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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

Vol. 10 No. 1 January - March 2012

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Editor's Note:

Please let us know if there are specific topics that you would like addressed in subtropical crop production. Phone or email the advisor in your county.

Visit your County Cooperative Extension website and the Calendar of Events to register for upcoming workshops or seminars.

In our effort to conserve resources, please help us save paper by signing up to receive your newsletter on line. Just visit the Cooperative Extension website, go to newsletter, click on Tropics in Subtropics and enter your email address.

Gary Bender
Editor of this Tropics in Subtropics issue

***A Comment from the Editor*:**

An unfortunate historic event occurred in the California citrus industry with the discovery of one tree infected with the Huanglongbing (HLB) disease in the Hacienda Heights area of Los Angeles. Every citrus grower in California needs to read the following articles and websites, and get prepared! Preparation includes learning about the disease and its vector, the Asian citrus psyllid (ACP), plotting out a course of action when the psyllids arrive at your grove, organizing spray applications with your neighbors and figuring out how you are going to remove trees when they become infected with the bacterium that is spread by ACP.

The first article is a press release from CDFA in March, with some follow-up information in April and May of 2012. We also include a summary of the control program in Florida (authored by Dr. Tim Spann).

Please take note: Florida has lost at least 200,000 acres of citrus to this disease and is close to having their entire acreage infected by the HLB disease (transmitted by ACP). California is in better shape than Florida (we hope) because the USDA, CDFA and the Citrus Research Board have trappers out with the goal to find the psyllids. Once found it is likely that it will be up to the grower to spray them out, or at least keep them at a low population. In private yards the state and counties may continue to spray them out, if the budget holds up. In addition, we have quarantines in place and we don't have hurricanes to blow the bugs all over the place. However, we do have a lot of traffic and people, and some people don't obey the quarantines. We still have some people who think it is clever to sneak around border stations and bring in citrus budwood, curry leaves or whole trees from foreign countries.

For more information on HLB and ACP, please go to the University of California's website at:

http://www.ipm.ucdavis.edu/EXOTIC/index.html

or to www.californiacitrusthreat.org, www.cdfa.ca.gov/citruscommittee/, www.citrusresearch.org, or www.SaveOurCitrus.org.

Quarantine for Huanglongbing Declared in Hacienda Heights Section of Los Angeles County

(Press Release from the California Department of Food and Agriculture, 3/30/2112)

A 93-square mile quarantine is in place in the Hacienda Heights section of Los Angeles County following the detection of the citrus disease Huanglongbing, or citrus greening.

Additional information, including a map of the quarantine zone, is available at http://www.cdfa.ca.gov/plant/PE/InteriorExclusion/acp_quarantine.html#hlbmaps. The zone is centered near the Pomona Freeway (Highway 60) and Hacienda Blvd. and extends south into a small portion of Orange County, north into Baldwin Park and West Covina, west into South El Monte and Whittier, and east into Walnut and Rowland Heights.

This area is part of a much larger quarantine already in place for the Asian citrus psyllid, the pest that spreads bacteria causing Huanglongbing. The new quarantine will prohibit the movement of all nursery stock out of the area, while maintaining existing provisions allowing the movement of only commercially cleaned and packed citrus fruit. Any fruit that is not commercially cleaned and packed, including residential citrus, must not be removed from the property on which it is grown, although it may be processed and/or consumed on the premises.

"The success of any quarantine depends on cooperation from those affected," said CDFA Secretary Karen Ross. "The stakes couldn't be higher for California citrus. We urge residents in the Hacienda Heights-area to do all they can to comply."

Because the latency period for the development of Huanglongbing symptoms in an infected tree can be two years, the quarantine is expected to last at least that long. CDFA, the USDA and the Los Angeles County Agricultural Commissioner's continue their work to investigate the source of the disease, to survey and test for it throughout the Los Angeles Basin, and to prepare for ground treatment of citrus trees within 800 meters of the find site – tentatively

scheduled to begin next week. In the long term, the strategy is to control the spread of Asian citrus psyllids while researchers work to find a cure for the disease.

Huanglongbing was confirmed last week in an Asian citrus psyllid sample and plant material taken from a lemon/pummelo tree in a residential neighborhood in the Hacienda Heights area of Los Angeles County.

The disease is bacterial and attacks the vascular system of plants. It does not pose a threat to humans or animals. The Asian citrus psyllid can spread the bacteria as the pest feeds on citrus trees and other plants. Once a tree is infected, there is no cure; it typically declines and dies within a few years.

Huanglongbing is known to be present in Mexico and in parts of the southern U.S. Florida first detected the pest in 1998 and the disease in 2005, and the two have now been detected in all 30 citrus-producing counties in that state. The University of Florida estimates the disease has tallied more than 6,600 lost jobs, $1.3 billion in lost revenue to growers and $3.6 billion in lost economic activity. The pest and the disease are also present in Texas, Louisiana, Georgia and South Carolina. The states of Arizona, Mississippi and Alabama have detected the pest but not the disease.

The Asian citrus psyllid was first detected in California in 2008 and is known to exist in Ventura, San Diego, Imperial, Orange, Los Angeles, Santa Barbara, San Bernardino and Riverside counties. If Californians believe they have seen evidence of Huanglongbing in local citrus trees, they are asked to please call CDFA's toll-free pest hotline at 1-800-491-1899. For more information on the Asian citrus psyllid and Huanglongbing, please visit: http://www.cdfa.ca.gov/plant/acp/

Figure 1. Samples from the 1st tree with HLB in CA. The key feature is the pronounced asymmetry of the chlorotic pattern.

Figure 2. Abnormally shaped fruit caused by HLB disease. (UC IPM Program).

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The original infected tree was a pummelo-lemon hybrid in a backyard. The tree had 21 grafts and the USDA Smuggling and Interdiction Trade Compliance Group are investigating the source of this budwood. The original tree has been removed.

An Outline of Management Options for HLB in Florida.

Tim Spann, University of Florida.

1. Tree Inoculum Removal
a. In Florida the disease cannot be eradicated. The goal is to keep infected tree populations low (2%?).
b. This requires a strong commitment to psyllid control, infected tree removal and resetting to maintain productivity.
c. This must be repeated continuously since psyllid control and scouting are not 100% effective.

2. Limitations to Tree/Inoculum Removal
a. Until a tree is detected and removed it can serve as a source of inoculum
b. Visual detection may not happen until 6-24 months after infection.
c. PCR is not reliable on symptomatic trees.
d. Timeliness. Is there a willingness to remove infected trees prior to harvest?
e. Cost. This includes scouting, tree removal, yield loss, resets, reset management.

3. The Bad Neighbor Effect
a. Psyllid control is unlikely to be effective over small areas. There are edge effects.
b. Inoculum removal most effective if done in large areas. Can you effectively manage inoculum levels if your neighbor is not?

4. The Success of Inoculum Removal.
a. In Brazil and Florida it appears that growers can be successful at maintaining low infection rates on large acreages. (5,000 acres)
b. Must be reset to maintain productivity
c. Can inoculum and psyllid levels be kept low enough to bring new trees into production?
d. We don't know what will happen long term
e. What about the small grower?

5. Foliar Nutritional Sprays.
a. This does not eliminate the bacterium/inoculum
b. The goal is to maintain the productivity of the existing trees.
c. Psyllid control must be maintained in order to minimize continuous inoculation.

6. Limitations to a Nutritional Program.
a. The grove will, in time, become 100% infected.
b. Duration of effect?
c. Quality of fruit?
d. Cost. We don't yet know the exact recipe needed.

7. The Success of Nutritional Programs.
a. A grove in SW Florida with HLB since late 2005 has not removed any trees and is still productive.
b. University trial plots initiated in 2008 on rehabilitated trees are still productive. This is replicated in two commercial groves.
c. Long term sustainability?

8. Is there a Hybrid?
a. Use a foliar nutrition program to maintain existing tree health until grove becomes unproductive.
b. Push entire grove and reset following an intensive psyllid control and inoculum removal program (and improved nutrient management).

Avocado Farming with High Priced Water

Can it Remain Profitable?

Gary S. Bender, Farm Advisor, UCCE San Diego County

Water prices in San Diego County continue to increase and there is no end in sight, especially with periodic drought years and California losing some share of its Colorado River water. It is easy to see the response from growers; water is being turned off in many of our districts leaving acres and acres of

dying trees. The water districts get nervous because there is not enough money coming in to cover their fixed costs, so they raise the price of water. And, they raise it again.

The math is simple. Some of our water districts are selling water to growers for $1200 - $1300 per acre foot. At a water requirement of about four acre feet per acre for avocados in the inland areas of San Diego County, water will cost $4800 - $5200/acre per year. If you are producing 5000 lbs per acre (the average yield in California for the last five years) and receive $1/lb for your fruit, you get less than your water costs. And that doesn't consider labor costs, fertilizer, taxes, insurance, vehicle costs etc. Profits? Are you kidding?

Are we done? Either prices for our fruit have to increase, or we have to increase the yield per acre. As for prices, we don't have control over market prices; they rise and fall with demand by consumers, on and off years in our groves and interference with Mexican, Chilean and now Peruvian imports.

Can we increase yield per acre? The private consultants and the farm advisors have spent our careers trying to help growers with proper irrigation scheduling and balancing out the pressures and flows, proper fertilization, controlling thrips and persea mites at the right time, and dealing with avocado root rot (which continues to be a huge problem). Despite good farming practices yields per acre have not increased dramatically for most growers. To be fair, some growers are doing quite well with good farming practices, good weather and good soil but it will probably take a ***dramatic*** increase for most of the growers to stay in business in San Diego County.

I saw a dramatic increase in yield per acre recently in two groves, one in Temecula (owned by John Cornell) and one in the southern area of Escondido (owned by Steve Howerzyl). The Temecula grove produced over 30,000 lbs/ac in the sixth year from planting and the Escondido grove produced 24,195 lbs/ac in the fifth year. Both are high-density groves planted on a 10' x 10' spacing (435 trees/acre). This kind of production is exciting and might bring hope to avocado production for the future in San Diego County. Yield data is supplied in Table 1 and 2.

Table 1. Hass avocado yield data supplied by the grower for a high density planting in Temecula. 384 trees /acre = 0.88 acre. Yield data adjusted to pounds/acre.

2004 planted	0
2005	0
2006	2,727 (est.)
2007	3,636 (est.)
2008	2,727 (est.)
2009	4,545
2010	32,727
2011	4,318

Table 2. Hass avocado yield data supplied by the grower for a high density, non-pruned planting in Escondido. Yield data is supplied in pounds/acre.

2006 planted	0
2007	0
2008	0
2009	5,080
2010	7,656
2011	24,195

However, both groves have problems!

The Temecula grove had a low fruit set in the spring of 2011. (This was the reason I was called out to look at it). Of course a large part of the problem is the inherent on/off cycle in avocados. However, in order to keep these trees in a high density situation without crowding, the grower had to prune the trees. In the late winter/early spring of 2011 every tree was pruned on all sides and topped at 8-9 feet. This effectively removed a lot of the fruiting wood and the trees had a reduced flowering and fruit set as a result. Remember, the Hass avocado flowers and sets fruit primarily on the outside of the tree canopy.

The Escondido grove was not pruned and all of the trees had grown into each other, creating an incredibly crowded grove. It was so crowded that the irrigator was complaining that he couldn't get through the grove to check the sprinklers. The

grower commented that his plan was to remove all of the trees in the eighth year and start over again according to the Hofshi idea that was suggested several years ago. (More on this later in this article).

I like the idea of close spacing for increasing yield per acre, but both groves need a good idea for maintaining the spacing and yet produce fruit every year. I proposed pruning in a three year rotation; the southwest side would be pruned the first year, the northeast side pruned in the second year, and the tree would be topped at eight feet in the third year. Then the whole process would start over again. By using this method there would always be fruiting wood on the tree. And it is an easy method to teach grove workers.

The only problem with this pruning idea is that we have never tried this in a trial. This is why I proposed a trial to the California Avocado Commission to set up a high density trial with Hass and Lamb Hass, comparing two pruning methods: complete pruning each year vs. the three year rotation idea. The Commission liked the idea and they funded the trial, along with grower education classes. The trial and the classes will commence in the summer of 2012.

High Density Avocado Plantings. High density plantings were proposed in California in an article in Subtropical Fruit News by Fallbrook grower Reuben Hofshi in 1999. Hofshi stated that the underlying premises for planting on close spacing were:

1. "To compete in the international market with low avocado prices will require more efficient farming and a significant increase in productivity.
2. Young trees are vigorous, produce large fruit early, have better canopy to root ratio and reach peak productivity approximately by 7 to 8 years.
3. Smaller trees are easier and less expensive to harvest, particularly when size picking is done, and are very amenable to snap harvest.
4. Spraying for different pests may become a way of life; smaller trees are probably the only ones that could be efficiently sprayed by ground rigs in hilly terrain."

In the last few years in California we are seeing a severe reduction in our labor force for harvesting. Pickers are getting picky; they have cell phones and they can call around to find the groves that can be harvested from the ground. Lugging a ladder around on a steep slope is just not desirable, and they can make a lot more money if they don't have to use ladders.

Researchers in other countries have been interested in high density plantings and many of the new plantings in Chile are planted in high density patterns. Ernst and Ernst, growers and nursery owners in South Africa maintain that high density can only be successful if the trees are pruned to a central leader immediately after planting, and maintained in that manner through the life of the tree. They are working with a Hass-like variety known as 'Maluma' which has more of a natural central leader than does 'Hass'.

Pruning. Growers in California have traditionally avoided pruning. Other than stumping periodically if the trees get too tall, not much pruning is done. One of the reasons is the labor to prune. It is difficult to determine from work done in foreign countries how much labor is involved in high density because many of the areas use the growth retardant paclobutrazol, a chemical we are not allowed to use in the U.S. We will keep track of our labor costs in our trial and will report this to growers interested in high density plantings.

Can avocado growers survive in a county with high priced water? Possibly. High density plantings may be one solution to a really serious problem. But growers must continue with good farming practices such as a complete leaf analysis each year along with proper irrigation scheduling.

Literature Cited:

Hofshi, R. 1999. High density avocado planting – an argument for replanting trees. Subtropical Fruit News. Vol. 8 (1).

Ernst, Z.R. and A.A. Ernst. 2011. High density planting: a case study of central leader pruning with Maluma. Proc. VII World Avocado Congress 2011, Cairns, Australia 5-7 Sept. 2011

Steve Howerzyl in his High Density Avocado Grove

Soil Moisture Sensors

Ben Faber, Farm Advisor, UCCE Ventura and Santa Barbara Counties

Soil moisture sensors fall into two broad categories, volumetric and tensiometric methods. One tells you how much water is in the soil and the other tells how difficult it is to remove water. Volumetric methods require a calibration of the sensor to the soil, whereas tensiometric is good to go when installed. The case in both methods is the grower learns to keep soil moisture within a given range of values and, in theory, the plant is kept in a better condition with improved health and yields and potential improved irrigation efficiency.

The most common volumetric methods rely on measuring the dielectric constant of the soil which determines the velocity of an electromagnetic wave or pulse depending on soil moisture content. These sensors have become widely used because they have a good response time, do not require maintenance and can provide continuous readings, allowing for automation. There are several different methodologies used: Time Domain Reflectometry, Frequency Domain Reflectometry (Capacitance), Amplitude Domain Reflectoremtry (Impedance), Phase Transmission, and Time Domain Transmission. There is quite a range in prices for these different devices, require calibration with soil moisture content and do not require close soil contact. Some devices are affected by the chemical nature of the soil. Even if they are not calibrated they can be used as relative change in moisture content over time.

The tensiometric methods include: Tensiometers, Gypsum Blocks, Granular Matrix Sensors, Heat Dissipation and Soil Psychrometer. These techniques require the sensor to come into equilibration with the soil moisture and generally are unaffected by soil salinity. Gypsum blocks and Granular Matrix are not very responsive in sandy soils and require good soil contact. These methods are less affected by salinity and do not require soil calibration, because they are reflecting the soil moisture tension the roots are seeing.

All soil moisture sensors need to be placed in a position that represents the irrigated area. They need to be placed in the active root zone where water is applied and taken up and must be near trees representative for the whole irrigated area. They should not be next to a sick tree, a smaller tree compared to the other trees or be in an area that obstructs applied water (such as under a canopy that intercepts applied water). It is always best to reinforce sensor values with manual field measurements with a soil probe to ensure that sensor placement and response is truly reflective of what is going on in the field, before completely relying on the sensor values. As with all field equipment, occasional visual inspection of the field and sensor readings should be made to make sure the situation has not changed, such as an emitter has clogged or broken near the sensor to find potential erroneous readings.

Volumetric Sensors

	TDR	FDR	ADR	PT	TDT
Appx. Cost (including logger/reader)+	$400- 20,000	$100-3,500	$500-700	$200-400	$400-1,300
Field Maintenance	No	No	No	No	No
Affected by salts	High levels	Minimal	No	>3dS/m	High levels
Soil type not recommended	Organic, salt, high cay	None	None	None	Organic, salt high clay

+ Prices as of 2009

Tensiometric Sensors

	Tensiometer	GB	GMS	HD	SP
Appx. Cost (including logger/reader)+	$50-300	$400-700	$200-500	$300--500	$500-1000
Field Maintenance	Yes	No	No	No	No
Affected by Salts	No	>6 dS/m	>6dS/m	No	maybe
Soil Type not recommended	Sandy	Sandy, high clay	Sandy, high clay	Sandy	Sandy, high clay








These sensors can be purchased individually and installed by the grower, or increasingly there are companies that provide a station which includes soil moisture, sensors for estimating plant evapotranspiration , data logger and software that determines an irrigation schedule for the crop. Some of these systems are outright purchase and some are for lease. In the future, there will be affordable satellite imagery that can help in irrigation scheduling which shows how rapidly this technology is changing.

Disclaimer: Discussion of research findings necessitates using trade names. This does not constitute product endorsement, nor does it suggest products not listed would not be suitable for use. Some research results included involve use of chemicals which are currently registered for use, or may involve use which would be considered out of label. These results are reported but are not a recommendation from the University of California for use. Consult the label and use it as the basis of all recommendations