

# Case Study

## Water management software for almonds

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November 2021

### Making Every Drop Count



# Summary

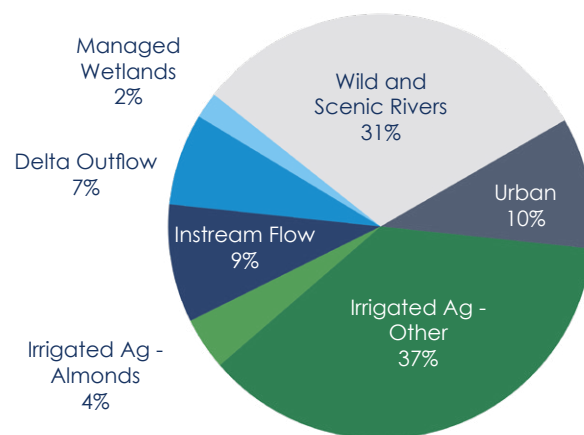
The California almond industry is under attack, all 1.3 million acres. This attack is from multiple fronts, including political, regulatory, environmental, and social. The common denominator – **water**.

Recognizing that agriculture uses four times more water than California's residential users, growers are proactively responding with 80% of almond producers using some form of technology to enhance their water use efficiency. Operations are now Wi-Fi-connected with devices such as mobile app-controlled irrigation systems, remote sensors, weather stations and satellite imagery all devoted to better managing crop performance.

However, a problem remains. Individually these devices are wonderful at creating data but are limited in their ability to talk to each other. Such siloed information is often more confusing than constructive. Overcoming this integration void across disparate data sources is the next great opportunity. This brings us to the capability of SWAN Systems and the success of our SWAN trials over the very dry 2021 irrigation season. The details are reviewed in this report, with the bottom line being that the ranch experienced an overall 40% productivity increase. Making every drop count was our objective and our achievement.

## Background

### California's Managed Water



Source: CA DWR, California Water Plan Update 2013

Almonds account for approximately 9.5% of water used to irrigate agriculture, or 4% of the total California Water Supply. The almond industry currently brings in over **11 billion dollars** into the state's total economy. This figure is expected to grow as the popularity of almonds increases due to their many health benefits, and also because there are four products generated from almonds that have an economic value. As well as the kernel we eat, which is protected by a hull and a shell, there is the tree itself. The trees store carbon and are transformed into electricity at the end of their lives; the shells become livestock bedding and the hulls are nutritious dairy feed. Making use of these other products reduces the water needed to grow other bedding and feed crops. Using and recycling these co-products can offset some of the almonds' water footprint. But unfortunately this is not enough, as many believe the amount of water required to grow almonds is too much, especially in times of drought.



California growers recognize that with the uncertainty of surface water supply, and the need to sustainably manage groundwater, the overall water footprint for agriculture will change, and they must do their part to make every drop count.

Over the past 20 years, almond growers have reduced the amount of water needed to grow each pound of almonds by 33% with improved production practices and the adoption of efficient micro-irrigation technology.<sup>1</sup>

**By 2025, the California almond community commits to reducing the amount of water used to grow a pound of almonds by an additional 20%.**

California's almond farmers continue to do more by adopting increasingly precise practices and installing efficient irrigation systems. Nearly 80 percent of almond orchards utilize this water-saving technology.<sup>2</sup>

We are now beginning to see almond farming involving Wi-Fi-connected orchards, mobile app-controlled irrigation schedules, embedded sensors, and remote sensing to better monitor soil moisture and crop health. The utilization of these tools and their associated data platforms will enable almond growers to grow their crops profitably and sustainably while providing the necessary insights to defuse environmental concerns.



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

<sup>2</sup>California Almond Sustainability Program. Aug. 2017.

# Agri-Zon LLC

Agri-Zon LLC is an almond and pistachio grower based near San Joaquin, California in western Fresno County. The management of Agri-Zon is no stranger to agricultural technology having used various techniques from the likes of Wiseconn, Davis Instruments, Saturas, GroGuru, Sentek, and Trapview.

Historically, Agri-Zon managed its irrigation by monitoring the changing demand of the almond trees based on water used by evapotranspiration (ET). ET scheduling accounts for the loss of water through soil surface evaporation and transpiration through the leaves. In almonds, ET changes throughout the growing season based on the weather, time of year, and the crop growth stage.

Water use by almond trees (ETc) can be estimated by multiplying reference evapotranspiration (ETo) by the crop coefficient (Kc). In California, the amount of water needed by mature almond trees varies depending on location. In the Fresno region the annual evapotranspiration rate is reported to be just under 54 inches<sup>3</sup>. As this figure is based on ETo data that has been averaged over the last 30 years, in practice the current ETc is likely to be greater.

As Agri-Zon sought to further refine their irrigation and management, they began utilizing a range of in-field sensors, (soil moisture, weather, etc.), along with satellite imagery to provide real-time insights and ensure their irrigation system was performing efficiently, delivering water uniformly across the orchard. Gaining this insight was time-consuming, as they had to access this information from multiple platforms, and then manually correlate it to manifest insights and make decisions.

Despite all this technology and data, Agri-Zon were still looking for a means to integrate their suite of digital irrigation tools into a single, closed-loop platform to schedule and manage their irrigation and nutrient applications.

Agri-Zon were not alone in this. The lack of interoperability among irrigation solutions has slowed progress towards the industry's goal of reducing the amount of water used to grow a pound of almonds, as well as the further adoption of agricultural tech innovations across the farm ecosystem.

Fortunately, holistic irrigation tools like SWAN Systems are now available. This Software as a Service (SaaS) enables almond growers to manage, visualize, schedule, and control all aspects of their irrigation activities on a single platform regardless of the size of operation, to provide a complete end-to-end irrigation management solution.

## SWAN Systems

In 2021 a new, smart irrigation platform arrived in California from Australia – SWAN Systems. SWAN (for Scheduling Water And Nutrients) is configurable water and nutrient management software used to help make data-driven decisions about how much and when to irrigate.

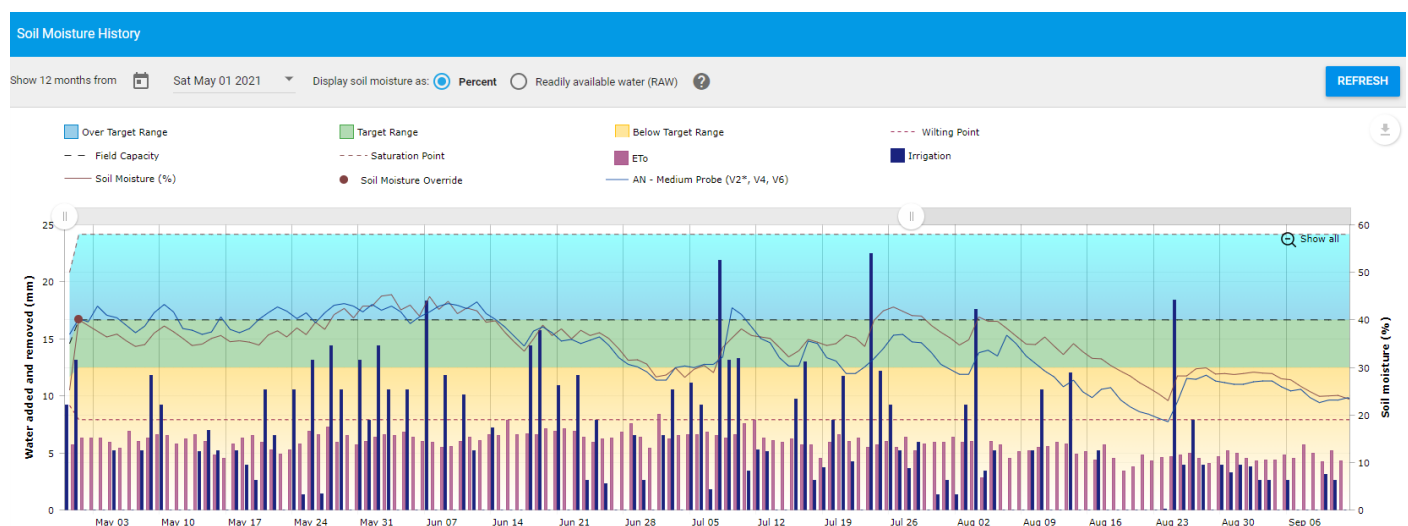
<sup>3</sup>(2016, Almond Board of California)

SWAN solves interoperability issues as it is designed to work with any hardware. This makes it very adaptable and versatile, enabling growers to manage irrigation at the whole farm level in one platform, even with a mixture of infrastructure types.

The power of SWAN Systems is its unique data-driven decision-making capabilities. To achieve this, many different data sources are utilized, including soil type, crop phenology, environment conditions, system flows and uniformity, soil moisture, and water quality. The combination of these sources allows for a comprehensive view and understanding of the crop, and its needs for optimal and sustainable growth, and productivity.

The ease of use and configurability of SWAN Systems allows a grower to match their on-farm environment precisely to irrigation decision-making.

The image below is taken from SWAN's soil moisture interface which displays detailed soil moisture balance status for each managed site, both historical and, importantly for decision-making, forecast. It can provide recommendations to optimise irrigation schedules according to seasonal allocation, weather forecasts and desired soil moisture. The configurability of the system enables the user to create multiple managed sites within a single orchard and receive recommendations based on crop, age, soil types or any other goal. All of the data is readily available for review and reporting.



Soil moisture history of a block of almonds at Agri-Zon's orchard. The graph shows how irrigation and ETo affected the soil moisture balance.

The 2021 growing season was an exceptional one for Agri-Zon. Despite water usage increasing by 16% on the previous year - in part due to much lower than average winter rainfall resulting in additional irrigations to fill the soil profile - they were able to **increase the ranch's overall productivity by over 40%**, a substantial improvement in water productivity. Thus, by integrating a range of irrigation optimization technologies through SWAN Systems, they were able to give the trees the right amount of water, at the right time. This increase in productivity has reduced the cost to grow a pound of almonds, and have allowed Agri-Zon to...

**... make every drop of water count.**



All crops take water to grow. Whether the water comes from rainfall, surface, or groundwater, the responsibility rests on the shoulders of almond growers to use it responsibly in the most sustainable way possible to ensure viable sources of food and water for generations to come.

Resource sustainability is crucial, but so is the sustainability of the almond grower. Making every drop count is also key to farm economics, as irrigation currently represents over 35% of an almond grower's operating budget<sup>3</sup>. Unfortunately, these costs are increasing in many areas of California as water becomes scarce and costly. This will require growers to turn to science and technology to viably manage their farm irrigation requirements.

SWAN enables almond growers to apply only what is needed for optimal, sustainable plant growth, allowing them to make the most out of every drop of water.

<sup>3</sup>University of California's 2019 Sample Cost to Establish an Orchard and Produce Almonds, San Joaquin South Valley

If you'd like to know more about how SWAN Systems could help to increase your farm's profits please contact Tim today  
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