

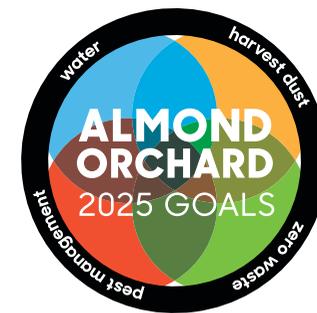


roadmap

ALMOND ORCHARD 2025 GOALS roadmap

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from the chair of the almond board of california

“ In January 2019, the California almond community set four ambitious goals aligning with our vision to make life better by what we grow and how we grow.

Established by the Almond Board of California's Board of Directors with input from a broad spectrum of stakeholders, the Almond Orchard 2025 Goals built on decades of progress. Yet, for the first time, we publicly committed to specific objectives, working to grow almonds in better, safer and healthier ways, all of which care for our communities and the environment.

Specifically, the California almond community has committed to the following goals by 2025:

-  Reduce the amount of water used to grow a pound of almonds by 20%
-  Achieve zero waste in our orchards by putting everything we grow to optimal use
-  Increase adoption of environmentally friendly pest management tools by 25%
-  Reduce dust during almond harvest by 50%

Committing to the goals was a tangible demonstration of our dedication to continuous improvement and a major step forward for our community and California agriculture as a whole. It was also the easy part.

Fulfilling these commitments will require hard work, dedication and resources. There are approximately 7,600 multigenerational farmers that grow almonds in California. In order to achieve these goals, we will need widespread adoption of improved orchard practices. We will need to fund independent research to test new technologies and share the results through industry outreach as those approaches are proven. We must work with government entities, nonprofits and others to create incentives for change. As we go, we will become better stewards of the resources we share with all Californians and even better farmers, more efficiently and responsibly producing 80% of the world's nutritious almonds.

This publication was designed to show the world the path we are taking to meet our objectives. While our roadmap is based on what we know today, we anticipate progress won't always be linear. We are going to experience advancements and setbacks as we go—weather will always be a challenge—but there are many routes that lead to our destination. We will need to be as agile as we are determined. Our industry has innovated its way to brighter futures before, and I am confident we will do it again.”



Holly A. King
ALMOND FARMER AND CHAIR
OF THE ALMOND BOARD OF
CALIFORNIA
December 2019



water efficiency

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%.**

Progress toward this goal is being measured against almond farmers' annual irrigation water applied per unit of crop yield. The data underlying this metric is derived from the California Almond Sustainability Program's (CASP) irrigation management module in which almond farmers assess and report their practices.

In addition to tracking goal achievement via CASP, the Almond Board of California is monitoring almond farmers' progress up the Almond Irrigation Improvement Continuum. Created by external irrigation experts, the Continuum outlines key irrigation management practices and how to achieve increasing levels of precision in each. ➤

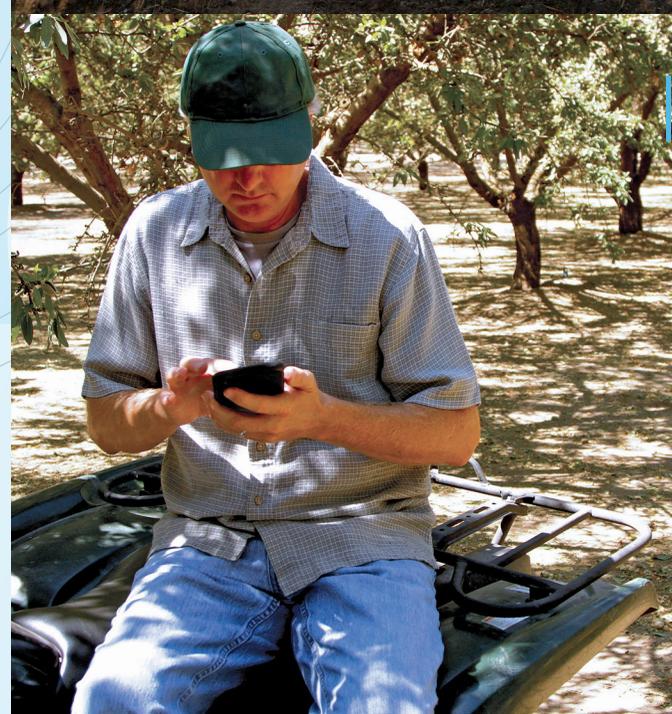
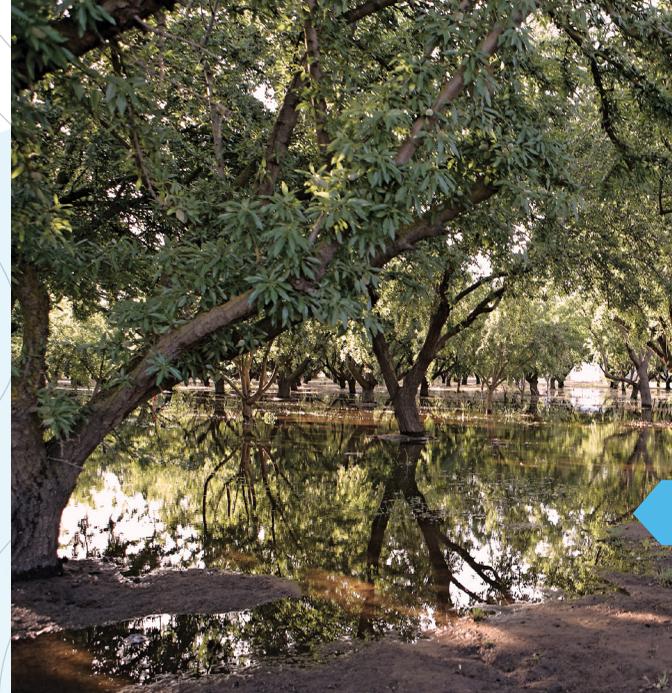
GOING FURTHER: ALMOND IRRIGATION IMPROVEMENT CONTINUUM

“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.”



Heith Baughman, ALMOND FARMER, BAKERSFIELD

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. August 2019



pursuing continuous WATER improvement

PAST

The California almond community began investing in research in 1982 to determine if a new irrigation method—microirrigation—could work in almond orchards. **PREVIOUSLY, FARMERS HAD FLOODED THEIR FIELDS OR USED LARGE SPRINKLERS.** The research showed positive results and farmers began implementing this technology as they planted new orchards.



PRESENT

Today microirrigation has been widely adopted in California's almond orchards, with **NEARLY 80% OF FARMS USING MICROSPIRINKLERS OR DRIP SYSTEMS?** These systems conserve water by applying it directly to the trees' roots rather than the entire field. Adoption continues to grow as older orchards are replaced.

FUTURE

While almond farmers have made strides in the area of irrigation efficiency, further improvements are underway. With tools like the **ALMOND IRRIGATION IMPROVEMENT CONTINUUM AND NEW TECHNOLOGIES**, farmers can better measure each orchard's irrigation needs, how much water is applied and monitor key factors like system performance, soil moisture and plant water status.



zero waste

ACHIEVING OPTIMAL USE OF EVERYTHING WE GROW

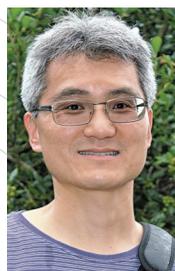
Almonds grow in a shell, protected by a hull, on a tree: products traditionally used for livestock bedding, dairy feed and electricity generation. With changing markets for these coproducts, the almond community is spurring innovation for higher value and more sustainable uses, with promising leads in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

Given that almond coproducts are widely utilized already, progress toward this goal focuses on reducing our environmental footprint and adding value—economically and environmentally—via three key measures. These include significant increases in recycling trees into the soil when an orchard is removed, diversifying applications for hulls and shells beyond current uses in the California dairy industry and the effective elimination of open burning as a means to dispose of woody biomass.

Progress toward these goals will be measured with data from periodic surveys of almond huller and sheller operations as it relates to hulls and shells and the California Almond Sustainability Program’s (CASP) air quality module in which farmers assess and report woody biomass-related practices. ➤

NOVEL APPROACH: STRENGTHENING RECYCLED PLASTIC

“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 and a valuable, novel use for almond shells.”



Bor-Sen Chiou, RESEARCH CHEMIST, USDA AGRICULTURAL RESEARCH SERVICE

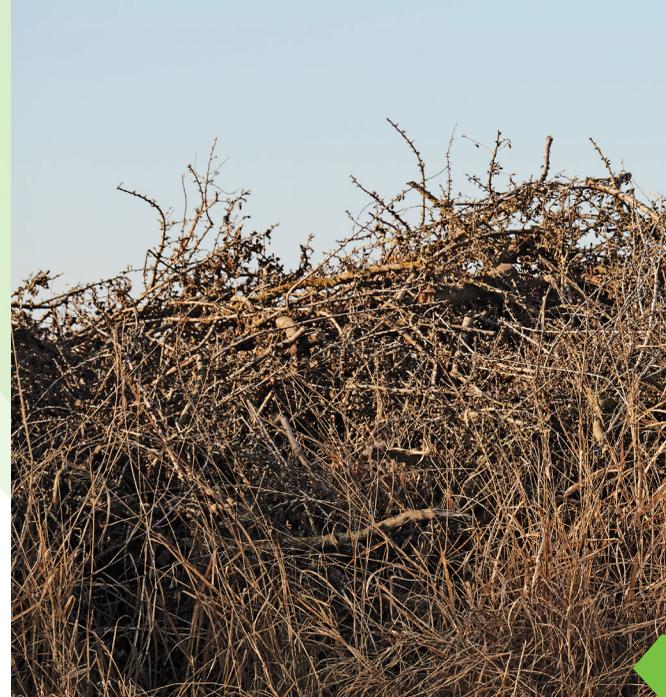
1. Brent Holtz, et al. Whole almond orchard recycling and the effect on second generation tree growth, yield light interception and soil fertility. VII International Symposium on Almonds and Pistachios. 2017. 2. Michael Wolff, et al. Whole Orchard Recycling report for the Environmental Farming Act Science Advisory Panel. 2019. 3. Seth Wynnes, et al. The climate mitigation gap: education and government recommendations miss the most effective individual actions. Environmental Research Letters. 2017.

pursuing continuous WASTE improvement

While the Almond Orchard 2025 Goals set specific targets, the almond community’s use of almond coproducts has been evolving for decades. This timeline focuses on one coproduct—woody biomass—and how almond trees are utilized at the end of their 25-year lifespans.

PAST

With significantly fewer almond orchards in the state and less protective air-quality laws, **BURNING OF AGRICULTURAL WASTE** was the norm prior to the 1990s. This included whole trees upon orchard removal as well as branches from regular tree pruning.



PRESENT

While **COGENERATION FACILITIES** that converted almond tree wood into electricity were a reliable option in the ensuing decades, these power plants are being phased out in California. With that change, farmers have started shifting to a new technique for almonds: whole orchard recycling.



FUTURE

Instead of removing the material from the orchard system, **WHOLE ORCHARD RECYCLING** grinds up the trees, spreads the wood chips across the field and works them into the soil prior to replanting. This practice improves soil health¹ and helps to address climate change. Models show that recycling the orchard sequesters 2.4 tons of carbon per acre² equivalent to living car-free for a year.³ Researchers are also exploring transforming almond wood into biofuels.





pest management

INCREASING ADOPTION OF ENVIRONMENTALLY FRIENDLY PEST MANAGEMENT TOOLS

As multigenerational farmers—many of whom live, work and raise their families on the land—farming responsibly is a top priority of almond farmers. 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 further protect our orchards, employees and communities, by 2025, we commit to **INCREASE ADOPTION OF ENVIRONMENTALLY FRIENDLY PEST MANAGEMENT TOOLS BY 25%**.

Progress toward this goal is being measured through the adoption of integrated pest management techniques across California's almond orchards for several key pests, including navel orangeworm, mites, Alternaria fungal disease and weeds. The data underlying this metric is derived from the California Almond Sustainability Program's (CASP) pest management module in which almond farmers assess and report their practices. ➤

PUSHING THE ENVELOPE: STERILE INSECT TECHNOLOGY



Sterile insect technology (SIT) has led to transformative change in other crops, nearly eliminating the target pest and, with it, the need for pesticides to treat it. At the Almond Board, we are looking at tools like this to control navel orangeworm, the most damaging insect pest of almonds, and have invested \$1 million in SIT research to date.”



Josette Lewis, DIRECTOR OF AGRICULTURAL AFFAIRS, ALMOND BOARD OF CALIFORNIA

1. Almond Board of California. Inedible Gross Percentage.
 2. California Almond Sustainability Program. August 2019.
 3. Almond Board of California. Inedible Gross Percentage.

pursuing continuous PEST improvement

While the Almond Orchard 2025 Goals set specific targets for a variety of pests, the almond community's pest management practices have been evolving for decades. This timeline focuses on control of the primary insect threat to almonds, navel orangeworm (NOW).

PAST

With little known about NOW's biology and pesticides as the only treatment option, 9% of almonds harvested in 1978 were lost to insect damage. **THE AVERAGE CROP LOSS IN THE 1970S WAS 6%!**

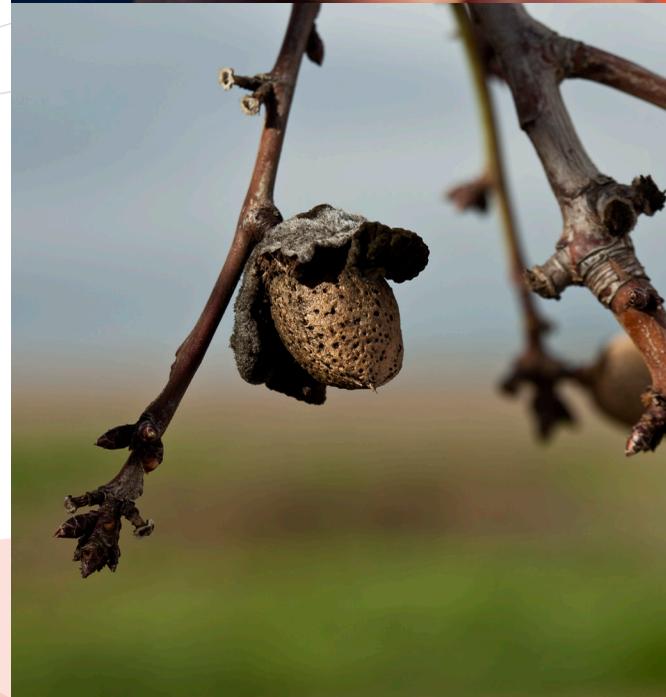
PRESENT

Winter sanitation, an integrated pest management approach for NOW in which almonds left on the trees after harvest are removed, is used in 91% of California almond orchards? This process removes a food source and shelter for NOW larvae, reducing the number of insects taking flight in spring and their potential to damage the crop. **TODAY, LESS THAN 2% OF ALMONDS HARVESTED ARE LOST TO INSECT DAMAGE!**

FUTURE

NEW TECHNOLOGY AVAILABLE TO FARMERS DISRUPTS THE MATING CYCLE OF NAVEL ORANGEWORM, REDUCING THEIR NUMBERS.

Additionally, monitoring tools help farmers track pest populations to decide if and when treatment is needed, rather than relying on a predetermined schedule.





air quality

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%**.

Progress toward this goal is being measured through the adoption of new low-dust equipment and harvest techniques, like reducing the number of passes and adjusting speeds, across California's almond orchards. Each of these practices has an associated dust reduction compared to traditional methods, measurable as total suspended dust particles per acre. The data underlying this metric is derived from the California Almond Sustainability Program's (CASP) air quality module in which almond farmers assess and report their practices.

In addition to tracking goal achievement via CASP, the Almond Board of California is working with researchers, farmers and other stakeholders to explore off-ground harvesting, which generates significantly less dust. ➤

BREAKING DOWN BARRIERS: EQUIPMENT INCENTIVES

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 other industry leaders, we now have federal and state air quality incentive programs available to farmers to help offset the cost of low-dust harvest equipment."



Jason Bayer, SALES MANAGER, EXACT HARVESTING SYSTEMS



pursuing continuous AIR improvement

PAST

Almond harvest changed significantly in the 1960s and 70s with the advent and adoption of mechanized harvest equipment. Prior to that, **ALMONDS WERE HARVESTED BY HAND**, with employees using mallets, poles, rakes and tarps to bring in the crop.



PRESENT

Today's almond harvest is less labor intensive, with skilled technicians operating specialized harvesting machines. However, inherent in the process is that almonds are shaken to the ground and picking them up creates dust. To reduce this, **FARMERS CAN FINE-TUNE EQUIPMENT SETTINGS TO BEST MATCH FIELD CONDITIONS** or purchase specially designed low-dust equipment.

FUTURE

Outside of further refinements to the existing harvest system, the almond community is **EXPLORING THE CONCEPT OF OFF-GROUND HARVEST**, which could have a number of benefits, including significantly reducing dust. Researchers and farmers alike are experimenting by testing equipment and drying options used by different crops and farming regions.

ALMOND ORCHARD 2025 GOALS

MORE INFORMATION AT
almonds.com/2025goals



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