California Almond Sustainability Program

Almond Board of California

The California Almond Sustainability Program (CASP) has reached a key milestone! Due to almond grower participation, we can tell the story of almond growers' stewardship. The first report on Almond Sustainability is now published!

CASP is based on grower and handler self-assessment of best management practices, the interpretation and communication of results, and the application of results for education and continuous improvement.

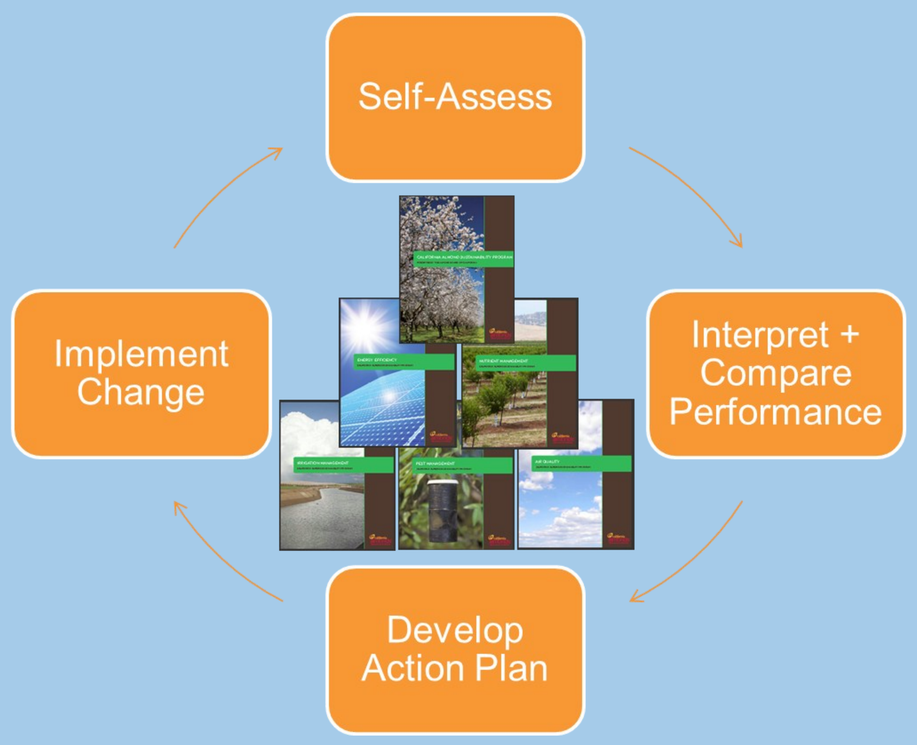
Documenting the California Almond community's thoughtfulness and efforts in using environmentally friendly and socially responsible practices is critical to ensuring California Almonds remain a crop of choice to grow and nut of choice to buy.

Growers and handlers participate by completing assessments at workshops or by using the online self-assessment and reporting system at www.sustainablealmondgrowing.org.

Participants assess their practices using one or more modules – Irrigation Management, Nutrient Management, Energy Efficiency, Air Quality and Pest Management. The content of modules is derived from ABC-funded research, University of California publications and expertise, grower and handler experience, and other authoritative sources. The results indicate that best management practices may not be appropriate for all circumstances because of site-specific differences and challenges. Content being added includes Social Responsibility, Ecosystem Management, Water Quality and Financial Management.

Significant grower participation has enabled understandings of statewide use of orchard best management practices with statistical significance. The hot-off-the-press 2014 Almond Sustainability Report tells the "Good Story" by applying SureHarvest's Sustainability Value Analysis Methodology to detail strengths, and potential opportunities for improvement, in practices that provide the most environmental value and grower economic benefits. Results also will be used to target educational needs to support continuous improvement.

Visit the Almond Board of California booth for your free copy of the Report, and to learn more about CASP and how to participate!



The interrelated CASP elements constitute the Cycle of Continuous Improvement, allowing participants to assess their practices; compare results to collective averages; learn about, plan for and implement alternative practices; and periodically reassess.

CASP Participation through July 2013

Individual Participants	1,080
Participants Affiliated with Organizations Submitting Assessments	575
Organizations Submitting Assessments	509
Orchards Assessed	638
Acres Assessed	95,496
Acres Managed by Organizations Submitting Assessments	255,891

2014 Almond Sustainability Report

For the Almond Board of California

The newly released 2014 California Almond Sustainability Report characterizes the strengths, and potential opportunities for improvement, in use of grower best management practices (BMPs) affecting energy, air, water and land (includes nutrients, pests and bees) resources.

This report constitutes a commitment by the Almond Board and its growers and handlers across the state to “Tell the Almond Growing Story” through the documentation of practices used for growing almonds.

Findings are based on self-assessment data collected from 638 orchards covering more than 95,000 bearing acres (more than 11% of the statewide total) by the California Almond Sustainability Program (CASP).

Data were analyzed to calculate 95% confidence limits for the percent of “Yes” responses to use of each BMP. Responses with confidence limits exceeding ± 10% were considered too variable to represent all California Almond orchards and were excluded.

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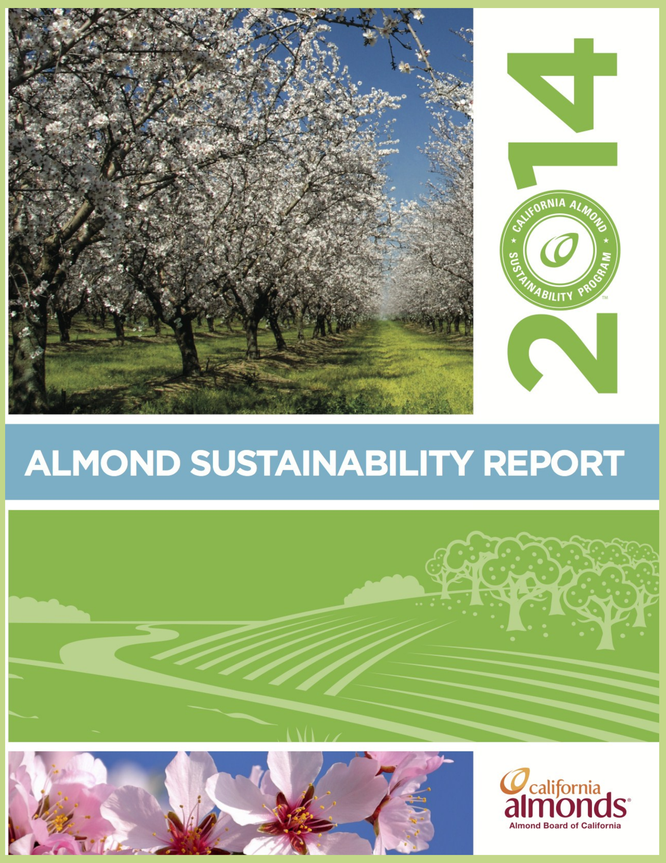


WATER — DETAILED ANALYSIS

This section describes in detail the key water stewardship practices that create environmental and economic value by optimizing water use efficiency (water quantity), and preventing adverse impacts on the quality of groundwater and surface water (water quality) for California Almond growers who adopt them.

Practices are organized and discussed in the following five areas:

- Orchard Establishment and Irrigation System Design
- Irrigation System Type, Infrastructure and Operation
- Irrigation Scheduling
- Water Infiltration
- Off-site Movement and Water Quality

Orchard Establishment and Irrigation System Design

Taking steps during orchard establishment to help achieve long-term irrigation efficiency will reduce use of resources, decrease environmental impacts, and enhance profits. Irrigation management is closely linked to energy, nutrient and pest management, for which the collective energy use (Kendall, 2013) and cost (ABC Production Costs Analysis, 2012; Duncan, et al., 2011; Connell, et al., 2012) can be significant. Since water affects nutrient movement, efficient irrigation also affects water quality. Efficient irrigation positions applied nutrients in the soil to optimize uptake by roots, avoiding nutrient losses and the potential for nitrate (NO_3) to contaminate groundwater (by leaching) and surface water (by runoff). Moreover, both over-irrigation and under-irrigation can increase pest problems, which can increase treatments, costs and the potential for water contamination by pesticides.

The top concerns related to agriculture and water quality are NO_3 and salts in groundwater, and pesticides and sediment in surface water. Improving irrigation efficiency by modifying soil properties and proper irrigation system design at orchard establishment minimizes these problems while conserving resources and improving the bottom line.

Recommended water stewardship practices before orchard establishment include determining if significant differences in soil characteristics exist and, if so, modifying soils or altering the design of irrigation systems to enhance water infiltration and distribution. To identify soil differences, growers for 62% of assessed orchards use soil maps (i.e., Natural Resources Conservation Service [NRCS] soil series or web soil survey), growers for 40% of orchards use yield maps if a previous crop existed, and growers for 16% of orchards use maps generated by advanced sensing technologies (e.g., electrical conductivity mapping).

Where drainage or compaction problems are detected from maps and subsequent soil evaluations, growers for 88% of assessed orchards deep-rip or slip-plow the soils, or dig backhoe pits for tree holes to reduce compaction/stratification layers. For 73% of orchards that require adjustments in pH, sodicity or salinity, growers add appropriate soil amendments. After making needed adjustment to soils, growers for 88% of orchards assessed ensure irrigation systems are designed to achieve target distribution uniformities, and for 69% of orchards ensure irrigation sets correspond to soil texture zones or topography.

These results show that most almond growers use soil maps and take subsequent actions before planting to ensure water infiltration and even distribution. Growers can improve their assessments of soil differences in orchard planning by increasing the use of maps generated by advanced sensing technologies.

Irrigation System Type, Infrastructure and Operation

Choosing and ensuring the operational efficiency of the irrigation system are important for efficient water use and for reducing water losses, environmental consequences and costs. Irrigation is delivered by drip systems for 29% of assessed orchards, by micro-sprinkler systems for 42% of orchards, by sprinklers for 13% of orchards, and by flood/furrow systems for 16% of orchards. Regardless of system type, growers for 43% of assessed orchards help maximize operational efficiency by conducting regular distribution uniformity tests.

The increased use of micro-irrigation technology (drip and micro-sprinklers) in almonds over the last three decades has greatly contributed to a near doubling of per-acre yields. This is achieved by the precise timing of water delivered to the root systems, which enhances water use by the crop and decreases off-site movement and resulting effects on the environment. Likewise, the use of micro-irrigation systems to precisely apply fertilizers (fertigation) optimizes nutrient uptake by roots and reduces risks to water quality. Micro-irrigation benefits pest management by decreasing the wetted area and resultant weed problems, and by limiting diseases through lowered humidity. These results show that growers for more than 70% of assessed almond orchards conserve and protect water by having micro-irrigation systems.

Pumps predominantly are used to move water for drip, micro-sprinkler and sprinkler systems. Using recommended infrastructure and optimizing the performance of systems with pumps ensure that intended amounts of water are being delivered, and minimize the likelihood of over-irrigation, which increases costs and may result in off-site movement of contaminants to groundwater or surface water. For assessed orchards with irrigation pumps, 71% have flow meters installed to monitor water use. Of these orchards, growers for 58% record meter readings per irrigation event, and regularly inspect and calibrate meters for 47%. Growers for 88% of assessed orchards with irrigation pumps have pressure gauges installed to measure pressure drops through filters. Of these orchards, growers for 88% check gauges annually for accuracy, and 90% regularly check pressure drops and clean filters if significant differences occur.

Micro-irrigation systems are substantial capital investments, so it is important to properly maintain them to ensure peak performance and optimal returns on investments. Accordingly, micro-irrigation systems for 64% of assessed orchards include pressure-compensating emitters to help maintain water distribution uniformity. Furthermore, growers for 90% of

The report is organized by topical sections for energy, air, water and land. Land includes the subtopics of nutrients, pests and bees. For each topic or subtopic, the report details grower use of relevant BMPs that have the most value for the environment and for grower economics. SureHarvest’s Sustainability Value Analysis Methodology was used to quantify and rank BMPs by value.

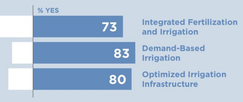
WATER:
ENVIRONMENTAL IMPACTS

Optimal water stewardship in almond farming ensures two objectives: 1) the efficient use of irrigation to achieve production goals, and 2) the prevention of adverse impacts of practices on the quality of water resources (groundwater and surface water). Because of competing interests, climate change and other factors, water has become an increasingly limited resource in California. In terms of agricultural effects on water quality, high-profile concerns include the contamination of groundwater by nitrate (NO_3) associated with fertilizer use, and the contamination of surface water by pesticides (e.g., organophosphates) and sediment.

Most of this contamination results from leaching or surface runoff, which can be influenced by irrigation practices as well as nutrient, pest and soil management practices. Because almonds are grown on more than 800,000 acres in the Central Valley of California, the use of recommended water stewardship practices by almond growers has marked effects on water conservation and protection. This chapter highlights strengths of, and potential opportunities for improvement in, management practices used by almond growers that impact 1) water usage and 2) water quality. The highlights are followed by a general, more detailed presentation on the state of water stewardship in the industry.

WATER USAGE ENVIRONMENTAL IMPACTS: STRENGTHS

The top three ways that almond growers conserve water while protecting the environment (% of assessed orchards):



This set of strengths demonstrates that most almond growers conserve water by using efficient irrigation practices, including the proper scheduling of irrigation and optimal maintenance of irrigation system infrastructure. Known as fertigation, irrigation generally is used to transport and place nitrogen from fertilizers in the root zone to maximize root uptake and limit NO_3 leaching and volatilization of the greenhouse gas nitrous oxide (N_2O). By preventing over-irrigating and conserving water, most growers are achieving this dual goal.

WATER USAGE ENVIRONMENTAL IMPACTS: OPPORTUNITIES

The top three ways that growers could increase water conservation and protect the environment (% of assessed orchards):

These opportunities represent further potential to conserve water by accounting for real-time crop evapotranspiration and using regulated deficit irrigation, where feasible, to restrict irrigation to exact amounts required to achieve yield goals. Where cover crops can be grown, they can be managed to conserve additional water by helping to “bank” soil water through improved water infiltration and retention, and thus decrease irrigation needs.