

ALMOND SUSTAINABILITY 2021

GROWING GOOD



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SUSTAINABILITY REPORT

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WHAT IS SUSTAINABILITY FOR CALIFORNIA ALMONDS?

Sustainability means balancing the needs of people, profit and the planet for a positive impact. 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 collaboratively defined what sustainability means for California 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

Of California's **7,600** almond farms, **90% are family farms**,² many owned and operated by 3rd and 4th generation farmers who **live on the land** and plan to pass it down to their children.

88% of California almond farmers and processors **give back** by participating in organizations, programs or boards that **support community well-being**.³



PROFIT

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

The almond community **adds \$9 billion** to California's GDP, generating \$19.6 billion in gross revenue.⁴



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 via **4 sustainability goals** and **48 years** of Almond Board of California-funded research with a total investment of **\$102 million**.

DID YOU KNOW?

An acre of irrigated farmland in California



produces

58-70X LESS

greenhouse gas



than an acre of urban land.¹

1. American Farmland Trust. A new comparison of greenhouse gas emissions from California agriculture and urban land uses. May 2015.
2. United States Department of Agriculture. 2017 Agricultural Census. 3. California Almond Sustainability Program. November 2021.
4. 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.



MEET BRIAN WAHLBRINK

CHAIR OF THE ALMOND BOARD OF CALIFORNIA + ALMOND FARMER, ROBERTS FERRY, CA

"Farming almonds in California is really important to my family and our legacy. My wife and I have two kids. And as an industry made up largely of family farms, my hope for them is similar to that of a lot of farmers here: that my children can grow up and have something they can be proud of, something they can build on, continue to improve upon and pass down to future generations."

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 718 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, providing support as they continue to improve their practices.

Throughout this document, you'll see evidence of that momentum across several different topic areas. Look for the "Work in Progress" features on each page for how farmers are making headway against initiatives like the Almond Orchard 2025 Goals and supporting pollinator health as they grow climate-smart almonds. ■



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 technology¹

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, mating disruption and monitoring pest levels so that pesticides are used sparingly and only if 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.



SUPPORTING ON-FARM STEWARDSHIP

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 where 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.

INDUSTRY OUTREACH

Supporting on-farm stewardship is a key component of CASP. Helping to transfer knowledge from research trials to farmers' fields, the Almond Board's Field Outreach and Education team hosts in-orchard workshops and conducts one-on-one orchard visits. Adjusting to the COVID-19 pandemic, the team also launched a popular virtual Training Tuesday series, connecting farmers, processors and their advisers with research experts.

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 gold- or silver-level equivalent, 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

1,519 schedules and budgets created, supporting on-farm decision-making

38 WORKSHOPS AND EVENTS

- Socially distanced on-farm visits
- Virtual Training Tuesdays

1,500+ farmers, field managers, applicators and others attended CASP events in 2021



MEET JAY KROEKER

ALMOND FARMER, SHAFTER, CA

"With all the challenges farmers face, we need all the support we can get. I can't read every research paper on almond farming so the workshops and education programs supporting farmers like me are invaluable—helping simplify and summarize what I can do on my farm to be more efficient and sustainable."

1. California Almond Sustainability Program, November 2021. 2. 37% represents the amount of California almond acreage where one or more CASP self-assessment modules have been completed. 3. Each assessment year begins November 1 for the year listed and ends October 31 of the following year matching the annual almond crop cycle.

ALMOND ORCHARD 2025 GOALS

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



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

WATER



I



II



III



IV

I. PRECISION IRRIGATION RESEARCH: HOW MUCH

Today, farmers use technology to make informed estimates of how much water their trees need. To move from estimates to actuals, farmer-funded research is evaluating existing and developing new remote sensing technology that can quantify how much water the trees are using in real time. Validating these will mean quicker adoption on-farm and ensures the best technology is used by the private sector.

II. PRECISION IRRIGATION RESEARCH: WHEN

Like the "how much" focus area, researchers are testing different tree sensors to help farmers make more precise decisions on when to irrigate. These sensors are like Fitbits for trees and can tell farmers precisely when they need to irrigate to avoid hurting crop yields and tree health.

III. PRECISION IRRIGATION RESEARCH: WHERE

By combining "how much" technology with different types of spatial imagery, researchers are creating and validating tools that assess variability within individual orchards, accounting for things like crop yields, soil type, tree varieties and plant health. With this, farmers and irrigation companies will be able to design irrigation systems that can meet hyper-local needs and conserve water.

IV. ON-FARM IMPROVEMENTS

While ABC's research partners advance irrigation science, those results are only as useful as their adoption on-farm. That's a core focus of ABC's Industry Outreach program, which released two new farmer resources this year: a step-by-step guide on best practices and a cost-benefit tool for irrigation system maintenance.

GROWING FOOD IN A CHANGING CLIMATE

With its Mediterranean climate, known for both droughts and floods, California is one of the five places on earth where almonds can grow. As climate change makes California more susceptible to water scarcity, it's our responsibility to use its limited water in the most sustainable way possible.

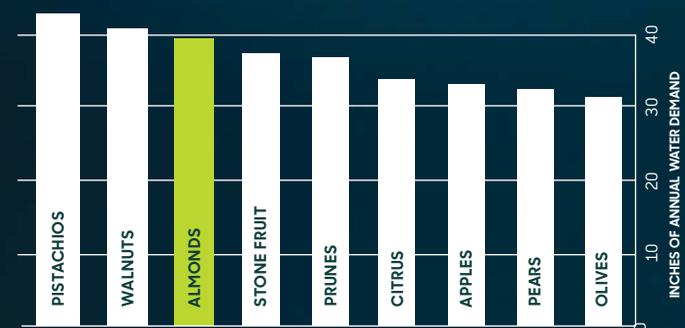
What sets almonds apart is that we have innovated and learned to use water with ever-increasing precision, which improves water use across all of agriculture. What's more, the water used to grow almonds also grows hulls, shells and trees, items that feed dairy cows, provide livestock bedding, capture carbon and create oxygen. California is our home too, and we are committed to taking care of it.

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 In the past ten years we've been working on further reductions with a goal of an additional 20% reduction by 2025. Today 82% of almond farms use microirrigation,² nearly two times the rate of California farms overall.³

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 are good sites for replenishing underground aquifers, California's largest water storage system. ■

ALL FOOD TAKES WATER TO GROW, AND ALMONDS ARE NO EXCEPTION



ANNUAL WATER NEEDS OF CALIFORNIA TREE CROPS⁵

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 sugars.⁶** So while nuts need more water than fruits and vegetables, they are also rich in essential nutrients, good fats and protein.



**MEET MATT
ANGELL**

ALMOND FARMER,
MADERA, CA

"I look at myself as a 'HERO' farmer—that is a High Efficiency Resource Operator. A HERO farmer carefully and efficiently uses resources to create a nutrient-rich food, with the least amount of impact on the environment. In drought years or not, water is a precious resource and I'm doing everything in my power to be as efficient as possible."

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 2021. 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.

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



II



III



IV

I. MARKET ASSESSMENT

Working toward the goal of optimal use, ABC is assessing the value proposition of new product streams for almond hulls and shells. This represents a shift from research to market development, taking promising ideas out of the lab and into the real world.

II. WHOLE ORCHARD RECYCLING

At the end of their productive lives, whole almond trees are ground up and incorporated back into the soil, a regenerative technique that improves soil health, water efficiency and yields. Farms that use whole orchard recycling capture 2.4 tons of carbon per acre,¹ equivalent to living car-free for a year.²

III. DAIRY FEED

Almond hulls are the #1 farm byproduct fed to California's dairy cows.³ They provide 5-9% of cows' daily ration but could be used for up to 20%, reducing the need to grow other feed crops and their associated land, water and greenhouse gas impacts.

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

1. Emad Jahanzad, et al. Orchard recycling improves climate change adaptation and mitigation potential of almond production systems. *PLoS ONE*. 2020.
 2. Seth Wynes, et al. The climate mitigation gap: education and government recommendations miss the most effective individual actions. *Environmental Research Letters*. 2017.
 3. Scott Somerville, et al. By-product use in California dairy feed has vital sustainability implications. *Agricultural and Resource Economics Update*. Giannini Foundation of Agricultural Economics, University of California. 2020.
 4. Zach McCaffrey, et al. Recycled polypropylene-polyethylene torrefied almond shell biocomposites. *Industrial Crops and Products*. 2019.
 5. Hannah Ritchie, et al. Environmental impacts of food production. *Our World in Data*. 2020.
 6. Alissa Kendall, et al. Life cycle-based assessment of energy use and greenhouse gas emissions in almond production. Part 1: Analytical framework and baseline results. *Journal of Industrial Ecology*. 2015.
 7. Joseph Poore, et al. Reducing food's environmental impacts through producers and consumers. *Science*. 2018.

CLIMATE-SMART AGRICULTURE

Packed with plant-based goodness, California almonds are a responsibly grown, zero waste food and an important part of a low-carbon diet⁵

Like forests, almond orchards capture and store carbon dioxide over their 25-year lifespans. And from a zero waste perspective, using everything the orchard grows (hulls, shells and woody biomass) offsets the carbon emissions of other industries. A life cycle assessment of California almonds found that current farming practices, coupled with coproduct use and the carbon captured by almond trees, offset about 50% of almond farming's carbon emissions⁶ With further production improvements and policy changes, almond farms could be carbon neutral, or even carbon negative.

What's more, some of those improvements are already underway. From the widespread adoption of whole orchard recycling, a regenerative practice that captures the same amount of carbon per acre as what you'd save by living car-free for a year, to planting blooming cover crops that improve soil health while creating pollinator habitat, almond farmers are working to be part of the solution. ■



MEET SECRETARY KAREN ROSS

SECRETARY, CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE

"The almond community is paving the way for other tree nut and fruit growers in climate-smart agriculture. I have great enthusiasm and passion for what the almond community's leadership means for all California agriculture."



MEET ALISSA KENDALL

LIFE CYCLE ASSESSMENT RESEARCHER, UNIVERSITY OF CALIFORNIA, DAVIS

"Based on their life cycle assessment, California almonds have a low carbon footprint relative to other nutrient-dense and energy-dense foods."

POLLINATORS

PROTECTING HONEY BEE HEALTH AND EXPANDING ON-FARM POLLINATOR HABITAT



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



I. CALIFORNIA POLLINATOR COALITION

This spring ABC led the development and launch of the California Pollinator Coalition with the California Department of Food and Agriculture and international nonprofit Pollinator Partnership. Joined by 20+ organizations representing most of California's farmland, the coalition is expanding pollinator habitat and finding solutions to bee health challenges.

II. BEE+ SCHOLARSHIP

Continued in 2021, ABC distributed another 100 farmer scholarships offsetting the cost of wildflower seeds through Project Apis m.'s Seeds for Bees program and Bee Friendly Farming certification through the Pollinator Partnership. In total this has enabled 200 farms to improve local habitats and biodiversity.

III. 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 use best practices, supporting bee health year-round.

IV. ON-FARM BIODIVERSITY

Since 2013 the Project Apis m. Seeds for Bees program has helped farmers add pollinator habitat to more than 95,000 acres of almond orchards¹ These plantings provide food sources for honey bees and native pollinators as well as improve carbon sequestration, soil health, water infiltration and more.

1. Billy Synk, Director of Pollination Services, Project Apis m. November 2021. Represents total plantings from 2013 to present. 2. Ramesh Sagili, Department of Horticulture, Oregon State University. 3. 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. 4. USDA-NASS. Honey Production Report. 1986-2020. 5. JP Tauber, et al. Colony-level effects of amygdalin on honeybees and their microbes. Insects. 2020.

BEE-FRIENDLY ORCHARDS

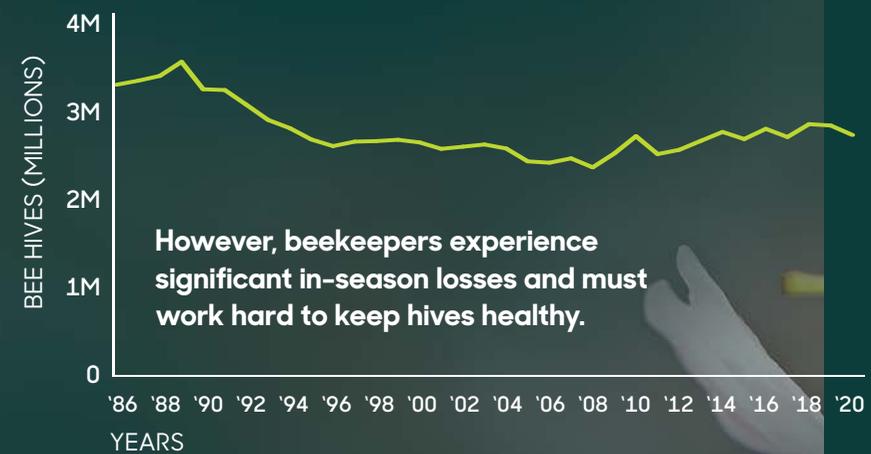
Honey bees and almonds are a partnership designed by nature. When almond trees bloom, honey bees get their first nutritious food source² of the year as they pollinate our orchards, consistently leaving stronger than when they arrived.³ While bees are only with us for two months of the year, we work to support their health for all twelve.

We've been leading bee health research efforts since 1995 so farmers can 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 provide supplemental nutrition and a welcoming 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 STEADY⁴



Pollinating almonds makes bees healthier.

Almond blossom nectar contains a naturally occurring compound, amygdalin, which reduces the viruses and gut parasites that attack bees.⁵



MEET LAURIE DAVIES ADAMS

PRESIDENT AND CEO, POLLINATOR PARTNERSHIP

"The almond industry has really shown itself to be a leader in pollinator health. From launching the California Pollinator Coalition to being recognized with the North American Pollinator Protection Campaign's Business for Bees Sustainability Award, almond farmers are doing the work on the ground too. This year 110,000 acres of almond orchards were certified through our Bee Friendly Farming program, representing 85% of all U.S. farms certified as 'bee friendly,' recognized for providing diverse forage and habitat for pollinators while practicing integrated pest management."

ALMOND ORCHARD 2025 GOALS

INCREASING ADOPTION
OF ENVIRONMENTALLY
FRIENDLY PEST
MANAGEMENT
TOOLS BY 25%



PEST MANAGEMENT



I



II

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

I. PEST ID CARDS

In partnership with University of California researchers, ABC created and distributed pest identification cards with the almond community. This low-tech tool helps farmers identify and monitor common insects and disease in their orchards, monitor beneficial insect populations, and determine if further steps are needed—all part of an integrated approach.

II. BENEFICIAL INSECTS

Think of beneficial insects as good bugs that eat bad bugs that damage almonds or almond trees. By managing the orchard ecosystem to provide a welcoming habitat for beneficials, sometimes through planting cover crops between the tree rows, farmers can reduce the need for chemical pest management tools.

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 promotes using pesticides sparingly and only if necessary. It also makes good economic sense for farmers, reducing input costs and improving effectiveness. ■



MEET DANTE ROJAS

PEST CONTROL ADVISER,
LIVINGSTON, CA

"We are continuing to learn how beneficial insects help both farmers and the environment. This is part of the integrated approach I advise farmers to use for pest management. It includes practices to create a healthy environment for beneficial insects, naturally deter harmful pests and in turn use less chemicals."

ALMOND ORCHARD 2025 GOALS

REDUCING DUST
DURING ALMOND
HARVEST BY 50%



AIR QUALITY



I



II

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

I. OFF-GROUND HARVEST

Off-ground harvest would significantly reduce harvest-related dust that can impact local communities and provides other benefits for farmers and processors. Researchers, equipment manufacturers and farmers are testing equipment and drying options, taking the best from different almond-growing regions around the world and adapting them to California orchards.

II. INTERIM MEASURES

In the short term, almond farmers are adopting newer harvest equipment designed to reduce dust. As that shift is happening, farmers are also working to ensure their local communities are aware of dusty conditions next to farms, providing clear signage to alert drivers of harvest activities.

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 BRET SILL

ALMOND FARMER,
SHAFTER, CA

"Being more sustainable in our orchards by using the new low-dust harvest equipment and adjusting existing machinery to keep dust down is very important for our environment, orchards and employees. It is important to us to be progressive and responsible."

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



@GrowingAlmonds
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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



Almond Journey Podcast
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