eight weeks ahead of shaking, depending on the material) as it takes time for the product to reduce ant activity. Altrevin is a short PHI material that provides rapid knock down of ant activity but provided fewer weeks of ant control than Clinch in UC research conducted by David Haviland, UCCE Entomology Advisor in Kern County.

- Efficacy of ant bait materials is also impacted by how they are used. Ant bait materials work because ants are attracted by the soybean oil in the bait. Rancid soybean oil does not attract ants. Bags open a week or so may have rancid oil and reduced efficacy. Buy new material and use it quickly. Regardless of the material used, wet bait is less effective than dry material. Spread bait several days ahead of irrigation, especially sprinkler irrigation, or wait a day or two after irrigation for best results.

3. **Hull split sprays:** Properly timed and applied hull split sprays reduced nut damage from navel orangeworm (NOW) and peach twig borer (PTB) by about 50%. Check with your PCA about materials and timings. Poorly timed and applied sprays will cost nearly as much as properly timed sprays (material and labor) but the results may be far less — especially in a high pressure year. The first spray should go out when the first nuts in the interior orchard trees (usually in the upper, southwest edge of the canopy) reach 2C stage of hull split (see photo) and the entire orchard sprayed within a week. If you are going to make one worm spray this year, this is the one to do according to David Haviland, UCCE Entomology advisor in Kern County. If a second spray is planned, the recommended timing is for later in July when residue of the first spray is fading, pollinizers are beginning to split and the start of 3rd generation NOW egg laying is approaching. Spraying when relative humidity levels are over 40% and temperatures below 80°F helps reduce evaporation spray loss. Many growers have moved to late evening through mid-morning spray timings. See extensive discussion of hull split spraying in the Time to Consider column in the May/June, 2020 issue of *Almond Facts*.

Night spraying. Photo credit: Franz Niederholzer

Other pest considerations this time of year include spider mites, summer diseases and rodents.

With drought conditions up and down the state, mite pressure should be up this year. Beneficial insects, particularly six-spotted thrips, and predatory mites can help control spider mites during these months ahead of harvest dry down. Knowing the balance of mites to predators in an orchard is key to limiting costs while avoiding leaf damage and crop reduction.

Monitor for spider mites and predators through May and June. There is no need to count mite numbers on a leaf, just note if there are spider mites and/or predators on each of 15 leaves per tree from five trees. Details on mite monitoring, including a printable, sampling form to record pest and predator levels is available at: ipm.ucanr.edu/PMG/C003/m003fcspdmites02.html. Information on the biology of mites along with options for control materials is available at: www2.ipm.ucanr.edu/agriculture/almond/webspinning-spider-mites.

There is no rain in the forecast as I write this, but disease infections following sudden late spring and/or summer storms are an annual concern. In particular, rust infections can produce leaf loss at harvest and extend nut drying

time, risking increased ant damage to the crop and delaying needed irrigation. See the latest version of UC IPMs Fungicide Efficacy and Timing Tables for almonds at the end of the bloom newsletter at: cesutter.ucanr.edu/newsletters/Pomology_Notes88311.pdf.

May and June is an important time for hull rot control. This damaging condition, caused by several different pathogens, requires use of several control approaches for the best results. Orchards where Monilinia hull rot infections are common should be sprayed with an effective fungicide three to four weeks ahead of hull split, usually in early June. Where Rhizopus or Aspergillis pathogens cause hull rot during early hull split, an integrated program including adequate, not excessive, orchard N status (not more than 2.5% leaf N in July samples), mild water stress in early hull split (think hard about this practice in a drought year) and a fungicide spray tank-mixed with the first hull split spray (2C hull split stage) delivers best results.

Keep up gopher and squirrel control. Info on biology and control of both at: ucanr.edu/sites/vpce.

Finally, June is a good time to prep equipment and your operation for harvest. Equipment maintenance, stockpile site prep, and employee education and training are key topics. Dust reduction education information is available in English and Spanish at: www.almonds.com/almond-industry/orchard-management/harvest/dust-reduction.

Best wishes for clear skies and a safe end of spring/early summer for all.

Franz Niederholzer, UCCE Farm Advisor, Colusa and Sutter/ Yuba Counties

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