Topics in Subtropics Newsletter

University of California Cooperative Extension

Fresno, Kern, Madera, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara,Tulare,&Ventura Counties

News from the Subtropical Tree Crop Farm Advisors in California

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In This Issue

Editor's Note:
Topics in Subtropics, is also available as an online blog. Visit our blog for up-to-date information that may be available prior to receipt of this newsletter: **http://ucanr.org/blogs/Topics/**

Has your mailing address changed? Would you like to add someone to our mailing list? Simply call or e-mail the farm advisor in your county to make additions or changes to our mailing list.

We strive to extend to you the most recent information pertaining to topics in subtropics. We encourage you to contact your local farm advisor to suggest topics of import to your commodity or industry for inclusion in future editions of this newsletter.

Ben Faber
Editor

The Spanish Avocado Industry

Ben Faber

I recently traveled to the Malaga area of Spain where there is quite a bit of new planting going on. The industry celebrated its industry in 2002 with the World Avocado Congress and we saw a considerable expansion of the industry then and more has occurred since then. More than 22,000 acres are in the ground. Much of the plantings are occurring on almond and olive ground which have become less profitable. Average grower acreage is similar to that of California's at about six acres per grower.

Production is along the southern coast of Andalucía and Valencia with some produced in the Canary Islands. Although a "Mediterranean" climate, it is both hotter and more humid on average than the California production area. Typically 'Hass' is harvested two months earlier there than here. Scarcity of water in some areas, although in the Malaga area there are a series of dams and water is not limiting. Labor cost and availability are similar to that in California. Also, unlike California, the fruit snap harvested and any stems remaining are clipped at the packing house. This more efficient harvest system is also used in Australia. A discussion of the method is described in the November 2002, AvoResearch Vol 2, Issue 2.

The industry produces 150 M pounds, the bulk of which goes to France and Germany where they are willing to pay good prices for quality fruit. It is a short drive to Paris and Berlin and fruit arrives in good condition. The bulk of this export market is in France and three export companies dominate this export. Per capita consumption in Spain is only about one pound per year, 3.5 pounds in France and now the US is about 4.5 pounds.

There are over 12 nurseries supplying trees to the industry, but two dominate. As here, growers are looking at high density plantings at as close as six feet apart, in row. They are using the standard varieties , such as 'Reed', 'Lamb Hass', 'Fuerte', 'Zutano', 'Bacon', 'Pinkerton' and 'Hass', but they are looking at newer varieties, such as 'Carmen' and 'Mendez'. There is still a good market for greenskins. They also have several rootstocks that we don't have, such as 'Atkinson' used in calcareous soil and 'Albaida' used in situations of Rosellinia fungus. This is a fungus similar to oak root fungus which they don't have as much as we do. Recently a long term trial was initiated evaluating over 10 scion varieties on five rootstocks, including 'Dusa' which is one of the most popular rootstocks now.

There is Phytophthora root rot there, but it is not as extensive as in our industry. Phytophthora disease control is done as here with mulches and phosphonates. One of the major sources of mulch was shells from the almond industry. With the eclipse of the almond industry, the shells have become very expensive and are going into other products. They are developing a yardwaste collection system, but it is

Avocado Grove in Spain

The Spanish Avocado Industry, Continued from Page 1

not as close to the avocado orchards as to make it a cheap source.

They also don't seem to have much of a problem with black streak, leaf blight, bacterial canker, and stem blight. These are diseases associated with poor water management and poor water quality. Not seeing these diseases does not mean that Spanish growers are better irrigators than California growers. The fungi that cause these disease are decomposers. They are everywhere that organic matter is – leaves, branches, dead weeds, etc. Some of the water quality reports I saw were really quite good compared to many of our waters. What this underscores is that when we have poor water quality, we really need to do an extremely good job of irrigation, especially when we have years of low or little rainfall.

The Spaniards do have a problem with Persea Mite which arrived there in 2005. It still is not under good biological control, but I saw an organic orchard that didn't spray, and the damage was acceptable. So something is finally kicking in to control this pest as has slowly occurred in California.

Strategizing for Water Cutbacks - Avocado and Citrus

Ben Faber

OK! Let's Strategize. There are four steps for everybody to consider, it doesn't matter if you have a backyard lawn and landscape or if you have 700 acres of avocados.

1. **Maintenance: Irrigation System and Cultural Practices**
2. **Improve Irrigation Scheduling**
3. **Deficit Irrigation**
4. **Reduce Irrigated Area**

1. Maintenance.

Irrigation System.

Fix leaks. Unfortunately, there are almost always leaks for all kinds of reasons. Pickers step on sprinklers, squirrels eat through polytube, branches drop on valves, coyote puppies like to chew….the system should be checked during every irrigation

Drain the lines. At the beginning of each year every lateral line should be opened in order to drain the fine silt that builds up.

Maintain or increase the uniformity of irrigation so that each tree or each area gets about the same amount of water. Common problems include different sized sprinklers on the same line or pressure differences in the lines. Where there are elevation changes, every line should have a pressure regulator, they come pre-set to 30 psi. Having all of your lines set up with pressure regulators is the only way you can get an even distribution of water to all of the trees, and it solves the problem of too much pressure at the bottom of the grove and not enough at the top.

Clean the filters often. You don't have a filter because you think that the district water has already been filtered? Hah! What happens if there is a break in the line in the street and the line fills with dirt during the repairs? All of your sprinklers will soon be filled with dirt.

Is water flow being reduced at the end of the lateral line? It could be because scaffold roots are growing old enough to pinch off the buried line. The only cure is to replace the line.

Cultural Management.

Control the weeds because weeds can use a lot of water.

Mulch? Mulching is good for increasing biological activity in the soil and reducing stress on the trees, but the mulch will not save a lot of water if you are irrigating often….the large evaporative surface in mulches causes a lot of water to evaporate if the mulch surface is kept wet through frequent irrigation. Mulches are more helpful in reducing water use if the trees are young and a lot of soil is exposed to direct sunlight.

2. Improve the Irrigation Scheduling.

CIMIS will calculate the amount of water to apply in your grove based on last week's water evapotranspiration (ET). You can get to CIMIS by using several methods; for avocado growers the best method is to use the irrigation calculator at the "Irrigation Scheduling Calculator" in the "Tools" section of www.avocadosource.com. If you need further instruction on this, you can call our office and ask for the Avocado Irrigation Calculator Step by Step paper. You need to know the application rater of your mini-sprinklers and the distribution uniformity of your grove's irrigation system.

CIMIS tells you how much water to apply, but you need tensiometers, soil probes or shovels to tell you **when** to water.

"Smart Controllers" have been used successfully in landscape and we have used one very successfully in an avocado irrigation trial The one we used allowed us to enter the crop coefficient for avocado into the device, and daily ET information would come in via a cell phone connection. When the required ET (multiplied automatically by the crop coefficient) reached the critical level, the irrigation system would come on, and then shut down when the required amount had been applied. Increased precision can be obtained by fine tuning these devices with the irrigation system precipitation (application) rate.

3. Deficit Irrigation.

Deficit irrigation is the practice of applying less water than the ET of the crop or plant materials. Deficit irrigation is useful for conserving water in woody landscape ornamentals and drought tolerant plants where crop yield is not an issue. Water conserved in these areas may be re-allocated to other areas on the farm or landscape. There hasn't been enough research on deficit irrigation of avocado for us to comment. We suspect, however, that deficit irrigation will simply lead to dropped fruit and reduced yield.

Stumping the avocado tree could be considered a form of deficit irrigation. In this case, the tree should be stumped in the spring, painted with white water-based paint to reflect heat, and the sprinkler can be capped for at least 2 months. As the tree starts to re-grow, some water should be added back, probably about 10-20% of the normal water use of a mature tree.

Regulated Deficit Irrigation for Citrus is an important method for saving water, and in some cases will reduce puff and crease of the peel. In one orange trial done by Dr. David Goldhammer in the San Joaquin Valley, an application of 25% of ETc from mid-May to Mid July saved about 25% of applied water for the year and reduced crease by 67%, without appreciably reducing yield.

Strategizing for Water Cutbacks, Continued from Page 4

4. Reduce Irrigated Area.

Taking trees out of production. Trees that are chronically diseased and do not produce fruit (or the fruit is poor quality) should be taken out of production during this period. Also consider: trees in frosty areas, trees in wind-blown areas, trees near eucalyptus and other large trees that steal the water from the fruit trees.

Changing crops. You may want to take out those Valencias during this period and replant to something that brings in more money, like seedless, easy-peeling mandarins. The young trees will be using a lot less water.

Fallow Opportunities. You may decide to do some soil preparation, tillage or cultivation, or even soil solarization of non-irrigated areas.

We have found that this four step process is a logical way to achieve water cutbacks with least impact. It is possible to achieve a ten percent reduction in water by only improving irrigation system uniformity and scheduling procedures. Often, these two measures also result in better crop performance and reduced runoff. Reducing irrigated area or taking areas out of production should be a last resort and a well thought out decision. Plan for the future, hopefully water will be more available in future years. Taking trees out of production.

California Agricultural Production Statistics

California agriculture experienced a nearly three percent increase in the sales value of its products in 2012. The state's 80,500 farms and ranches received a record $44.7 billion for their output last year, up from $43.3 billion in 2011 and $37.9 billion during 2010. California remained the number one state in cash farm receipts with 11.3 percent of the US total. The state accounted for 15 percent of national receipts for crops and 7.1 percent of the US revenue for livestock and livestock products. Exports totaled $18.18 billion in value which represents an eight percent increase over the previous year.

California's agricultural abundance includes more than 400 commodities. The state produces nearly half of US-grown fruits, nuts and vegetables. Across the nation, US consumers regularly purchase several crops produced solely in California.

California's top-ten valued commodities for 2012 are:

Milk — $6.9 billion
Grapes — $4.449 billion
Almonds — $4.347 billion
Nursery plants — $3.543 billion
Cattle, Calves — $3.299 billion
Strawberries — $1.939 billion
Lettuce — $1.448 billion
Walnuts — $1.349 billion
Hay — $1.237 billion
Tomatoes — $1.170 billion

California Agriculture Production Statistics, Continued from Page 5

Please see complete statistics for 2012, reproduced as PDF files below, or use the link in the right column to access this report and others on the NASS website.

Agricultural Statistical Overview
Field Crops
Floriculture
Fruit & Nut Crops
Livestock & Dairy
Vegetable & Melon Crops
Exports
California Agriculture Statistics Review (entire)

And even more:
http://www.nass.usda.gov/Statistics_by_State/

Maintaining the Citrus Orchard with a Reduced Irrigation Allotment

Craig E. Kallsen,

While my experience with citrus is relatively short compared to many of the senior members of our industry who grew up with it, certainly, these are the worst drought conditions that I have ever seen. Short of a miracle March, which appears to be fast fading, I don't see a way out of this predicament. The options, generally, appear to be grim or grimmer.

What is the worst case scenario? I once worked for a large commercial citrus company that abandoned a block of oranges near Famoso California. The oranges received no irrigation other than what rain fell. By the following spring, most, but not all of the trees appeared to have survived, but as one can imagine they weren't very pretty to look at. Besides the actual leaf and fruit loss that a lack of water will cause, a mature citrus tree that loses its canopy, is extremely prone to sunburn, and attack by secondary fungal and insect pathogens.

So what are the options of dealing with a situation where the grower only has a small percentage of the water necessary to grow a mature crop of citrus?

Options for Dealing with Reduced Water Allocations

The option for one grower who owns an aged, mid-season orange grove that the fruit does not hold particularly well on, is to remove the orchards since he hasn't nearly enough water to farm it. Newly planted citrus trees use a lot less water than mature trees, probably less than 5% or so of mature trees if drip irrigated when first planted. This choice appears sound.

Several growers in local irrigation districts have been notified that they will receive half of their normal water delivery. While this situation is far from ideal, it is certainly better than the allocation many districts will be able to deliver. Some districts are able to deliver this amount of water, largely as a result of the foresight of those that saw the need to establish underground water banks in the area. What are the options for farming with the information, at this time, that you have only 50% of the water allocation necessary to grow citrus?

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An optimistic grower with a tolerance for risk, experiencing this situation of a 50% delivery, might assume that through unexpected large precipitation events or change in water-delivery policies that there will be plenty of water available later in the season, and he or she can go ahead and irrigate at full crop ET. This strategy brings to mind an incident at a water district office in the early 1990s that I was unfortunate enough to witness, where a grower actually wept when informed that his water allocation had been exhausted mid-season, and no more water would be forthcoming.

So what other options might be available for irrigating only 50% of normal besides gambling or orchard removal? What does research tell us?

Regulated Deficit Irrigation Research

In data reported from 1998 – 2000, Dr. David Goldhamer, a U.C. Cooperative Extension Specialist, researched regulated-deficit irrigation in navel orange (specifically a mature block of 'Frost Nucellar' on Troyer Orange rootstock) near the town of Famoso in Kern County. Optimal citrus production not only involves overall yield of fruit, but the quality of the fruit. For example, fruit size plays an important role in grower returns. This study was extensive, and included 14 deficit irrigation treatments. Eleven of these treatments were during the active growing season for periods of 4 to 9 weeks and involved water application rates during these intervals from 0 to 50% of the fully watered control. While Dr. Goldhamer found a fairly strong relationship between gross yield and applied water, there was no relationship between the amount of applied water and gross revenue, fruit load, and packable cartons (i.e. fancy and choice) for any of the treatments compared to the control. Frost Nucellar navel oranges can have a problem with puff and crease which deficit irrigation seems to reduce. Dr. Goldhamer reported that the two highest gross revenues came from the treatments that received 0% of the applied water thru May 31 and then irrigated the same as the fully-watered control trees, and the treatment receiving only 25% of that of the control trees from the period May 15 through July 15 and then irrigated fully. Dr. Goldhamer went on to say that, "our early season regulated-deficit-irrigation data suggest that (seasonally) applied water can be reduced by 25% relative to fully-irrigated trees without reducing gross revenue." To keep things in perspective, I am not sure how water storage in the soil profile or average annual rainfall (which averaged 8 inches during the time of this study) was taken into account in this research.

Later, Dr. Goldhamer looked at regulated deficit irrigation in 'Lane-late navels, which, if fully-irrigated, can grow out of desirable sizes and become overly large and granulated. The following table came from a presentation that he gave in Kern County in 2008.

Seasonal Stress Period	2003-5 Mean Applied Water (inches)	Single Fruit Wt. (g)	Harvest Fruit Load (No./tree)	Total Fruit Yield (tons/ac)	Gross Revenue ($/ac)
Early	24.0	379 c*	138 a	13.5	3070 a
Mid	25.0	310 b	215 c	15.5	4560 ab
Late	29.2	301 b	201 bc	15.2	6540 c
Season Long	17.0	257 a	198 bc	12.8	6220 bc
Control	37.1	392 c	155 ab	15.2	3610 a

Maintaining the Citrus Orchard with a Reduced Irrigation Allotment, Continued from Page 7

Notice in the table that the applied water in the season-long stress was less than 50% of that of the fully-irrigated controls. In the season-long stress, fruit were smaller as were yields, but gross revenue was greater because the fruit did not become too large, and granulation was reduced. Based on this data, a grower with Lane Late navels, may actually be better off with a 50% delivery reduction! I have spoken with a number of growers with late-maturing navels, who regularly only irrigate at about 75% of normal citrus ET, and report a reduction in overly-large fruit, granulated fruit, and reduced alternate bearing.

What else reduces crop water requirement?

A number of years ago I did some pruning research. One of the treatments was severe and involved spring interior pruning, topping and hedging. I ended up removing about 30% of the crop canopy. With the onset of irrigation I realized that by removing about 30% of the crop canopy, I reduced the irrigation requirement of these trees. The tensiometers in the severe pruning plots never showed any stress and the ground was always wet. By experimenting with various smaller-orificed fan-jet emitters, I discovered that the irrigation requirement of these smaller trees had been reduced in proportion to the canopy (i.e. about 30%). It should not have been a surprise. Physics and plant physiology predicts this finding pretty well. We can carry pruning only so far, but it would appear that by reducing tree canopy by about 30% we will reduce our water requirement by about 30%. Remember, however, that citrus bears fruit on one-year-old wood. If we want to produce some crop, we have to leave some one-year-old wood. Topping and some light interior pruning should be able to allow us to reduce crop water use and provide some harvestable fruit. If a large percentage of the top of a tree is removed, and large supporting scaffold branches are exposed, the exposed branches should be whitewashed or treated with another reflective material such as lime or kaolinite clay to prevent sunburn. This treatment is especially important if combined with a regulated deficit irrigation program which will decrease the ability of the tree to cool itself through transpiration.

Reduce Competition for Water

Cover crops and weeds will compete with the citrus for water. This may be the year to spend money on tillage and herbicides to keep other plant species from using the water the citrus crop needs.

Possible protocol for producing some citrus fruit with a 50% or less water allocation

So, how can we incorporate these research findings into a plan of action for producing a crop with only 50% of the water needed to grow a mature citrus tree in the southern San Joaquin Valley and have trees in fair condition for next season? Let's assume that the orchard is currently being irrigated very efficiently (which is another whole other topic) and that there is very little water stored in the soil and that rainfall will be negligible. Based on the research discussed above, what follows is a possible scenario for reducing crop water demand for an acre of mature citrus by about 50%, while still providing an option for some harvestable commercial citrus production.

PERIOD: Spring leaf out through bloom

Through topping and interior pruning, remove about 30% of the crop leaf canopy. Leave sufficient one-year-old wood to produce some fruit. After pruning, treat with copper, zinc, lime mixture to reflect sunlight and reduce sunburn and fungal/bacterial invasion. Treat with registered insecticide if wood borers become a problem.

Do not irrigate until mid- May. We want to harden the tree through slow development of water stress. The idea is to reduce new leaf flush and flowering and encourage fruitlet drop. Reduced fruit numbers will increase the chance of obtaining some fruit of marketable size.

Maintaining the Citrus Orchard with a Reduced Irrigation Allotment, Continued from Page 8

Some research by Dr. Pehrson, suggested that nitrogen fertilization, although reduced, should be decreased less than the irrigation water, and more frequent smaller applications to drought-stressed trees is better than a few large applications.

PERIOD: Mid-May through November 1

Irrigation scheduling

First, we don't want to do a lot of 'little' or light, frequent irrigations. Evaporation from the surface can be extreme, especially in the summer. It can approach ½ inch of water a day in an evaporation pan. We want to make each irrigation count so what we lose to evaporation is a relatively small percentage of what we apply. We want most of it to soak into the soil. This evaporation loss also suggests that we water at night and/or during days that are overcast, when a 'trace' of rain might fall. One plan for irrigating citrus with a 50% allocation, and assuming we removed about 30% of the leaf canopy, might be that we skip every other irrigation or more, but apply the same amount of water at each irrigation (assuming that we don't have any runoff) that we would have applied assuming a 'normal' 100% water allocation. If runoff is a problem, ensure that the soil is properly amended or tilled, to assure maximum water infiltration. By skipping, at a minimum, every other irrigation, water application efficiency should be close to 100%. The goal, which can be greatly assisted by careful soil water monitoring, will be to turn on the irrigation system at just past the point where no available water remains in the rooted area of the soil profile.

If a large summer cloud burst hits, the irrigation for that time period can be skipped. It is not advisable to provide too much additional water at one time as this could trigger summer or early flush of new growth that will increase water demand of the tree and orchard.

A second application of a reflective material, such as a kaolinite clay product, could be applied in mid-summer to reflect the high levels of in-coming summer solar radiation.

What about water wells?

If surface water is not available, existing or new wells are a welcome option on some properties. Many growers in the San Joaquin Valley have irrigation wells. It is no secret that in most areas of the Valley, groundwater extraction is exceeding recharge. As dependence on groundwater increases, a common scenario is that wells need to be deepened in many areas to maintain flow rates. Going deeper is not always an option and in many areas no useable groundwater is available. In other areas, well-water quality is too poor for citrus, which is not tolerant of high pH, sodium, chloride, boron, or elements such as arsenic or lithium. If water quality is poor, and some good quality surface water is available from the district, mixing the two sources may be an option. Water quality should be checked at intervals through the year, to ensure that the quality remains good enough for citrus. If not, suitable amendments can be added to the water or soil, to maintain water infiltration rates and maintain a root environment sufficient for producing citrus. Wells should be tuned up prior to spring, to ensure they are moving the most water possible, as efficiently as possible.

Eventually, as we all know, snow and rain will again fall on California.

The 2014 Drought in California

Etaferahu Takele, UCCE Area Farm Management Economist

The state and federal governments have recognized that California is in a state of emergency and drought is impacting California's agriculture and natural resources and Californians. In this article we would like to provide information from various sources related to the drought and what the Federal and State Governments and the University of California are doing to mitigate the impacts of drought. We will disseminate new information as they become available.

Federal: The Obama administration has announced and will provide assistance to Californians impacted by drought. California could potentially receive over $100 million to assist the state in mitigating the impacts of drought. Currently, the USDA has declared 54 California counties as primary natural disaster areas due to drought. To see the list of counties visit 2014 All Drought – Primary and Contiguous Counties List. Federal programs are available for use in the primary natural disaster areas. For more information on federal drought assistance visit the USDA Disaster and Drought Information website.

State: Governor Brown has made a proclamation of a state of emergency and has ordered state and local agencies to assist California in mitigating the impacts of drought and educating the public. According to the proclamation, state agencies such as the Department of Water Resources, State Water Resource Control Boards, California Department of Food and Agriculture, Department of Fish and Wildlife, Department of Forestry and Fire Protection, the Drought Task Force along with water suppliers and municipalities, will execute a statewide water conservation campaign to make all Californians aware of the drought and encourage reduction in water usage by 20 percent. In addition to the federal programs the California Department of Community Services and Development also provided a list of agencies that can help migrant and seasonal farm workers impacted by drought. For more information on state drought assistance visit the California Drought Resource website.

University of California, California Institute for Water Resources: University of California experts are working hard to provide drought assistance to farmers and Californians. A series of video seminars are available online for view at the California Institute for Water Resources. To view the online seminars visit Water and Drought Online Seminar Series. In addition, a series of drought seminars and events will be conducted in various counties throughout the year. To see the list of upcoming seminars and evets visit the Drought Events website. A list of drought experts can be viewed at the Drought Expert website.

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Ben Faber

Farm Advisor