

ALMOND SUSTAINABILITY 2020

GROWING GOOD





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DEFINING SUSTAINABILITY

for California Almonds

Sustainability requires balancing the needs of people, profit and the planet. While there is no one-size-fits-all approach, California almond farmers are committed to evolving their practices and continuously challenging themselves to do more. ■

In 2005, the California almond community created and adopted a formal definition of sustainability specific to almonds.

SUSTAINABLE ALMOND FARMING UTILIZES PRODUCTION PRACTICES THAT ARE ECONOMICALLY VIABLE AND BASED UPON SCIENTIFIC RESEARCH, COMMON SENSE AND A RESPECT FOR THE ENVIRONMENT, NEIGHBORS AND EMPLOYEES. THE RESULT IS A PLENTIFUL, HEALTHY AND SAFE FOOD PRODUCT.



PEOPLE

More than **90%** of California almond farms are **family farms**¹

96% of California almond farmers and processors give back by participating in organizations, programs or boards that support **community well-being**²



PLANET

California is one of five places on earth with **the ideal Mediterranean climate** needed to grow almonds.

Almond farmers are improving their practices and reducing impacts through 47 years of Almond Board of California-funded research with a total investment of **\$95 million** and **4 sustainability goals**.



PROFIT

Almond production supports California's economy by **creating 110,000 jobs statewide**³

The almond community **adds \$9.2 billion dollars** to California's GDP, generating \$19.6 billion in gross revenue³

1. United States Department of Agriculture. 2012 Agricultural Census.

2. California Almond Sustainability Program. November 2020.

3. University of California Agricultural Issues Center. The Economic Impacts of the California Almond Industry. August 2020.



When you grow a healthy food people love, you have to do it right.

RESPONSIBLY GROWING A BETTER FUTURE

Backed by research, we use science to guide our sustainability journey. Since 1973, the Almond Board of California (ABC) has supported nearly 700 research projects on the industry's behalf, working with independent experts and leading universities to uncover the positive impact of almonds on human health, improve food safety and optimize farming practices.

And our work doesn't stop there. Collaborating with university extension programs, nonprofit partners and others, ABC staff is dedicated to sharing best practices with almond farmers and processors and providing support as they continue to improve their farming practices.

Throughout this document, you'll see evidence of that momentum across several different topic areas. Look for the "Work in Progress" features for how the almond community is making headway on initiatives like the Almond Orchard 2025 Goals and supporting pollinator health. ■



MEET KENT STENDERUP
CHAIR OF THE ALMOND BOARD OF CALIFORNIA + ALMOND FARMER, ARVIN, CA

"The almond community is thinking not just to 2025, but beyond that for our kids and the environment. Our focus is on our future. We are in a growth stage, but we also know that must be done responsibly."

ALMOND ORCHARD 2025 GOALS

California's almond farmers and processors are leading by example and paving the way for improvements across agriculture and a healthier planet.



FURTHER REDUCING THE WATER USED TO GROW ALMONDS

Between the 1990s and 2010s, almond farmers reduced the amount of water needed to grow a pound of almonds by 33% with improved production practices and adoption of efficient microirrigation technology.¹ **By 2025, the California almond community commits to reduce the amount of water used to grow a pound of almonds by an additional 20%.**



ACHIEVING ZERO WASTE IN OUR ORCHARDS

The nutritious almonds we eat grow in a shell, protected by a hull, on a tree: products traditionally used for livestock bedding, dairy feed and electricity generation. Today the almond community is spurring innovation for higher-value and more sustainable uses, with promising research in the areas of recycled plastics, fuel and more. **By 2025, the California almond community commits to achieve zero waste in our orchards by putting everything we grow to optimal use.**



INCREASING ADOPTION OF ENVIRONMENTALLY FRIENDLY PEST MANAGEMENT TOOLS

Responsible almond farming requires protecting the crop and trees from bugs, weeds and disease through an integrated pest management approach. This means using tools and techniques like beneficial insects, habitat removal and mating disruption, as well as monitoring pest levels so that pesticides are used only when necessary. To further protect our orchards, employees and communities, **by 2025, we commit to increase adoption of environmentally friendly pest management tools by 25%.**



IMPROVING LOCAL AIR QUALITY DURING ALMOND HARVEST

California almonds are harvested by shaking the crop to the ground where it dries naturally inside protective hulls and shells before being swept up and collected, a process that creates dust in the local area. To address this nuisance, the almond community is taking short- and long-term steps to reimagine how we harvest and, **by 2025, commits to reduce dust during harvest by 50%.**



WANT TO LEARN MORE? Visit Almonds.com/2025Goals for the latest, including the *Almond Orchard 2025 Goals Roadmap*.

1. University of California, 2010. Food and Agriculture Organization of the United Nations, 2012. Almond Board of California, 1990-94, 2000-14.



CALIFORNIA ALMOND SUSTAINABILITY PROGRAM

TRACKING PROGRESS

In 2009, we established the California Almond Sustainability Program (CASP) to educate almond farmers and processors about best practices as well as gain insights about how they farm collectively. CASP functions through self-assessments in which participants answer questions about their practices across the spectrum of almond farming topics. This information provides data about how California almonds are grown and the adoption of best practices while highlighting opportunities for improvement.

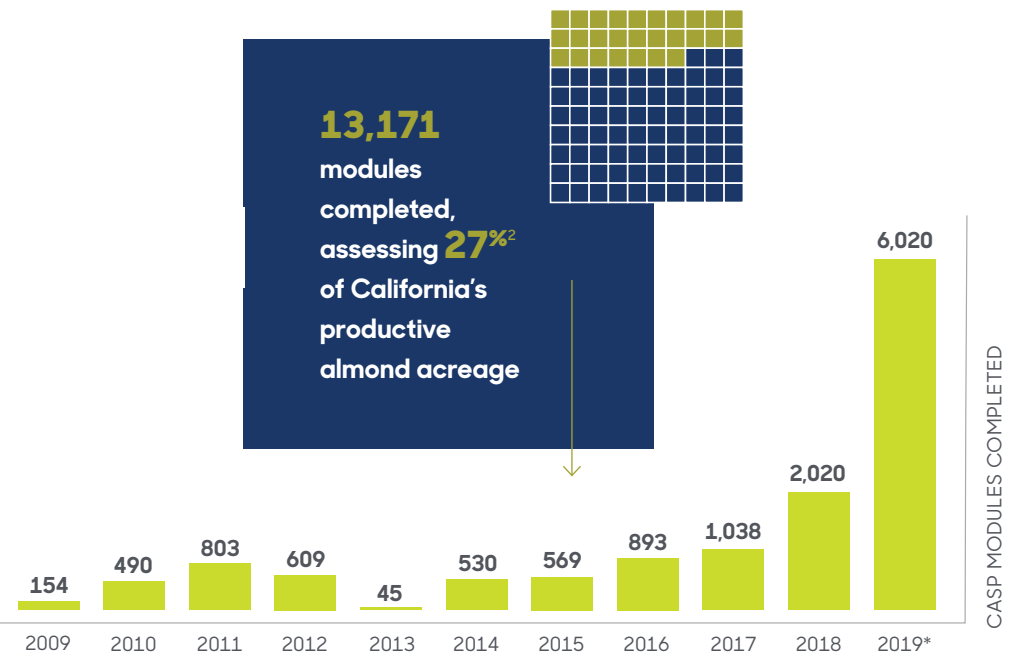
CASP also plays an important role in measuring progress toward the Almond Orchard 2025 Goals, providing baselines and metrics for many of those initiatives.

LINKING BEYOND ALMONDS

In response to increasing questions from buyers and retailers about how almonds are grown, ABC launched the CASP Supply Chain Program this year, linking farmers' CASP assessments with their almond processor. This provides processors with aggregated sustainability information about how the almonds they handle are grown. Currently 10% of California's almond processors are utilizing the CASP Supply Chain Program!

SAI GLOBALLY RECOGNIZED

Benchmarked gold-level equivalent against the Sustainable Agriculture Initiative Platform's Farm Sustainability Assessment (FSA), CASP provides a tool and common language to translate the practices relevant to growing almonds in California to general sustainable farming practices. Of the farms that have measured their individual practices against the FSA through CASP, 83% are silver-level equivalent or better, indicating top sustainability performance! ■



9 SELF-ASSESSMENT MODULES

1. Irrigation management
2. Nutrient and soil management
3. Pest management
4. Air quality
5. Energy efficiency
6. Bee health and pollination
7. Financial management
8. Ecosystem management
9. Workplace and communities

2 CALCULATORS

1. Irrigation scheduling
2. Nitrogen budgeting

1,310 schedules and budgets created, supporting on-farm decision-making

2,031 farmers, field managers, applicators and others attended CASP events in 2020

39 WORKSHOPS AND EVENTS

- Orchard workshops
- Individualized on-farm visits

"Virtual Tailgates" and digital "Lunch and Learns"

Adapting to COVID-19, ABC staff and partner organizations went virtual. Given the great success of those events, CASP will be offering a mix of virtual and in-person events going forward to best meet participants' needs.

MEET MALLVINDER KAHAL

ALMOND FARMER, MERCED, CA

"The big benefit for farmers is that CASP doesn't require them to go find this information. It provides farmers with the tools to learn about sustainability and ultimately grow almonds in a more sustainable way."



ALMOND ORCHARD
2025 GOALS

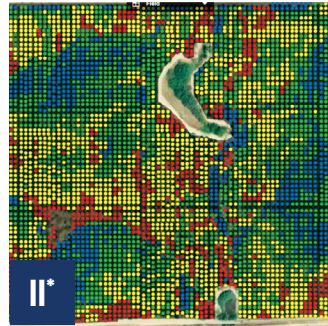
REDUCING THE AMOUNT OF WATER NEEDED TO GROW A POUND OF ALMONDS BY 20%



WATER



I



II*



III



IV

WORK IN PROGRESS: THESE PROJECTS AND PRACTICES ILLUSTRATE THE CALIFORNIA ALMOND COMMUNITY'S COMMITMENT TO WATER STEWARDSHIP.

I. MOBILE FIRST:

Many in-field sensors (soil moisture, weather, etc.) report data directly to farmers' phones and tablets, sharing real-time performance and reducing the need to visit each field to observe conditions. More advanced systems allow farmers to turn off and on irrigation systems remotely, increasing precision.

II. WATER STRESS MAPPING:

Using a mix of aerial imagery and other inputs, some farmers are taking a high-tech approach to monitoring irrigation system performance and tree health. Maps help farmers spot stress zones in their orchards, illustrating where adjustments can be made for improved efficiency and yields.

III. IRRIGATION SYSTEM MAINTENANCE:

In partnership with local Resource Conservation Districts, the extension arm of California's Department of Conservation, ABC is helping farmers get back to basics, ensuring their irrigation systems are performing efficiently, without leaks and delivering water evenly across the farm.

IV. ON-FARM SUPPORT:

ABC's Field Outreach and Education team provides boots-on-the-ground support for California almond farmers, meeting one-on-one to provide training and technical information and share best practices. ■

ON-FARM IMPROVEMENTS

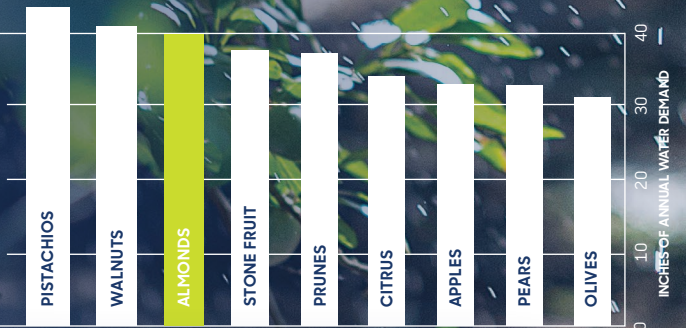
With its Mediterranean climate, California is one of the five places on earth where almonds can grow, so it's our responsibility to use water in the most sustainable way possible. California is our home, too, and we are committed to taking care of it.

That's why, between the 1990s and 2010s, we reduced the amount of water used to grow each pound of almonds by 33% thanks to improved production practices and adoption of efficient microirrigation technology.¹ Today, 85% of California almond farms use microirrigation,² nearly two times the rate of California farms overall.³

We know there is still more to be done, and that's why we're doing it. In addition to a commitment to an additional 20% reduction, the almond community is also working to improve groundwater sustainability for all Californians. Research has shown that 675,000 acres of California almond orchards have soil suitable for groundwater recharge.⁴ Combined with access to excess stormwater in wet years, these farms would be good sites for replenishing underground aquifers, California's largest water storage system. ■

ANNUAL WATER NEEDS OF CALIFORNIA TREE CROPS⁵

All food takes water to grow, and **ALMONDS** are no exception.



While almond trees use around the same amount of water as other fruit and nut trees,⁵ **plants require more energy, and thus more water, to create protein than sugars⁶**. So though nuts need more water than fruits and vegetables, they are also rich in essential nutrients, good fats and protein.

MEET LINDA MARKARIAN GAVORIAN
ALMOND FARMER, FOWLER, CA

"While my family has been farming for generations, I'm new to almonds. ABC's Field Outreach and Education team came out to check our irrigation system. We were having issues with our water efficiency, but after a few small changes, we had systemwide improvements."



1. University of California, 2010. Food and Agriculture Organization of the United Nations, 2012. Almond Board of California, 1990-94, 2000-14. 2. California Almond Sustainability Program. November 2020. 3. California Department of Water Resources. California Water Plan Update. 2013. 4. Land IQ. Groundwater Recharge Suitability Analysis. November 2015. 5. Larry Schwankl, et al. Understanding your orchard's water requirements. University of California, Division of Agriculture and Natural Resources. Publication 8212. 2010. 6. Nathalie Munier-Jolain, et al. Are the carbon costs of seed production related to the quantitative and qualitative performance? An appraisal for legumes and other crops. Plant, Cell & Environment. Volume 23, Issue 11. 2005.

* Imagery provided by Ceres Imaging

ALMOND ORCHARD
2025 GOALS

ACHIEVING ZERO WASTE
IN OUR ORCHARDS BY
PUTTING EVERYTHING
WE GROW TO
OPTIMAL USE



WORK IN PROGRESS:
THESE PROJECTS AND
PRACTICES ILLUSTRATE
THE CALIFORNIA
ALMOND COMMUNITY'S
COMMITMENT TO
ZERO WASTE.

ZERO WASTE



I. WHOLE ORCHARD RECYCLING:

At the end of their productive lives, whole almond trees are ground up and incorporated back into the soil, a regenerative agriculture approach that improves soil health, boosts water efficiency, increases yields and reduces greenhouse gases¹

II. POULTRY FEED:

Almond hulls can feed animals big and small, and new research has found they are a source of good nutrients for chickens². Further testing is underway to see if feeding antioxidant-rich hulls can combat a common disease in broilers and improve egg yolk composition from layers.

III. SOIL AMENDMENTS:

A common practice in broccoli farming, plowing under plant remains after harvest, improves soil quality but can also leach nitrogen into the groundwater. New research shows that adding almond shells to the soil can immobilize that nitrogen as well as increase yields in subsequently planted crops³

IV. RECYCLED PLASTICS:

Using a process known as torrefaction, almond shells can be transformed into a charcoal-like material and mixed with recycled plastics, making them stronger and more heat stable. If this can be scaled beyond the lab, it increases our ability to recycle existing plastic, resulting in less new plastic in the world!⁴ ■

CLIMATE-SMART AGRICULTURE

Finding ways to reduce our environmental footprint while adding value is at the heart of almond farming, ensuring farmers can grow a better future for their families, communities and the planet. So when we say zero waste, we mean using everything we grow to make the world a better place.

The nutritious almonds we eat grow in a shell, protected by a hull, on a tree—coproducts traditionally used for livestock bedding, dairy feed and electricity generation. With 85 studies funded to date, new research is exploring optimized uses where every byproduct is an input for another product or valuable in its own right.

Focusing on approaches that are a win-win for farmers and the planet, benefits of some ideas being explored are:

- Improving soil health by utilizing regenerative agriculture principles
- Addressing climate change by storing carbon in the soil
- Improving crop yields and water use efficiency
- Protecting groundwater quality
- Offsetting the need to grow other crops (and thus reducing the resources needed to grow them)

CARBON SEQUESTRATION

Farms that use whole orchard recycling sequester 2.4 tons of carbon per acre¹...



...equivalent to living car-free for a year⁵

MEET MANUEL CONDE
ALMOND FARMER, OAKDALE, CA

"I believe everything you take to grow a tree needs to be put back into the earth. Whole orchard recycling is better for the earth, meaning I can leave it better for the next generation."



1. Emad Jahanzad, et al. Orchard recycling improves climate change adaptation and mitigation potential of almond production systems. PLoS ONE. March 2020. 2. Woo Kyun Kim, et al. Effect of almond hull as an alternative ingredient on broiler performance and nutrient digestibility. Poultry Science Association 108th Annual Meeting. 2019. 3. Joji Muramoto, et al. Mobilizing mineralized nitrogen from cole crop residues using organic amendments. Final report to California Specialty Crop Block Grant Program. 2019. 4. Zach McCaffrey, et al. Recycled polypropylene-polyethylene torrefied almond shell biocomposites. Industrial Crops and Products. 2019. 5. Seth Wynnes, et al. The climate mitigation gap: education and government recommendations miss the most effective individual actions. Environmental Research Letters. 2017.



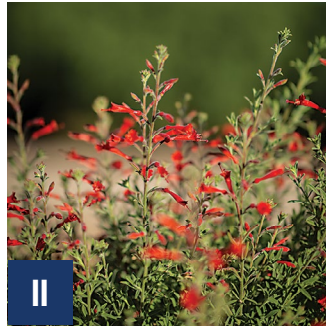
PROTECTING HONEY BEE HEALTH AND EXPANDING ON-FARM POLLINATOR HABITAT



BEE HEALTH



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III



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WORK IN PROGRESS: THESE PROJECTS AND PRACTICES ILLUSTRATE THE CALIFORNIA ALMOND COMMUNITY'S COMMITMENT TO IMPROVING POLLINATOR HEALTH.

I. BEE+ SCHOLARSHIP:

New in 2020, ABC offered 100 farmer scholarships to offset the cost of blooming cover crop seeds through Project Apis m.'s Seeds for Bees program. It also covered the cost of Bee Friendly Farming certification through the Pollinator Partnership, creating momentum for future years.

II. FLORAL DIVERSITY:

To add diversity of pollen and nectar available on farms, some almond farmers are planting blooming cover crops and hedgerows near or within almond orchards. These plants also support honey bee health and provide food sources for native pollinators.

III. BEE RESEARCH COALITION:

ABC brings together government and nonprofit organizations that support bee health research on a regular basis. The goal? Coordinating our collective efforts to find solutions to persistent hive health challenges and increasing access to quality foraging opportunities for honey bees.

IV. IN-FIELD BEEKEEPER SUPPORT:

Through ABC, almond farmers have been a longstanding supporter of the Bee Informed Partnership's Tech Transfer Teams. These highly trained field agents work with U.S. beekeepers to monitor hives and advise on pest and disease best practices, supporting bee health year-round. ■

BEE-FRIENDLY ORCHARDS

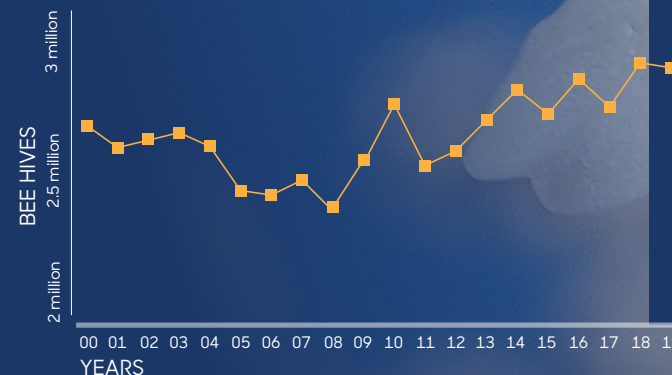
Honey bees and almonds are a partnership designed by nature. When almond trees bloom, honey bees get their first nutritious food source¹ of the year as they pollinate our orchards, consistently leaving stronger than they arrive². While bees are only with us for two months of the year, we work to support their health for all twelve.

We've been leading bee health research efforts since 1995 so farmers can confidently provide a safe habitat for bees before they move on to pollinate other crops. In collaboration with partners beyond our industry, our Honey Bee Best Management Practices serve as a guide to all of agriculture for protecting pollinator health on-farm. And by planting blooming cover crops and hedgerows, farmers are working to add supplemental nutrition and habitat for all pollinators.

What's more, we're working with others to solve the challenges bees face. While those are complex – varroa mites, other pests and diseases, lack of floral resources, limited genetic diversity and pesticide exposure – we know by partnering together, we can find real solutions. ■

THE NUMBER OF HONEY BEES IN THE U.S. REMAINS STEADY³

However, beekeepers experience significant in-season losses and must work hard to keep hives healthy.



BLOOMING COVER CROPS MEAN HEALTHIER BEES, SOILS AND FARMS.

Since 2013, almond farmers have planted **41.2K ACRES** of bee pastures in partnership with bee nonprofit Project Apis m.⁴



MEET CHRISTINE GEMPERLE
ALMOND FARMER, TURLOCK, CA

"As an almond farmer and a hobbyist beekeeper I am acutely aware of how these two biosystems are connected. I am passionate about planting forage to strengthen bee colonies, providing habitat for beneficial insects and native pollinators and building soil health, which increases water holding capacity. It's just one of the hundreds of climate-smart ag practices that can contribute to the solution for climate change – and help bees along the way."

1. Ramesh Sagili. Department of Horticulture, Oregon State University. 2. Ellen Topitzhofer, et al. Assessment of Pollen Diversity Available to Honey Bees in Major Cropping Systems During Pollination in the Western United States. Journal of Economic Entomology. 2019. 3. USDA-NASS. Honey Production Report. 2000–2019. 4. Billy Synk. Director of Pollination Services. Project Apis m. November 2020. Represents total plantings from 2013–present.

ALMOND ORCHARD
2025 GOALS

INCREASING ADOPTION OF ENVIRONMENTALLY FRIENDLY PEST MANAGEMENT TOOLS BY 25%



PEST MANAGEMENT



WORK IN PROGRESS: THESE PRACTICES ILLUSTRATE THE CALIFORNIA ALMOND COMMUNITY'S COMMITMENT TO IMPROVING PEST MANAGEMENT.

I. WINTER SANITATION:

Farmers use this approach to control navel orangeworm (NOW), the primary pest of almonds. By removing any nuts left on the trees after harvest, they eliminate the winter food source for NOW larvae, reducing the number of insects that take flight the following spring.

II. MATING DISRUPTION:

New technology is allowing farmers to interrupt the mating cycle of NOW moths during the spring and summer months, reducing their numbers. This approach utilizes pheromones that confuse male moths, making them unable to find females and mate. ■

As multigenerational farmers, many of whom live, work and raise their families on the land, farming responsibly is the top priority for almond growers. Regarding pest management, this means protecting the orchard from bugs, weeds and disease with an integrated set of tools that reduce reliance on pesticides. Using techniques like beneficial insects, habitat removal, mating disruption and monitoring of pest levels, this approach ensures pesticides are used sparingly and only if necessary. It also makes good economic sense for farmers, reducing input costs and improving effectiveness. ■



MEET GARRETT BOWMAN
ALMOND FARMER, MODESTO, CA

"We live on the farm, we drink the groundwater, our kids play in the orchard, they climb the trees. So it's important to me to farm in an ethical manner, a sustainable manner, in a way that will allow my kids to continue to farm in the years to come."

ALMOND ORCHARD
2025 GOALS

REDUCING DUST DURING ALMOND HARVEST BY 50%



AIR QUALITY



WORK IN PROGRESS: THESE PROJECTS AND PRACTICES ILLUSTRATE THE CALIFORNIA ALMOND COMMUNITY'S COMMITMENT TO IMPROVING AIR QUALITY.

I. LOW-DUST EQUIPMENT:

In recent years, equipment manufacturers have designed low-dust sweepers and harvesters, but buying new equipment has cost implications for farmers, many of whom are small family operations. Partnering with allied organizations, ABC helped develop federal and state incentives to offset costs.

II. OFF-GROUND HARVEST:

The almond community is exploring off-ground harvest, which could have several benefits for farmers, as well as significantly reduce harvest-related dust that can impact local communities. Researchers and farmers are experimenting by testing equipment and drying options used by different farming regions around the world. ■

California almonds are harvested by shaking the crop to the ground where it dries naturally in the sun inside protective hulls and shells. While less labor intensive than previous harvest methods, the process of mechanically picking up the crop creates dust in the local area. To address this nuisance, the almond community is taking short- and long-term steps to reimagine how we harvest. ■



MEET SEBASTIAN SAA
ASSOCIATE DIRECTOR OF AGRICULTURAL RESEARCH, ABC

"We are excited to continue our journey that started back in the early 2000s with developing best management practices to reduce dust. This has evolved into collaborating with the local air district to develop incentives and with equipment manufacturers to understand how we can harvest almonds without producing dust."

MORE ON ALMOND SUSTAINABILITY AT:



AlmondSustainability.org
Additional information about how the almond community is growing good



Almonds.com/2025Goals
Home to the Almond Orchard 2025 Goals and progress underway to achieve them



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The latest on almond sustainability in 280 characters or less



Almonds.com/Magazine
Sort by "Growing Good" for profiles, news, features and more



SustainableAlmondGrowing.org
Online portal for California Almond Sustainability Program participants



Almonds.com/ResearchDatabase
Reports from nearly 50 years of almond farming and environmental research

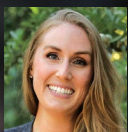
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