ALMOND SUSTAINABILITY 2019

GROWING GOOD

california almonds®
Almond Board of California

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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.

SUSTAINABILITY

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.

ECOLOGICALLY SOUND

CALIFORNIA IS ONE OF FIVE PLACES ON EARTH WITH THE MEDITERRANEAN CLIMATE NEEDED TO GROW ALMONDS.

Learning, improving practices and reducing impacts through **46** years of Almond Board-funded research with a total investment of $**89** million and **4** new sustainability goals.

ECONOMICALLY VIABLE

ALMOND PRODUCTION SUPPORTS CALIFORNIA'S ECONOMY BY CREATING 104,000 JOBS STATEWIDE

and adding $**11** billion to California's GDP while generating $**21** billion in gross revenue.[1]

SOCIALLY EQUITABLE

MORE THAN 90% OF CALIFORNIA ALMOND FARMS ARE FAMILY FARMS.[2]

93% of California almond farmers and processors donate their time and money to local organizations.[3]

1. University of California Agricultural Issues Center. The Economic Impacts of the California Almond Industry. December 2014.
2. United States Department of Agriculture. 2012 Agricultural Census. 3. California Almond Sustainability Program. August 2019.

COMMITTED TO CONTINUOUS IMPROVEMENT

SUSTAINABILITY FOR CALIFORNIA ALMONDS SPANS FROM OUR ORCHARDS TO OUR COMMUNITIES TO ALMOND CONSUMERS AROUND THE WORLD.

Built upon a research program founded in 1973, the California almond community is on a sustainability journey, raising the bar on farming and processing practices along the way.

With an investment of $89 million to date, research supported by the Almond Board of California (ABC) encompasses almonds' impact on human health, ensuring food quality and safety and improving farming practices while minimizing environmental impacts. This has built a foundation of continuous improvement that's helping almond farmers grow an economically, environmentally and socially responsible crop.

In addition to supporting research, ABC conducts outreach to share key findings with farmers, processors and other important stakeholders. Working with a range of strategic partners, we achieve success jointly, leveraging allied organizations' strengths and circles of influence. Important partners include universities and extension programs, government agencies, nonprofits, brands and industry organizations.

Meet Holly King

ALMOND FARMER + CHAIR OF THE ALMOND BOARD OF CALIFORNIA

"We've always been focused on minimizing our environmental footprint and being good neighbors—and we have the track record to prove it. But for the first time, we've publicly set goals for how we will farm in the future. We're excited to be embarking on this journey."

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

THE ALMOND ORCHARD 2025 GOALS ARE A TANGIBLE EXAMPLE OF THE CALIFORNIA ALMOND COMMUNITY'S COMMITMENT TO CONTINUOUS IMPROVEMENT.

We're working to grow almonds in better, safer and healthier ways, protecting our communities and the environment.

FURTHER REDUCING THE WATER USED TO GROW ALMONDS

Over the past two decades, almond farmers have successfully reduced the amount of water needed to grow a pound of almonds by 33% via 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

Almonds grow in a shell, protected by a hull, on a tree: products traditionally used for livestock bedding, dairy feed and electricity generation. With changing markets for these coproducts, the almond community is spurring innovation for higher value and more sustainable uses, with promising leads 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 our local communities. 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%.**

MORE AT ALMONDS.COM/2025GOALS

CALIFORNIA ALMOND SUSTAINABILITY PROGRAM

ASSESSING PRACTICES + MEASURING PROGRESS

A sustainability program tailor-made for California almond farmers and processors, the California Almond Sustainability Program (CASP) was established in 2009 to educate participants about responsible practices and obtain information about the farming practices they use, thereby facilitating continuous improvement. Now celebrating its 10-year anniversary, CASP's scope has expanded, playing an important role in measuring progress toward the Almond Orchard 2025 Goals.

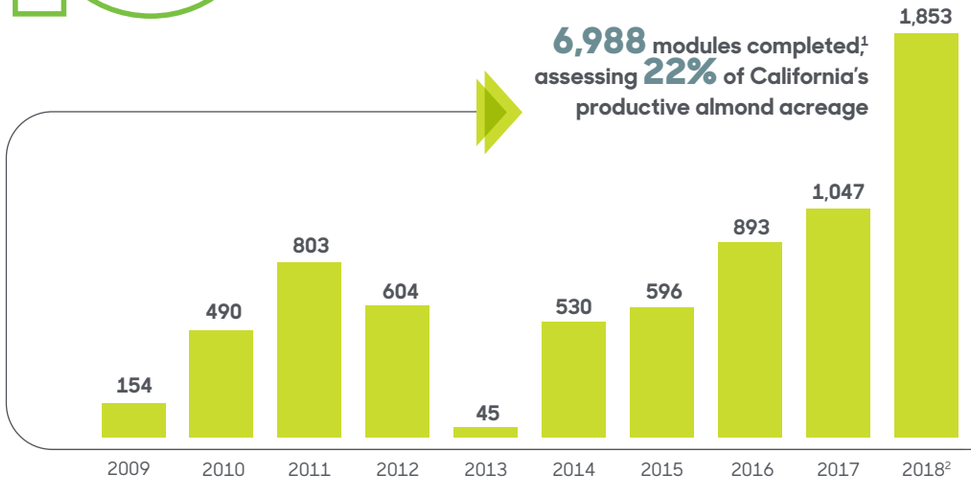
CASP functions through self-assessments in which participants answer questions about their practices across the spectrum of almond farming topics, being reminded of best practices in the process. This information helps tell the story of how California almonds are grown, providing key metrics about the adoption of best practices and highlighting opportunities for improvement.

GLOBALLY RECOGNIZED

Recently benchmarked gold-level equivalent against the Sustainable Agriculture Initiative (SAI) Platform's Farm Sustainability Assessment, CASP's self-assessments provide a tool to translate the practices relevant to growing almonds in California to general sustainable farming practices. Putting almond practices into this larger framework is key to answering sustainability questions from major users of almonds, including ingredient buyers and retailers.

A Decade of Progress

6,988 modules completed,[1] assessing **22%** of California's productive almond acreage



9 SELF-ASSESSMENT MODULES

- Irrigation management
- Nutrient and soil management
- Pest management
- Air quality
- Energy efficiency
- Bee health and pollination
- Financial management
- Ecosystem management
- Workplace and communities

2 ONLINE CALCULATORS

1,051 schedules and budgets created, supporting on-farm decision making

- Irrigation scheduling
- Nitrogen budgeting

WORKSHOPS AND EVENTS

40 events offered in 2019, reaching **1,600** attendees

- Orchard workshops
- Expert lectures
- Lunch + learns
- Individualized on-farm visits

Meet Mel Machado

MEMBER RELATIONS DIRECTOR, BLUE DIAMOND GROWERS

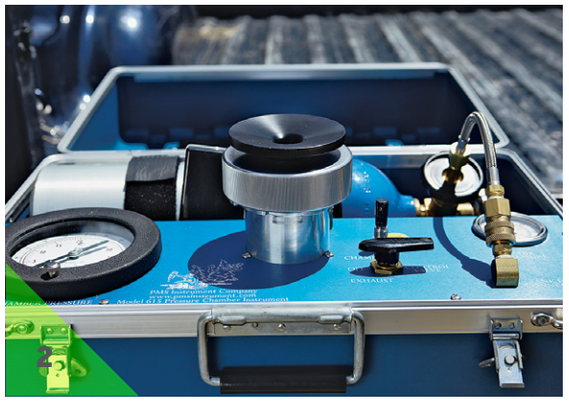
"Our customers and consumers are seeking greater transparency about how almonds are grown. CASP gives us the opportunity to tell that story in a statistically significant way while also providing insights to us about what in-orchard practices and technologies our farmers want to learn more about."

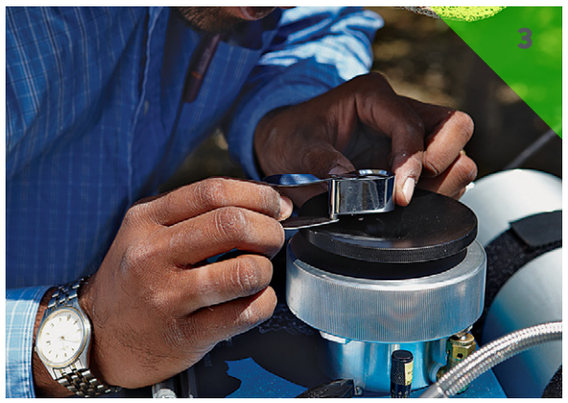
1. Each assessment year begins November 1 for the year listed and ends October 31 of the following year, matching the annual almond crop cycle.
2. Data represents completed assessments through July 31.

SPOTLIGHT ON:

WATER

Making Every Drop Count





PRECISION IRRIGATION TECHNOLOGY: EXPLAINED

One tool almond farmers use to ensure they are irrigating just enough to meet the needs of their trees and the developing crop is the pressure chamber. It tells farmers whether there is sufficient water available in the soil or if the tree is stressed.

HERE'S HOW IT WORKS:

1. A leaf is selected in the lower tree canopy during the middle of the day and placed in a small foil bag.
2. Once removed from the tree, the leaf (still inside the bag) is placed into a small, pressurized chamber.
3. Similar to measuring blood pressure in humans, the machine exerts pressure on the leaf. When water is forced out of the end of the leaf's stem, a pressure reading is taken.
4. The pressure readings correlate with ranges of plant stress that farmers use to determine how "thirsty" their trees are, helping them precisely decide when to irrigate.

On-Farm Improvements

In 1982, the California almond community began investing in research to determine if a new irrigation method—microirrigation—could work in almond orchards. The results were positive and, by targeting water applications directly to the trees' roots instead of uniformly across the field, farmers conserved water and created other operational efficiencies. As this technology was adopted and other farming practices were improved, farmers reduced the amount of water needed to grow a pound of almonds by 33%.[1]

Today 77% of California almond orchards use microirrigation[2] and, as older orchards are replaced, we expect that number to grow. While almond farmers have made great strides in irrigation efficiency, there's more everyone can do. In addition to funding water research—totaling 221 projects to date—ABC and irrigation experts have developed the Almond Irrigation Improvement Continuum. Supported by dedicated ABC staff, the Continuum outlines a path to improvement for every almond farmer in five key management areas.

The almond community is also working to find solutions for water sustainability in California more broadly. An analysis of soil characteristics found that 675,000 acres of California almond orchards have moderately good or better soil suitability for groundwater recharge.[2] 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.

AHEAD OF THE CURVE

Almond farmers are leading adoption of efficient irrigation technology.

CALIFORNIA ALMOND IRRIGATION METHOD[3]

- 77% microirrigation
- 10% sprinkler
- 13% flood

CALIFORNIA STATEWIDE IRRIGATION METHOD[4]

- 42% microirrigation
- 15% sprinkler
- 43% flood

Meet Heith Baughman

ALMOND FARMER, BAKERSFIELD

"By adopting practices outlined in the Almond Irrigation Improvement Continuum, I'm using 10% less water, my power bill has dropped significantly, and I've addressed disease problems in my orchard. What's more, by fine-tuning my approach, I've increased crop yields significantly, all while becoming a better steward and manager of this important resource."

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

1. University of California, 2010. Food and Agriculture Organization of the United Nations, 2012. Almond Board of California, 1990–94, 2000
2. Land IQ. Groundwater Recharge Suitability Analysis. November 2015. 3. California Almond Sustainability Program. August 2019.
4. California Department of Water Resources. California Water Plan Update 2013: Volume 3, Chapter 2.

SPOTLIGHT ON:

ZERO WASTE

Using Everything We Grow

WHOLE ORCHARD RECYCLING: EXPLAINED

Almond orchards generally live for 25 years, during which the trees remove carbon dioxide from the air and store it as wood, a process known as carbon sequestration. This new orchard removal approach extends that carbon sequestration by storing it in the soil, using the trees' woody biomass to build healthier soils and address climate change. Models show that recycling the orchard sequesters 2.4 tons of carbon per acre,[1] equivalent to living car-free for a year.[2]

HERE'S HOW IT WORKS:

1. Each almond tree is knocked over, starting the orchard removal process.
2. The trees are put through a large grinder that breaks them down into small wood chips.
3. The wood chips are spread evenly across the field and then worked into the soil by a tractor.
4. A new orchard is then planted, benefiting from increased soil organic matter and nutrients as well as improved water infiltration and storage, as soil microbes gradually break down the wood.[3]

A Genuine Bioeconomy

Almonds grow in a shell, protected by a hull, on a tree. Traditionally, these coproducts have been used as livestock bedding, dairy feed and transformed into electricity. However, changing markets and increased production has led the California almond community to investigate new uses.

With 79 research projects funded to date, ABC is supporting scientists exploring innovative applications for almond coproducts that contribute to the larger goal of creating a genuine bioeconomy, where every byproduct is an input for another valuable product. This has the potential to provide value to other industries, farmers and the environment.

PRODUCED IN 2018[4]

- HULLS: 4.5 billion pounds
- KERNELS: 2.3 billion pounds
- SHELLS: 1.6 billion pounds

GROWING IN CALIFORNIA IN 2019[5]

165 million almond trees

Meet Bor-Sen Choiu

RESEARCH CHEMIST, USDA
AGRICULTURAL RESEARCH SERVICE

"The almond industry has traditionally used shells as livestock bedding, but research has shown they can serve a higher purpose, with greater economic and environmental benefits. Through torrefaction, burning in the absence of oxygen, almond shells are transformed into a charcoal-like material that can be ground up and added to post-consumer recycled plastics, giving them added stiffness, heat stability and color. If we can scale this beyond the lab, this will translate to less new plastic in the world."

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

1. Michael Wolff, et al. California Department of Food and Agriculture. Whole Orchard Recycling report for the Environmental Farming Act Science Advisory Panel, October 2019. **2.** Seth Wynes, et al. The climate mitigation gap: education and government recommendations miss the most effective individual actions. Environmental Research Letters. 2017. **3.** Brent Holtz, et al. Whole almond orchard recycling and the effect on second generation tree growth, yield light interception and soil fertility. VII International Symposium on Almonds and Pistachios. 2017. **4.** Almond Tree Fruit Weight, 2018/19 Crop Year. Addendum to July 2019 Position Report. August 2019. **5.** 2018 NASS Almond Acreage Report. April 2019. 2019 Objective Report. July 2019.

SPOTLIGHT ON:

BEE HEALTH

Supporting Our Pollination Partners

BEES + ALMONDS: EXPLAINED

Honey bees play a vital role in our food supply, pollinating over 90 crops grown in the U.S.[1] Almonds are one of those, but did you know the bees and beekeepers benefit too?

HERE'S HOW IT WORKS:

1. **Prior to almond bloom, beekeepers transport their hives to orchards across California where the blossoms will be the bees' first natural food source of the year.**
2. **As they buzz around pollinating the crop, the bees gather high-quality pollen and nectar containing all 10 of the amino acids their diets require.[2]**
3. **Bee hives regularly grow in strength and size thanks to this nutritious diet. After bloom, beekeepers often split strong hives into two.**
4. **With more hives available for crop pollination and making honey, beekeepers fan out across the U.S., bringing their bees to pollinate sunflowers, apples, blueberries, peaches, citrus and more.**

Bee-Friendly Orchards

Every almond you eat exists because a honey bee pollinated an almond blossom. And every honey bee who visits an almond orchard gets its first natural food source of the year there, building up reserves of worker bees and stored food to support a healthy start to their pollination season.[3]

Because of honey bees' essential role in almond production, ABC has invested more in honey bee health research than any other crop group,[4] with 125 projects funded to date. And what's more, farmers have widely adopted voluntary measures, like Honey Bee Best Management Practices, to protect bees in the orchard and beyond. Some farmers are even planting pollinator habitats in or near their orchards as additional food sources before and after almond bloom. Not only do those blooming plants support honey bees, they provide food sources for native bees.

PLANTING BEE PASTURES

Since 2013, almond farmers have planted over **25,000 football fields worth of bee pastures** through Project Apis m.'s Seeds for Bees program.[5] This makes for happy honey bees and native bees too!

Meet Elina Niño

EXTENSION APICULTURIST
UNIVERSITY OF CALIFORNIA, DAVIS

"The Almond Board of California is a very proactive and progressive partner. They are at the forefront of pollinator research, continuously funding projects supporting honey bee health not only in California, but throughout the country. It is motivating to have grower partners work so closely with the beekeeping industry."

ADDRESSING THE FIVE FACTORS IMPACTING HONEY BEE HEALTH

1. World Atlas. March 2019. 2. Ramesh Sagili, Department of Horticulture, Oregon State University. 3. USDA-ERS. Land Use, Land Cover and Pollinator Health: A Review and Trend Analysis. July 2017. 4. Gene Brandi, Vice President, American Beekeeping Federation. 5. Billy Synk, Director of Pollination Services, Project Apis m. November 2019. Represents total plantings from 2013-present (34,000 acres).

SPOTLIGHT ON:

PEST MANAGEMENT

Adopting More Environmentally Friendly 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. With regard to pest management, this means protecting the crop and trees from bugs, weeds and disease with an integrated set of tools that reduce reliance on pesticides. This approach utilizes techniques like beneficial insects, habitat removal and mating disruption, as well as monitoring pest levels so that pesticides are used only when necessary.

Not only does using an integrated pest management approach improve sustainability, it also makes good economic sense for farmers, reducing input costs and improving the effectiveness of pest control.

To support continuous improvement in this area, ABC is investing in research to find better ways to manage harmful pests and sharing that information with farmers and their advisors.

Meet Josette Lewis

DIRECTOR OF AGRICULTURAL AFFAIRS,
ALMOND BOARD OF CALIFORNIA

"This summer I had the opportunity to visit farmers and researchers in Canada who are using sterile insect technology to combat a key pest of the local apple industry. Using this, they have cut pesticide use by almost 95% across their farming region. At the Almond Board, we are looking at tools like this for control of navel orangeworm, the most damaging insect pest of almonds."

INCREASING ADOPTION OF ENVIRONMENTALLY FRIENDLY PEST MANAGEMENT TOOLS BY 25%

SPOTLIGHT ON:

AIR QUALITY

Improving Local Air Quality During Harvest

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 our local communities. To address this nuisance, the almond community is taking short- and long-term steps to reimagine how we harvest.

To minimize dust in the short term, ABC is working with farmers to fine-tune harvest practices and adopt low-dust equipment, which can add up to substantial improvements.

Looking to the future, the almond community is also exploring the concept of off-ground harvest, which could have a number of benefits beyond significantly reducing dust. Researchers and farmers alike are experimenting by testing equipment and drying options used by different crops and farming regions.

REDUCING DUST DURING ALMOND HARVEST BY 50%

Meet Jason Bayer

SALES MANAGER,
EXACT HARVESTING SYSTEMS

"Reducing harvest dust not only makes us better neighbors and stewards of the land, it also has benefits for overall tree health. But a key way to do that, buying new equipment, has cost implications for farmers, many of whom are small family operations. Thanks to the efforts of the Almond Board, equipment manufacturers and others, we now have incentive programs available to farmers to help offset the cost of low-dust harvest equipment."

MORE ON ALMOND SUSTAINABILITY:

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

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

@almondboard
The latest on almond sustainability in 280 characters or less

Almonds.com/Blog
Get to know the California almond community through profiles, news and more

SustainableAlmondGrowing.org
Online portal for California Almond Sustainability Program farmer and processor participants

Almonds.com/ResearchDatabase
Reports from over 45 years of almond farming and environmental research

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