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# CAC's Pine Tree Ranch Provides Challenges & Opportunities

The California Avocado Commission (CAC) leased 11 acres of the Pine Tree Ranch (PTR) in Santa Paula (Ventura County) from the Cal Poly Pomona Foundation in 2013 for use as a demonstration grove. The purpose of this endeavor was to have a place where CAC could set up demonstration plots showing growers the results of CAC-funded research or showcase new technologies that may be of benefit to growers. As every grower knows, the best laid plans too often are in conflict with reality.

Of the 11 acres leased, two acres were mature avocado trees and nine acres were old lemon trees that were removed, chipped and replaced, in 2014, with about seven acres of newly-planted avocados. Those newly-planted trees were promptly eaten by drought-weary deer in the 2014-15 winter. In 2015, the small well on the property was recommissioned and we finally had our own water supply for our portion of the ranch. By the end of 2015, it was clear something was terribly wrong. After some investigating, we learned that our well had exceedingly high salts and was killing our trees. In addition to these setbacks, in 2015 the threat of shot hole borers led to the beginning of pesticide trials at Pine Tree Ranch since these trials involved unregistered materials that would require crop destruct. The combination of these trials and the toxic well water severely debilitated the two-acre block of mature trees in CAC's leased acreage.

In 2016, CAC regrouped and focused on figuring out how to salvage our investment in Pine Tree Ranch and utilize the property to provide grower demonstrations. We are happy to report that the CAC-managed portion of PTR is looking much better these days and plans are coming together for some exciting new demonstration projects.

## Rehabilitating Old Trees

The two acres of mature trees that CAC inherited have an unknown history. By looking at old aerial images we know that the block was either stumped or replanted in the early 2000s. However, except for recent replants, we do not know the rootstock for any of the trees in the block. Given the recent well-related salinity issues and pesticide injection trials, the block needs rehabilitation and that's exactly what we plan to do.

Every grower knows that if they can afford it, replacing an old block and starting over with new trees is probably the best way to go. However, economic realities often prevail when making decisions. When faced with the decision about what to do with an old block of trees, growers must consider a lot of questions. How long can you afford to be out of production? Can you afford the replacement trees? Can you afford the labor to remove the old trees and properly plant the new ones? Often the answers to these questions result in growers doing something other than removing and replacing an old block.

Since the purpose of PTR is to be a demonstration grove, we've decided to share our experiences with growers as we look at several different options for rehabbing our old block. In doing so, we hope to help you make more informed decisions in the future.

The two-acre block will be divided into quadrants, approximately one-half acres each, and each quadrant will be rehabbed using a different method:

1. Remove and replant
2. Stump and replant dead or missing trees
3. Stump and top work, and replant dead or missing trees
4. Pruning and intensive fertilization to redevelop the existing tree

For each rehab method, we'll keep records of the input costs – trees, labor, fertilizer, etc. – and production records. These data will be shared with growers in future magazine articles and at PTR field days. Our hope is that we will be able to provide growers with information about each of these scenarios so that when you are faced with making a similar decision you'll have the necessary information to make the best decision for you and your grove.

## Irrigation Automation

Although we were fortunate to have a good rainy season this year, water

*Figure 1. An aerial image of the two acre mature block of avocados at Pine Tree Ranch from February 2005 (left) and October 2016 (right). The image from 2005 shows either newly planted trees or stumped trees; the image from 2016 shows the current status of the block with many missing, dead and weak trees. (Images from Google Earth)*

is going to continue to be a limiting factor for California agriculture going forward. There are many systems available that claim to help growers with their water woes, but knowing your trees' water needs and applying water to meet that need when it is needed is a tried and true method. Because there are so many products on the market, many growers don't know where to start.

CAC has received a California Department of Food and Agriculture specialty crop block grant to install an automated irrigation demonstration block at PTR so growers can see a couple of different systems in action, and see how they perform compared with traditional irrigation scheduling.

A new one-acre block is being planted that will be divided into four different irrigation zones. One zone will be irrigated by traditional means, using an irrigation calculator to incorporate evapotranspiration, tree size and irrigation system parameters to calculate how much water to apply. The other three zones will be irrigated automatically based on soil moisture sensor data that is used to open and close irrigation valves automatically. Each of the three zones will use different soil moisture sensors to show the range of price and sophistication of the sensors available.

The benefit of irrigation automation over traditional irrigation scheduling is in the timing of water application. For example, if you know your tree needs 100 gallons of water during a specific week of the year what is the best way to apply that 100 gallons? Should you irrigate in one application over several hours or is it better to divide irrigation sessions up into several smaller applications? To answer that question, you need to know about your soil type (maybe there's multiple types in your grove), your soil's water holding characteristics, and your tree's rooting depth and area at a minimum.

By using soil moisture sensors placed near the soil surface (about four inches deep) and at the bottom of the root zone (about 24 inches), you can tell when your soil profile is drying out and when it is full. If those sensors are connected to a valve controller, your irrigation can be turned on automatically at pre-set soil moisture values. An automated system is especially useful on very porous soils with poor water holding capacity, like decomposed granite, because it allows you to apply only as much water as the soil can hold at a given time. This prevents water wastage from deep percolation and reduces nutrient leaching as well.

Based on the experience of some avocado growers who are using automated irrigation systems, preliminary data from PTR's own soil moisture sensors and experiences in other tree crops, the potential for water savings could be as high as 50 percent or more compared with conventional irrigation scheduling and manually turning systems on and off.

## Berm and Flat Planted Trees

At the west edge of PTR is a 10-row block of trees with five rows planted on flat ground and five rows planted on berms. Typically, berms would be used in heavy soils where you need to improve drainage, or soils with heavy root rot pressure where the improved drainage can help with disease management. Neither of these situations exist at PTR, where we have very gravelly, well-drained soil and low root rot pressure. However, having some bermed rows provides us with the opportunity to look at the benefits and discuss the pros and cons of berms during field days.

Dr. Jochen Schenk, a professor at California State University at Fullerton (CSUF), has taken advantage of these bermed rows and his graduate student Miriam Moura is conducting some of her master's degree research at PTR. Moura has installed sap flow sensors on several trees planted on the berms and the adjacent flat rows and is looking at the effects of the berms on tree water use. The sap flow sensors measure the rate at which sap – and by extension water – is flowing through the tree, and these data can be converted into tree water use.


*Figure 2. A Dynamax sap flow sensor prior to installation (left) and a sap flow sensor installed on an avocado branch (right). The sensors are installed on branches of about one inch diameter and must be adjusted about every four weeks to account for branch diameter growth. The sensors are hardwired to a base station, which then transmits the data to the internet via a wi-fi connection or cellular modem.*

Although the sensors were only installed in mid-2016, clear differences can be seen between the bermed and flat planted trees. Because both plantings are being irrigated the same and the berms drain more quickly than the flat rows, the sap flow slows sooner after an irrigation in the bermed rows as the amount of available water decreases. Moura will be providing growers with an update on her research in an upcoming issue of *From the Grove*, and it will be a featured tour stop during the 10th International Workshop on Sap Flow that Dr. Schenk will be convening at CSUF in May 2017.

## High-density Plantings

The high-density block that was planted in 2014 is developing well. The block consists of trees planted at nine different spacings: 15 x 15, 15 x 10, 15 x 7.5, 10 x 15, 10 x 10, 10 x 7.5, 7.5 x 15, 7.5 x 10, and 7.5 x 7.5 (feet between rows x feet between trees). To date, there has been no pruning done on any of the spacings, but the highest densities are starting to become crowded.

This block will be utilized in upcoming field days to discuss different management approaches to high density plantings. One potential tool that will be looked at is the use of Tre-hold® Sprout Inhibitor as a means of reducing and slowing regrowth following pruning. Since it was registered for use on avocados a few years ago, Tre-hold® has gained a small, but loyal following among some growers, but to our knowledge no one has ever looked at it as a possible tool in managing high density plantings. In other parts of the world where avocados are grown at high densities, uniconazole (a gibberellic acid inhibitor) is used to control tree growth, but it is unlikely that uniconazole will ever be registered for use on a food crop in the United States. Thus, Tre-hold® may be our only option for a plant growth regulator for use in high-density plantings going forward.

Although things got off to a slow start and there were numerous setbacks during the first couple of years at Pine Tree Ranch, we are confident that things are on the right track now. We have a great grove management team in place that is eager to work on the various projects outlined above and help us provide readily-applicable production practices information to California's avocado growers. We look forward to seeing you at an upcoming field day.