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.

Neil O'Connell
Editor

Costs of Orchard Establishment and Production Summary for Avocados in California:

Based on 2011 studies:
www.coststudies.ucdavis.edu
Etaferahu Takele, UCCE Area Advisor, Ag. Econ/Farm Management, southern California and Mao Vue, UCCE Staff Research Associate

In fall 2012, we completed and published sample costs and returns studies for establishment and production practices for conventional and organic avocados in the major producing counties. We divided the production regions into two parts to show the differences in production methods and costs especially as related to water prices. The northern part of the growing region includes Ventura, Santa Barbara and San Luis Obispo counties. The southern part of the growing region includes San Diego and Riverside counties. We developed four studies, two conventional methods and two organic methods, one for each region.

Data for the sample cost studies were obtained from growers, farm advisors, pest control advisors and other agricultural institutions including banks, agricultural appraisers and equipment dealers. The data we obtained were entered into a budget generator program for calculation and development of sample establishment and production costs.

The studies provide the detail assumptions used in the development of establishment and production costs (ref. the above website) Some common assumptions to all of the cost studies include average labor wages with benefits of $14 per hour for manual and irrigation labor and $18 per hour for machine labor. We used a price of $1.07 per pound which is the five-year average obtained from the California Avocado Commission (CAC) to calculate crop value and we assumed an additional $0.20 per pound premium for organic avocados, and used $1.20 per pound for organic avocados crop value.

Table 1 shows the summary of costs of establishment and production and returns per acre by production method, region, and county. Establishment costs include the accumulated net costs (gross returns less costs) during the orchard development period from year 1 to 6. The production costs estimates are for year 7 + when the trees are considered nearly mature and fully yielding. Gross returns are price per pound times yield. Gross margin are returns above operating and cash overhead costs and returns to management are returns above total costs.

Table 1. Summary of Costs of Establishment and Production and Returns per Acre, By Production Method and Region.

	Avocado Production Systems							
	Conventional Production Method				Organic Production Method			
	Northern Region		Southern Region		Northern Region		Southern Region	
	Ventura & Santa Barbara	*San Luis Obispo*	*San Diego*	*Riverside*	*Ventura & Santa Barbara*	*San Luis Obispo*	*San Diego*	*Riverside*
Spacing	22'x11'	22'x11'	20'x15'	20'x15'	22'x11'	22'x11'	20'x15'	20'x15'
Trees per Acre	180	180	145	145	180	180	145	145
Establishment Costs (Yrs. 1-6)	$35,111	$35,176	$38,235	$32,407	$39,552	$39,773	$43,626	$37,798
Production (Mature) Year Yield (Yr. 7 +)	12,400 lbs.	11,200 lbs.	9,000 lbs.	9,000 lbs.	10,500 lbs.	9,500 lbs.	7,700 lbs.	7,700 lbs.
Production Cost (Yr. 7 +)	$10,912	$10,196	$12,980	$10,613	$12,222	$11,579	$14,420	$12,053
Gross Returns at Production	$13,268	$11,984	$9,630	$9,630	$13,335	$12,065	$9,779	$9,779
Gross Margin *(Returns above Operating & Cash Overhead Costs)*	$7,382	$6,819	$544	$2,542	$6,499	$5,886	-$327	$1,671
Returns to Management *(Returns above Total Costs)*	$2,356	$1,788	-$3,350	-$983	$1,113	$486	-$4,641	-$2,274

Establishment and production costs are higher for San Diego County than any other avocado producing counties for both the conventional and organic production. In conventional production, establishment costs in San Diego County are higher by 8% above the northern growing region of Ventura, Santa Barbara and San Luis Obispo counties and 15% above Riverside County. Production costs in San Diego County are higher by 15% above Ventura and Santa Barbara counties and 21% above San Luis Obispo and 18% above Riverside County. The main difference is accounted for by water cost, which in our study was assumed $1,200 per ac-ft. for San Diego County, $650 per ac-ft. for Riverside County, $325 per ac-ft. for Ventura and Santa Barbara, and $200 per ac-ft. for San Luis Obispo. According to the local farm advisor, the high water cost in the southern growing region, especially in San Diego County, is due to various drought years and the loss of shares of water from the Colorado River. Other influencing factors that resulted in higher establishment and production costs for San Diego County include lower yields due to wider space planting (145 trees per acre vs. 180 per acre in the northern region) and higher labor costs for material applications on steeper hillsides.

Organic avocado production costs are generally higher than conventional production regardless of the production region. Orchard establishment costs of organic avocados run 11-12% higher in the northern producing region and 12%-14% in the southern region than the conventional production practices. Similarly, production costs run 11%-12% higher in the northern producing region and 10%-12% higher in the southern producing region than conventional production practices. The main differences between conventional and organic productions include material costs, hours spent on labor, and yields. Organic material particularly in fertilization and pest management tends to cost more and require more labor hours for application than conventional materials. For example, organic fertilizers are usually in dry or granular form and have lower amount of nitrogen per pound (feathermeal 12% for organic vs. UN-32% nitrogen for conventional) therefore requires higher application rates and will take longer to apply by hand. Organic pest control such as spinosad ($34 per ounce) for thrips control cost more than conventional insecticide (abamectin $1 per ounce). In addition, organic growers spend more hours hand weeding in the northern region. Gypsum is hand applied for phytopthora root rot treatment in organic production and costs more to apply than potassium phosphite for conventional production. Overall, costs for organic production results in $3,453 more ($2,471 more for fertilization, $348 more for pesticide, $338 more for root rot treatment and $296 more in weeding) than the conventional method in the northern region and costs $3,804 more ($2,846 more for fertilization, $346 more for pesticide and $610 more for root rot treatment) than the conventional method in the southern region.

There is also a yield difference between conventional and organic productions. Yield is generally higher for conventional than organic production methods regardless of the production region. The yield level provided by growers includes 15% more for conventional production methods than the organic production methods for the northern producing region and 14% more in southern producing regions.

Gross returns estimates for organic production in the northern producing region are higher than gross returns in San Diego and Riverside counties for both conventional and organic production. This is due to higher yield attained from the narrow space planting in the northern producing counties (22’x11’=180 trees per acre in the northern producing regions vs. 20’x15’= 145 trees per acre in the southern producing region).

Gross margin (returns above all cash costs) and returns to management (returns above total costs except management) are all positive for both the northern and the southern part of the growing region. However, gross margins are much lower than the northern growing region. Net margins are positive for the northern part of the growing region but are negative for the southern part.

Table 2. Analysis of Breakeven Costs and Returns per Pound of Avocados
Based on $1.07 per pound price for Conventional Avocados and $1.27 per pound price for Organic Avocados

	Conventional Production Method				Organic Production Method			
	Northern Region		Southern Region		Northern Region		Southern Region	
	Ventura & Santa Barbara	*San Luis Obispo*	*San Diego*	*Riverside*	*Ventura & Santa Barbara*	*San Luis Obispo*	*San Diego*	*Riverside*
Gross Margin Breakeven (ash Costs per acre divided by Yield per acre)	$0.47	$0.46	$1.01	$0.79	$0.65	$0.65	$1.31	$1.05
Gross Margin ($) (Price per pound minus Gross Margin Breakeven)	$0.60	$0.61	$0.06	$0.28	$0.62	$0.62	-$0.04	$0.22
Net Margin Breakeven (tal Costs per acre divided by Yield per acre)	$0.88	$0.91	$1.44	$1.18	$1.16	$1.22	$1.87	$1.57
Net Margin ($) (Price per pound minus Net Margin Breakeven)	$0.19	$0.16	-$0.17	-$0.11	$0.11	$0.05	-$0.60	-$0.30

Breakeven is the cost of production per acre divided by yield per acre.
Gross margin is gross returns (price time yield) minus cash costs of production.

We provided the breakeven prices analyses in Table 2. Given our costs of production estimates and yield assumption of 12,400 and 11,200 pounds per acre for conventional avocados, respectively for Ventura and Santa Barbara counties and San Luis Obispo County the breakeven prices to cover cash costs are $0.47/lb. in Ventura and Santa Barbara counties and $0.46/lb. in San Luis Obispo County. Whereas the breakeven prices to cover all costs are $0.88/lb. for Ventura and Santa Barbara counties and $0.91/lb. for San Luis Obispo County. This means given the $1.07 price per pound of avocados, there will be $0.60/lb. gross margin and $0.19/lb. net margin for Ventura and Santa Barbara counties; and there will be $0.61/lb. gross margin and $$0.16/lb. net margin for San Luis Obispo County.

For organic production, given the cost of production estimates and yield assumption of 10,500 and 9,500 pounds per acre, respectively for Ventura and Santa Barbara counties and San Luis Obispo County, the breakeven price to cover cash costs is $0.65/lb. for all counties (Ventura, Santa Barbara, and San Luis Obispo). The breakeven prices to cover all costs in organic production are $1.16/lb. for Ventura and Santa Barbara counties and $1.22/lb. for San Luis Obispo County. This means that given the $1.27 price per pound of organic avocados, there will be $0.62/lb. gross margin for all counties and $0.11/lb. net margin for Ventura and Santa Barbara counties and $0.05/lb. net margin for San Luis Obispo County.

In the southern producing region, given our costs of production estimates and yield assumption of 9,000 pounds per acre for conventional avocados for both San Diego and Riverside counties, the breakeven prices to cover cash costs are $1.01/lb. for San Diego and $0.79/lb. for Riverside. Whereas, the breakeven prices to cover all costs are $1.44/lb. for San Diego County and $1.18/lb. for Riverside County. This means that given the $1.07 price per pound of avocados, there will be $0.06 per pound gross margin for San Diego County and $0.28/lb. gross margin for Riverside County. However, the breakeven price falls short by -$0.17/lb. and -$0.11/lb. net margin, respective for San Diego and Riverside counties.

Given our costs of production estimates and yield assumption of 7,700 pounds per acre for organic avocados, for San Diego and Riverside counties, the breakeven prices to cover cash costs are $1.31/lb. for San Diego and $1.05/lb. for Riverside. The breakeven prices to cover all costs are $1.87/lb. for San Diego County and $1.57/lb. for Riverside County. This means that given the $1.27 price per pound of organic avocados, there will be a shortfall of -$0.04/lb. gross margin for San Diego County but a positive gross margin of $0.22/lb. for Riverside County. Net margins fall short of the breakeven prices by -$0.60/lb. and -$0.30/lb., respectively for San Diego and Riverside counties.

Overall, narrow space planting with higher yields and lower water costs are positive impacts on returns to management in the northern

producing region with substantial profitability levels that keeps the industry moving forward. On the other hand, the wider spacing and lower yield and higher water costs have negatively affected the overall returns to management in the southern producing region. Currently, there is a trial in the southern producing region on narrow spacing with an emphasis on pruning methods. In the future, we hope to develop a thorough costs study on narrow spacing in the southern producing region after trials are completed. For detail information on our assumptions, costs tables, and profitability analyses copies of the avocado costs studies for both regions on conventional and organic avocados can be retrieve from the above referenced website.

Huanglongbing Conference, Florida,

February 2013

Ben Faber

This February there was a four day international conference in Orlando, FL that attracted 467 people from 21 countries, including about 20 from California. There were 87 oral presentations and over 80 posters that covered all aspects of Huanglongbing, the insect vector (Asian Citrus Psyllid or ACP), disease detection, insect control and monitoring and a whole lot of information on the genome of the bacteria, how it compares to other infectious bacteria and what can be done to exploit its genetics to control the disease. To learn more, the proceedings and agenda can be found at:
http://irchlb.org/hlb/schedule.aspx.

To start off, this is an amazing example of coevolution among a plant, a bacteria and an insect. It appears that the citrus tree may give off an odor which at low concentrations acts as an attractant, but at higher concentrations is a repellant. The infected tree also gives off volatile organic compounds (VOCs) that can be used to identify affected trees. These chemicals are not pheromones which are social odors emitted by some insects which act to affect insect behavior, such as mating or causing aggregation. Being able to use these new odors will allow for better methods of monitoring the insect with lures. We currently use blunder traps which are not a very good indication of whether there are ACP present.

Currently the most commonly used technique for identifying infected trees is the use of the polymerase chain reaction (PCR) method which is a biochemical technology that identifies the presents of the bacterial DNA. This method was used on the leaves of trees since that is what the psyllid feeds on and where the bacterial infection starts. Results have been erratic and inconsistent and often would not give results until many months after the infection started.

The bacteria clog the phloem tissue which carries sugar to the roots and on which the psyllid feeds. The higher concentration of sugar accelerates the development of the insect and it can lay more eggs. The bacteria travel down the stem at measured rates of one centimeter per day and accumulate in the root system. The root tips are the growing points and where the plant directs sugar to feed the new root growth. It is from the roots that the bacteria go out to all points of the canopy where it can then be picked up by uninfected psyllids which can then go on to find a new tree to feed on. By measuring root tips, rather than leaves, the detection is more rapid and much more consistent, since the bacteria levels are higher in the tips than the point of infection. Disease detection is now being improved by better understanding of the biology of the infection process and thereby allowing faster determination of whether a treatment works.

The ability to evaluate what treatments work has allowed researchers to determine such things as what rootstocks and scions might be most vulnerable, what spray programs are the most successful and how better to lay out trials. It turns out that there is an edge effect during a psyllid invasion and that the first affected trees are right on the perimeter. By focusing spray programs in this area can slow the movement of the insect to the middle of the orchard.
Actual economic control of this pest and disease are still some time away, but with this new understanding of the disease process we will be closer to finding a solution.

Fruit drop and defoliation associated with HLB

Going Out of Business in the Citrus Business
Doing it the Right Way

By Gary Bender

High priced district water in San Diego County is really making it tough on citrus growers. Many of the citrus growers in San Diego County are finding it increasingly difficult to make a profit, but they usually stick it out for several years before they turn the water off. Why do they wait so long? Market prices may go up for all kinds of reasons including freezes in other parts of California or Florida, or the discovery of illegal pesticide residues in foreign fruit, or an unusual demand for fruit in the U.S. Sometimes it makes sense to farm organically because the return prices can be high enough to stay in business, but farming expenses may increase and we have often seen yield and fruit quality decline. However, it may become apparent after awhile that some varieties of citrus, such as Valencia oranges, may be have seen their day and it is time to move on with something else. So, the water gets turned off.

Areas in the county with good quality and abundant well water will probably stay in the Valencia orange business for some time, especially with declining acreage in other areas which tends to make orange prices go higher.

Unfortunately, citrus trees usually do not completely die if the water gets turned off. They struggle to produce a few leaves with water supplied by spring rains. They don't produce fruit; they just have a few leaves.

Normally this wouldn't be a big deal. But things have changed in California. Asian Citrus Psyllid (ACP) has infested hundreds if not thousands of backyard citrus trees in Los Angeles County, and is now spreading through Riverside and San Bernardino counties. Psyllids are occasionally found in the southern parts of San Diego County and they are being sprayed out by CDFA. All of a sudden ACP are now being found in quite a few locations in the citrus groves in northern San Diego County (Fallbrook, Pauma Valley and Borrego Springs).

Asian Citrus Psyllids by themselves don't do very much damage, but they are the carrier for the Huanglongbing (HLB) disease which is well on its way to killing out a large percentage of the citrus industry in Florida. We still have not found any HLB disease in California (except for one tree in Los Angeles County, which was removed).

Here's the Problem! Dying citrus groves are everywhere in San Diego County; most of them had the water turned off in the last few years when the water districts raised their prices. And nobody is watching these groves to check for ACP. And even if they were found, would the grower pay the money to have the trees sprayed? I doubt it!

So, let's do the right thing. In order to protect citrus in California, these dying trees need to be cut down and the stumps either removed or killed.

How can this be done? When I was younger I cut down my father-in-law's orange grove in Riverside, so I have some experience (and I still have a sore back). I cut the trees into fire-place size logs and sold and delivered the firewood. I cut the trunks off about 3 feet from the ground, and yanked out the stumps with a tractor. I piled up the stumps and burned them in the winter (you can't do that in Riverside anymore, but you

can in San Diego County in the winter if you have a burning permit from the fire department). You can also bring in a chipper to chip up the smaller branches and brush. They even have some giant grinders that will grind the whole tree right down to the ground.

Commercial Growers and ACP. Over the past several years we have had quite a few meetings for commercial growers on ACP and I would advise all growers (for a refresher course) go to the website http://www.ipm.ucdavis.edu/index.html and click on Exotic and Invasive Pests, then click on Provisional Treatment Guidelines for Citrus under the Asian Citrus Psyllid and Citrus Greening Disease headline.

For homeowners and commercial growers, the basic strategy is to treat the trees with a foliar spray when leaf flush begins in the spring, alternating with a soil treatment with a systemic insecticide. Homeowners can use carbaryl (Sevin) for the foliar treatment, commercial growers have quite a few choices (refer to the list of pesticides on the University of California's website at www.ipm.ucdavis.edu). The systemic should be applied in the summer when the soil warms up; homeowners can us imidacloprid (Bayer Advanced Fruit, Citrus and Vegetable Insect Control), and commercial growers can use Movento, Admire Pro or Platinum. Make sure you read the labels carefully and apply the correct amounts because some of these materials are toxic to bees.

Task Force Formed. One of the lessons that came out of Florida was that aerial applications of pesticides should be coordinated so that all of the growers in an area should treat at the same time. If not, the insects hunker down in the non-treated groves and move back into the treated groves fairly quickly. So in order to coordinate this effort a task force of volunteer growers along with the Farm Bureau, County Agriculture Weights and Measures Dept., and the CDFA are meeting at the Farm Bureau once a month. A Regional Coordinator has been hired, Mark Nyberg, who will work with growers to develop treatment plans. You can reach Mark at (805) 832-3187, or email him at agexpert@dslextreme.com. You can also find information on the Farm Bureau website www.sdfarmbureau.org.

Strategy. The strategy is fairly simple: we hope to keep the ACP suppressed so that the spread of HLB is very slow (when it is discovered here). And the grower should remove the dead and dying trees.

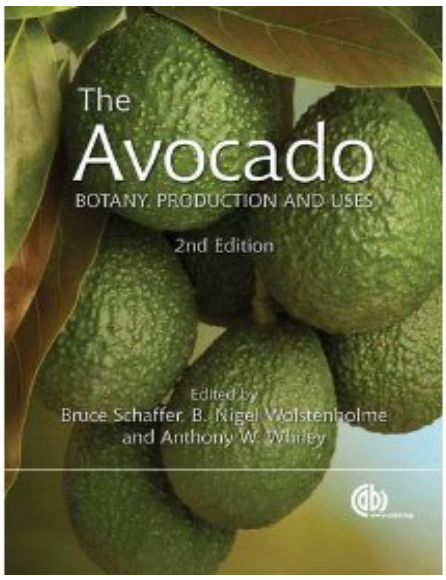
So, let's either keep the trees and treat them, or remove them!

A stressed orange grove which has had the water turned off for one year.

The Avocado: Botany, Production and Uses, 2nd Edition

By Bruce Shaffer, Nigel Wolstenholme and Anthony Whiley

This brand new book summarizes avocado science and technology and reviews production practices on a worldwide scale. The book is split into 15 chapters and covers all aspects of avocado production and science and includes: history, distribution and uses, taxonomy and botany, propagation, crop management, diseases and insect and mite pests. This book builds on the 2002 edition and includes the works of 45 writers from all over the avocado world.



Winter Irrigation

By Ben Faber

"We don't need to irrigate, it's winter." This is a commonly held idea, and many years it is true. Adequately timed rains will often meet the needs of avocado trees during the winter period, and in times like last year, even satisfy much of the spring requirement. And the calls are coming in – "What's wrong with my trees, they have all these brown leaves?" This from San Diego to San Luis Obispo.

In a low rainfall year, irrigation can be as necessary as at other times of the year. This is because a subtropical evergreen like avocado continues to use water regardless of rainfall patterns. At the time of writing this article in March, we have had a scant 4 inches in Ventura and this is on top of a low rainfall year in 2011-12. Rain is necessary to leach the salts that have accumulated from the last irrigation season.

The driving forces for plant water use are light intensity, wind and relative humidity, as well as temperature. Remember how cold, dry winds can dry your skin or freeze-dry backpack food. Even during the winter, the trees are quite capable of losing large amounts of water with clear skies and cold winds.

Dry Santa Ana conditions are also more common in winter than in the past. This winter, a time of drought, I went out to see an orchard to evaluate it for pruning. On arrival, my first concern was for the water stress in the trees. The grower, however, was unconcerned. The trees had been dutifully irrigated the previous Friday. But over the weekend, a Santa Ana had blown for three days and completely dried the soil in the top 10 inches. Digging around the roots convinced the grower of water stress. Do not take irrigation for granted.

Contributing to the problem is the determination of what amount of rainfall is effective. Effective rainfall is defined as the amount of water that is retained in the root zone after rain. Avocados, especially on shallow soils, do not have much of a root zone. Most soils can be expected to hold about 2 inches of available water in the top 2 feet, less the more sandy, more the more heavy.

If rainfall exceeds the holding capacity within the root zone, it is lost to the plant. Just imagine if all the year's expected rain fell during one storm. It would not be long before irrigation would be required with no more rain coming. The extra water may, however, perform the all-necessary function of leaching accumulated salts from the root zone. When the rain gauge says that 2 inches fell, it is quite possible that all that rain will not be available to the tree. This also goes for the quarter inch storms we get that do not even make it through the leaf litter. It is not

effective rainfall, even though it may wash the persea mite off the leaves.

One of the best ways to assess the effectiveness of rainfall within the root zone is with tensiometers. These trusty instruments are most commonly used to schedule irrigations. A good rainfall should return the 8- and 18-inch depth gauges to close to 0 cbars. This will tell you whether the rain thoroughly wetted the root zone. It will not tell you how much may have passed through the root zone, however.

If you are using soil sampling to assess the depth of rain infiltration, simply squeezing a handful of soil can help. Regardless of soil texture, a wetted soil will form a ball or cast when thoroughly wetted. Water moves as a front through the soil. After a rain, take soil samples with depth to find where the potential to form a ball abruptly ends. This will tell you the depth of effective rain.

How well a soil holds together can also be an indication of when to irrigate. Even a sandy loam texture will retain a ball that does not hold together well when there is still adequate moisture for the tree. The possibility of forming a ball decreases with water content. When visible cracking of a soil ball is obvious, it is time to irrigate.

Winter irrigation is something we do not commonly perform, but in low rainfall years it is an activity we need to consider, especially for controlling the salts that accumulate from our previous irrigation season.

Salt damage due to lack of leaching

Update from Israel on the Polyphagous Shot Hole Borer and its Fusarium fungal symbiont

By Mary Lu Arpaia (Extension Specialist, UC Riverside) and David Obenland (Plant Physiologist, USDA-ARS)

We recently had the opportunity to visit Israel and spend several days looking at avocados including a visit with Zvi Mendel and Stanley Freeman, the lead researchers in Israel on the Polyphagous Shot Hole Borer (PSHB) and its Fusarium fungal symbiont. (The authors would like to thank them for their editorial comments on this report.)

So far the beetle is still largely confined to the central coastal region of Israel and the northern Negev. The beetle has also been found in the Upper Galilee at Kibbutz Hagoshrim in avocado and on ornamental trees in other locations in this region which is quite far from the primary infested area. The infested avocado trees have been destroyed but the beetle population already spread outside of the site of the initial infestation. Interestingly, this find was with a grower who packs their avocados in the coastal area. It is assumed that the beetles arrived in the bins originating from the infested area. This is a reminder to California growers and packers that to minimize the spread of pests clean bins are essential. The spread of avocado thrips and persea mite in California is also assumed to have been by bins containing vegetative material.
The Israeli researchers have continued searching for materials that will either control the beetle or the fungus. They have had reasonable success in the lab when they test materials under controlled conditions but application out in the field is not effective. There are no chemical treatments on the horizon that growers can use.

We visited infested avocado orchards in the Hefer Valley and the region southwest of the Carmel mountains (south of Haifa). We visited a Reed orchard which is believed to have been infested approximately 5 to 6 years. Three years ago this grove showed heavy infestation in the entire grove. What we saw on our visit was severe limb dieback, many broken branches scattered on the orchard floor, dropped mature fruit and smaller than normal fruit size for the fruit remaining on the trees. Signs of the beetle boring as evidenced by sugar exudates were easy to find wherever we looked. Dr. Mendel told us that the grower is giving up on this orchard and plans to bulldoze the orchard after harvest. We went on to see several other groves; in all except a 2-year-old orchard it was easy to find limb dieback, fallen fruit and sugar exudate up and down branches. We were told that they do not often find infestation of young groves but when they do, it is usually on the base of the trunk (either rootstock or scion).

We visited a plot with some growers along with Leo Winer (an extension officer) and Udi Gafni (head of the research and development unit of GRANOT) where insecticide applications to infested trees had been made last fall (2012). Unfortunately, signs of continued beetle activity were relatively easy to find. The growers told us about seeing fruit shriveling as the branch dies back. Since substantial fruit drop occurs of both mature and developing there is also an overall drop in productivity as an infestation spreads throughout a grove. Growers are extremely concerned and frustrated that there are no control measures for the beetle. Similar to California, Israel has historically used minimal pesticide sprays. The growers know that in areas already infested that spray applications are key to their continued orchard viability.

Avocado growers in Israel are also seeing problems with Botryosphaeria fungal infections. We visited the northern Negev Desert area where avocados are grown. We went to a large Hass orchard the grower is attempting to control this problem using phosphite injections. We were able to see upper limb dieback and staining on the upper branches.

In the meantime, Drs. Mendel and Freeman are continuing to study beetle biology and the behavior of the Fusarium fungal component. Dr. Mendel is developing a method to raise the beetle in the laboratory. This will be an important breakthrough since it will allow for a better understanding of the beetle life cycle. They know that the female beetle once it flies and seeks a place to burrow has about a 48 hour

window to successfully establish itself in the host plant since this is the time period it can survive without feeding. We also learned that the beetle carries the Fusarium spores in its mycangium (a specialized structure at the back of its jaw), rather than hyphae. The larvae and pupa do not have mycangium, only the adults. While the larvae pupate, the Fusarium in the galleries sporulates and the emerging adult as it feeds picks up the Fusarium spores. On a side note, Drs. Mendel and Freeman do not necessarily agree with our use of the name PHSB. They argue that the beetle is monophagous (eats only one kind of food, Fusarium) but uses several tree species as hosts. We will have to see how the final name for the beetle is ultimately settled among the insect taxonomists.

Finally, Dr. Mendel is very worried about the spread of the beetle to native tree species in Israel, especially oaks which are found in many areas throughout the country. The box elder (which also occurs as a landscape tree in California) has been decimated by the PHSB. This is a warning flag for all California residents to take action to safeguard our native oaks, other native species and landscape trees.

These visits reinforced the extreme importance that the California industry must be diligent looking for tree infestation. The industry must work with the landscape industry and forestry service in southern California to understand how fast the infestation is spreading and what hosts are most susceptible. The industry needs to continue funding both applied (surveys, control measures and understanding of the beetle and fungal biology) as well as more basic work such as the origin of the beetle. This latter piece of information may lead to better ideas concerning control measures. Finally California researchers and industry leaders would be well advised to collaborate closely with our Israeli colleagues. They are facing this crisis head on since the PSHB has already spread into commercial groves. From their advanced experience, the California industry can learn much.

A conference on the PSHB and its Fusarium fungal symbiont was held in August 2012 in Riverside. The talks from this meeting are available for review on the website www.avocadosource.com. Video of the conference presentations from the public meeting are available for viewing on YouTube. The science portion of the meeting will be posted on YouTube in the forthcoming weeks.


A.


B.

Figure 1A, B. 'Reed' avocado tree in the Hefer Valley, Israel. Note previous limb breakage and branch dieback due to infestation by the PSHB and its fungal symbiont, Fusarium. (Pictures taken 3/9/2013 by M.L. Arpaia).

Figure 2. Infested 'Reed' branch in later stages of decline. The white larvae are termites. Once the branch begins to dieback, termite infestation usually follows. Note the staining of the wood and evidence of the PHSB galleries. (Picture taken 3/9/2013 by M.L. Arpaia)

Figure 3. External symptoms of infestation including sugar exudate and bark darkening reveals wood staining due to Fusarium infection of the woody tissue. (Picture taken 3/9/2013 by M. L. Arpaia)

Topics in Subtropics

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