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Topics in Subtropics Newsletter

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News from the Subtropical Tree Crop Farm Advisors in California

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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 for this issue of Topics in Subtropics

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A Caution on Free "Compost/Mulch"

Gary Bender, UCCE Farm Advisor, San Diego County

The polyphagous shothole borers *(Euwallacea sp.)* that spread fungal diseases *(Fusarium euwallaceae and possibly Graphium sp.)* to susceptible trees in Los Angeles County have now been found in mid and northern Orange County and western San Bernardino County. Sick and dying trees are being cut down and shredded or chipped. A lot of different species of trees are affected, including **avocado, box elder, castor bean, coast live oak, Engelmann oak, sycamore, bigleaf maple, white alder, olive, peach, persimmon, goldenrain, mimosa, liquid amber.and red willow.**

Why is this important to growers in San Diego, Riverside, Ventura and Santa Barbara counties? Because growers in San Diego County (and probably other coastal counties) are being offered *free shipping* by the waste disposal companies of wood chips and *free spreading* of the mulch in their groves. **What a deal!! But wait a minute!**

The problem lies in that the material I have seen is either not composted or poorly composted, because it heats up in the grove after delivery and starts steaming. This means that freshly shredded or chipped trees could very likely be spreading the borers right into their groves!

Growers should ask themselves "why are these trees in Los Angeles being cut down in the first place?" Trees are being pruned and cut down for a variety of reasons, but now that we have a new pest for which there is no control, we have to be very cautious about what we bring into our groves. Other problems that could be brought into groves include *Phytophthora* root rot and trunk cankers, oak root fungus, Dothiorella wood cankers, and Asian citrus psyllid.

Growers should insist that only correctly composted mulch be brought into their groves. During the composting process the piles should be turned at least five times to allow the material on the outside of the pile to be turned into the middle for correct heating of the entire pile.

"Shotholes" caused by the Polyphagous Shothole Borers

Oriental Fruit Fly Affects Green Waste Movement in Southern California

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

This just in from Cal Recycle pertaining to the movement of green waste in Southern California. Now with Asian Citrus Psyllid so widespread in that area and the spread of Polyphagous Shot Hole Borer, it is a good idea to consider carefully the source of green waste used for mulching.

The Oriental Fruit Fly (OFF) attacks over 230 crops, including citrus, other fruits, nuts, vegetables and berries. In August, 2013, the OFF resurfaced in the Anaheim area of Orange County and in the Artesia/Cerritos area of Los Angeles County.

To prevent the spread of the pest, authorities have established a 130-square-mile quarantine, which includes portions of Orange and Los Angeles Counties, (Quarantine zone). Many host plants for the OFF grow in the urban landscape and end up in recycled green material.

USDA, CDFA, and County Agricultural Commissioner staff, enforce the Federal Domestic Quarantine and the State Interior Quarantine. These quarantines prohibit movement of green material unless specific conditions are met. The State Interior Quarantine for OFF includes portions of Orange and Los Angeles counties.

Links:

http://www.cdfa.ca.gov/plant/pdep/target_pest_disease_profiles/oriental_ff_profile.html

http://pi.cdfa.ca.gov/pqm/manual/pdf/maps/3423OFFOrangeLosAngeles.pdf

http://pi.cdfa.ca.gov/pqm/manual/pdf/410.pdf

For additional information, please contact Elena Yates (916) 341-6466, of the CalRecycle Organic Materials Management Unit.

Olive Tree Phenology: The relationship of fruit load to vegetative growth and return bloom

Elizabeth Fichtner, UCCE Farm Advisor Tulare Co.
Carol Lovatt, Professor of Plant Physiology, Botany and Plant Sciences, UC-Riverside.

The first step in researching and developing strategies for mitigating alternate bearing (AB) in 'Manzanillo' table olive is to model the tree phenology with respect to the alternating 'ON' (high yield) and 'OFF' (low yield) cycles. In olive, the vegetative growth in one year produces the nodes bearing potential floral buds in the second year. Fruit load suppresses vegetative growth and return bloom; however, the mechanism underlying this relationship is unknown.

Hypothesized mechanisms (or combinations thereof) include:

1) Fruit inhibit vegetative growth, resulting in fewer nodes with the potential to flower and bear fruit.

2) Fruit inhibit floral development and/or spring bud break, reducing the number of inflorescences at return bloom.

3) Fruit reduce the number of perfect flowers in return bloom, resulting in fewer flowers with the ability to bear fruit.

Fruit load and inhibition of vegetative growth

Relationship of fruit load to vegetative growth. Olives are borne on one-year-old shoots; consequently shoot growth will be depressed during the year of a heavy crop, resulting in lack of fruitful shoots the following year (Sibbett, 2000). Working in both commercial orchards and at the Lindcove Research and Extension Center, our research team has similarly modeled this relationship in 'Manzanillo' olives in Tulare County. We assessed the influence of fruit on vegetative growth on 'ON' trees in comparison to 'OFF' trees, where 'ON' refers to trees with a heavy crop load, and 'OFF' refers to trees with a low or negligible crop load. Additionally, within 'ON' trees, we assessed vegetative growth on shoots bearing fruit and shoots not bearing fruit. The results of our study demonstrate the inhibitory effect of fruit on vegetative growth at both a tree and shoot level (Table 1). For example, between July 2012 and September 2012, an average of 3.3 nodes per shoot were produced on 'OFF' trees, whereas, non-bearing and bearing shoots on 'ON' trees produced an average of 0.7 and 0.6 nodes per shoot, respectively (Table 1).

Table 1. Vegetative growth represented by the cumulative number of nodes per shoot produced between July 2012 and the stated month.

Tree Status 2012	**Shoot Status**	# Nodes July '12	# Nodes July-Aug '12	# Nodes July-Sept '12	# Nodes July-Oct '12	# Nodes July-Feb '13	# Nodes July-April '13
OFF Control	No Fruit	2.2 a	2.9 a	3.3 a	3.3 a	3.6 a	5.0 a
ON Control	No Fruit	0.6 b	0.7 b	0.7 b	0.7b	1.0 b	2.7 b
ON Control	Fruit	0.2 b	0.5 b	0.6 b	0.6 b	0.8 b	3.3 ab
P value		0.0019	0.0047	0.0058	0.0059	0.0053	0.0397

Seasonality of vegetative growth. As a precursor to developing chemical treatments (e.g. Plant growth regulator) to mitigate AB, we investigated the fluctuation of growth rate by season (Table 1). The results of our 2012 data collection indicate that vegetative shoot growth proceeds through September, but effectively ceases sometime between September and October. Minimal vegetative growth occurs during the winter months (i.e., October through February), but the vegetative growth rate accelerates in the late winter/early spring (February-April).

<u>*When does vegetative growth on 'ON' branches effectively 'catch up' to growth on 'OFF' branches?*</u> Our data suggest that vegetative growth rapidly accelerates on 'ON' shoots between February and April; by April no significant difference was observed in the number of nodes produced since the preceding July for bearing shoots on 'ON' trees and 'OFF' trees. During the late winter/early spring, the fruit are no longer present to suppress vegetative growth, and formerly 'ON' shoots will effectively 'catch up' to the 'OFF' shoots. This late winter/early spring growth; however, will not produce inflorescences in the current year because they were formed after floral bud induction and development.

Fruit may inhibit floral bud break

Fruit inhibit return bloom in 'Manzanillo' olive (Table 2); however, it is yet unknown whether fruit only inhibit vegetative shoot growth, or also inhibit the formation of floral buds, or only inhibit the spring break of floral buds. Our research has documented the extent of fruit's suppression of return bloom, with inflorescence counts highest on 'OFF' trees, followed by non-bearing and bearing shoots on 'ON' trees. The combined whole-tree and localized shoot effect on inflorescence counts was observed on bearing shoots of 'ON' trees, as evidenced by statistically fewer inflorescences produced per shoot than non-bearing shoots on 'ON' trees (Table 2).

Table 2. Influence of tree and shoot status on inflorescence production.

Tree Status 2012	Shoot Status	Total Inflorescences per Shoot
'OFF' Control	No Fruit	9.3 a
'ON' Control	No Fruit	2.8 b
'ON' Control	Fruit	0.6 c
P value		0.0001

Our current data suggests that, in addition to the loss of potential inflorescences due to the inhibition of summer vegetative shoot growth, at least a portion of fruit-mediated reduction of return bloom is related to reduced spring bud break. Floral buds of 'Manzanillo' olive are formed in late summer or early fall, but branch injections with the cytokinin plant growth regulators 6-benzyladenine or a proprietary cytokinin in February 2012 resulted in over 60% increase in number of inflorescences on non-bearing shoots on 'ON' trees at bloom in 2012, consistent with overcoming bud dormancy of viable floral buds. Our data, therefore, demonstrate that a portion of reduced return bloom is related to inhibition of floral bud break.

…a portion of reduced return bloom is related to inhibition of floral bud break …

Fruit reduce the percent of perfect flowers at return bloom

Olives are andromonoeceous, meaning they produce both perfect flowers, containing male reproductive structure (stamens) and female (pistil) structures, and staminate flowers (containing only male parts). Staminate flowers are unable to bear fruit. During floral bud development, all buds contain pistils and stamens; however, pistil abortion approximately 8-10 weeks prior to bloom results in a reduction in the proportion of perfect flowers formed. The results of our research provide evidence that the bearing status of a shoot affects the percent of perfect flowers formed (Table 3). The results suggest that failure of the pistil to develop and form a perfect flower is strongly associated with the presence of fruit set on a shoot and not due to crop load since the percentage of perfect flowers on nonbearing shoots of 'ON' trees is equal to that of nonbearing shoots on 'OFF' trees, but dramatically reduced for bearing shoots on 'ON' trees. Consequently, shoots bearing fruit in year one will have fewer perfect flowers in year two.

… shoots bearing fruit in year one will have fewer perfect flowers in year two.

Table 3. The bearing status of trees and/or shoots influences the characteristics of return bloom.						
Treatment	**Shoot Status**	**Total Inflorescences per Shoot**	**Total Flowers per Shoot**	**Flowers/ Inflorescence**	**Total Pistilate Flowers per Shoot**	**% Perfect Flowers**
'OFF' Control	No Fruit	9.2 a	24.6 a	3.3 a	21.4 a	87
'ON' Control	No Fruit	0.2 b	1.6 b	1.6 a	1.4 b	88
'ON' Control	Fruit	0.4 b	0.0 b	0.0 a	0.0 b	0
P-Value		≤0.0009	≤0.0001	≤0.1745	≤0.0001	

Summary

As a result of collaborative work between UC Cooperative Extension and UC Riverside, we have enhanced the understanding of the phenology of 'Manzanillo' olive with respect to alternate bearing and the cycling of 'ON' and 'OFF' crops. This phenological modeling illustrates the influence of fruit on vegetative growth and the seasonality of vegetative growth. The work additionally addresses the influence of fruit on both return bloom and the number of perfect flowers produced. Last, our work on mitigation of AB in olive provided evidence that fruit reduce floral intensity by inhibiting spring bud break and that floral buds had developed.

Further studies are underway to elucidate the timing of flower bud development. We are currently investigating whether fruit inhibit floral development on bearing shoots of 'ON' trees by examining the expression of key genes that regulate floral development. Enhanced understanding of the phenology of 'Manzanillo' olive will allow for precision timing of practices designed to mitigate AB and minimize the annual fluctuations in crop load and industry inventory.

Acknowledgements

We are grateful to H. Fox and C. Hill, Tulare Co. Olive Growers, for cooperation in our field experimentation, as well as the Lindcove Research and Extension Center for field and laboratory support. Funding for this work was graciously provided by the California Olive Committee.

Literature Cited

Sibbett, S. 2000. Alternate bearing in olive trees. California Olive Oil News. Vol. 3, Issue 12.

Training and Pruning of Cherimoya

Scott Van der Kar, cherimoya grower, Santa Barbara County

Training

At planting (preferably in spring), if trees have an unbranched trunk greater than 2 feet tall, the tree should be headed back. This procedure should induce other buds along the trunk to shoot. Always remove leaves at positions where new shoots are required. Leaf removal is important since the petiole covers the bud and prevents bud break. Lower branches with weak crotches (less than 45°, or greater than 90°) should also be removed.

During the first summer one shoot is encouraged to dominate by lightly pinching back the other shoots and loosely tying the main shoot to the stake. This shoot (leader) will become the tree trunk.

About every three months some pruning can be performed to rapidly create a large framework. Select primary scaffolds beginning with the lowest facing the prevailing winds. Select additional scaffolds, upward along the leader at intervals of several inches or more, to form a spiral pattern around the trunk.

Head these scaffolds to 18 inches in length to maintain the central leader. Remove strong unsymmetrical growth not required as the leader or scaffold branches. Also remove any limbs with weak crotches. The position of scaffold branches can be selected by removing a leaf in the desired position, thereby uncovering the bud.

In subsequent years continue to select primary scaffold branches until four to six are present. Then allow the leader to become the topmost scaffold. Continue to head back scaffolds. Each time they are pruned, they tend to produce two strong end shoots. One or two weaker shoots might also form, these should be removed. As the pattern continues, the tree will gradually open up.

Pruning Bearing Trees

How heavily to prune will depend on the variety and the tree's vigor as judged by the tree spacing, soil and climate. Unpruned trees initially bear substantially more fruit, but as the canopy becomes crowded, the inside becomes devoid of leaves and fruit, and production moves to the outside of the canopy. As a consequence, it is more difficult to pollinate and harvest, and more damage to fruit from branch rubbing is encouraged.

From the third or fourth year from planting the goal should be to prune about 6 to 8 inches from the new growth. This pruning should be done in the spring prior to bloom. If there is excessive growth during the summer, a light fall pruning may be necessary. However, heavy cropping will retard vegetative growth.

Each year branches that are crowding the center need to be thinned out along with dead wood. Fruiting wood that has grown more than 18 inches from the scaffolds also needs to be headed back to prevent the limbs from breaking with the weight of fruit.

The best level of pruning is going to be determined by experience. The severity of pruning will vary according to the lateral growth each season and cropping level. Other guidelines are to avoid too much shading within the canopy and to allow enough room between branches so that fruit will set clear of limbs and other fruit.

This is an abridged version of the pruning article in the California Cherimoya Association Handbook.

High Density Avocado Installation:
Use a quick cost study to make a decision.

Gary Bender, UCCE Farm Advisor, San Diego County

Since our last article on high-density avocados appeared in Topics in Subtropics (Vol. 10 no. 1, Spring 2012) we have had a lot of questions from growers concerning the cost of installation of such a grove. We have also had a lot of interest from potential winegrape growers who think this might be the way to go given that wine-grapes use about 25% of the amount of water per acre compared to avocados. For higher quality wines growers use less water, but harvest lower pounds/acre.

I am currently advising a student at Cal State San Marcos who is doing a cost study for removing an avocado grove and installing a winegrape planting in San Diego County. Hopefully we will have an article on that in the near future.

We don't have a lot of experience in high density avocados but we will try to show some costs to help you decide.

Clearing an older grove can get expensive. In a study we did in 2010 we found that it cost $40/tree to cut a tree down, haul the cut wood down to a firewood stack and haul small branches to a chipper. The old stump is usually killed with an herbicide and left in place to rot. So, just to remove a tree at 109 trees/acre may cost $4,360 per acre.

For our high density planting we will be planting Hass avocados grafted on Dusa rootstock. We are using this rootstock because it appears from several trials to be a good rootstock for resistance to avocado root rot in the well-draining hillside soils in San Diego County.

The current price is about $30/tree (plus or minus). For a 10' x 10' spacing we would plant about 435 trees per acre, this would be an initial cost of $13,500/acre. We are not calculating the cost of a grove road installation, and we are assuming that the entire acre would be planted.

Planting cost: digging, planting, wrapping and staking trees takes about 15 minutes per tree. This includes carrying the tree to the hole. At 435 trees per acre, this would take about 109 hrs. At $14/hr, this would cost $1526/ac. Stakes (435) at $2.25/stake would cost $979/ac.

The irrigation system installation would cost $2,660/ac. This is based on an entire system being installed in a 20 acre block, divided by 20 to get the cost per acre.

There are quite a few other costs that you can see from our complete avocado cost study (Takele et.al, 2011) but these basic costs will get the trees in the ground (Table 1).

Table 1. Basic costs per acre for the installation of a high density avocado grove. It is assumed that land is cleared and ready to plant. Installations of grove roads are not considered.

Trees (Hass on Dusa rootstock)	$13,500
Planting (digging, planting and wrapping)	$1,526
Stakes	$979
Irrigation system	$2,660
Total per acre	**$18,665**

If you are thinking about planting 10 acres, then you would need $186,650 in the bank to get the trees in the ground. There will be some shifting of costs because this study does not include clearing or building of grove roads, and with grove roads you will be planting less numbers of trees/acre.

Will you make more money in the long run? That is the question we are trying to answer with our high density trial in Valley Center.

Reference

Bender, G.S. and E. Takele. 2010. A guide to estimate compensation for loss of a single avocado tree. University of California Cooperative Extension county publication AV 606.

Takele, E., Bender, G.S., and M.Vue. 2011. Avocado sample establishment and production costs and profitability analysis for San Diego and Riverside counties, conventional production practices. http://coststudies.ucdavis.edu/

High Density Avocado Trial in San Diego County

Volatile Organic Compound (VOC) Emissions from Pesticides

Tunyalee Martin, UC Statewide IPM Project, Davis, CA.

(This article summarizes California Department of Pesticide Regulation's online VOC information.)

It's that time of year again when hot weather fuels the creation of ground-level ozone, also called smog. High levels of ozone can harm people and crops. Ozone is caused by mixing volatile organic compounds (VOCs), nitrogen oxide, and sunshine. Some pesticides emit VOCs that contribute to ozone formation.

Between May 1 and October 31 when smog is likely to form, using pesticides that release VOCs may be restricted in the five nonattainment areas (NAAs) where ozone levels do not meet federal or state air quality standards:

Sacramento Metro NAA: all of Sacramento and Yolo counties; parts of El Dorado, Placer, Solano, and Sutter

San Joaquin Valley NAA: all of Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare counties; parts of Kern

Southeast Desert NAA: parts of Los Angeles, Riverside, and San Bernardino counties

South Coast NAA: all of Orange County; parts of Los Angeles, Riverside, and San Bernardino

Ventura NAA: all of Ventura County

In NAAs, regulations affect field soil fumigation with:

- methyl bromide
- 1,3-dichloropropene
- chloropicrin
- metam sodium
- metam potassium
- dazomet
- sodium tetrathiocarbonate

Regulations may require reduced application rates, specific injection depths, soil compaction requirements, and a tarpaulin repair response plan. Fumigants used in greenhouses and for certain nursery fumigations, potting soil, individual tree and vine replantings, or harvested commodities are not affected.

In the San Joaquin NAA, where 65% of the VOC emissions are from nonfumigant pesticides, regulations begin November 1, 2013 for high-VOC pesticide formulations of:

- abamectin
- chlorpyrifos
- gibberellins
- oxyfluorfen

Pesticides that contain solvents typically release high rates of VOCs. Solid formulations release the least amount. Starting in 2014 a PCA recommendation is required for use during May 1 to October 31. If the VOC emissions level is exceeded, applications for high-VOC formulations may be prohibited.

Whether in a NAA or not, simple steps can minimize the release of VOCs into the air.

- Use other pest management tactics.
- Choose low-emission pesticides or formulations.
- Avoid emulsifiable concentrate (EC) formulations and fumigants.
- Use DPR's VOC calculators to determine emissions.
- Consider reducing the amount of pesticide applied by spot treating, making fewer applications, or using target-sensing equipment.
- Choose low-emission application methods for fumigants.
- Fumigate and cover with tarpaulins.
- Fumigate and cover with several post-fumigation water treatments.
- Apply through drip irrigation.
- If possible, apply pesticides before May or after October.

Follow laws and regulations, especially in NAAs where additional regulations may be in effect.

When choosing a pesticide using the UC Pest Management Guidelines, click on the Air Quality button at the top of each treatment table.

Citrus: http://www.ipm.ucdavis.edu/PMG/selectnewpest.citrus.html

Avocado: http://www.ipm.ucdavis.edu/PMG/selectnewpest.avocado.html

It will take you to the Department of Pesticide Regulation's VOC calculators to determine emissions from fumigant and nonfumigant pesticides.

DPR Resources:

- VOC emissions from pesticides: http://cdpr.ca.gov/docs/emon/vocs/vocproj/vocmenu.htm
- Nonattainment area maps: http://cdpr.ca.gov/docs/emon/vocs/vocproj/em_region.htm
- Reducing VOC emissions from field fumigants: http://cdpr.ca.gov/docs/emon/vocs/vocproj/reg_fumigant.htm
- Reducing VOC emissions from nonfumigant pesticide products: http://cdpr.ca.gov/docs/emon/vocs/vocproj/reduce_nonfumigant.htm

Get on the VOC email list to be alerted about changing situations (go to cdpr.ca.gov and click on "Join E-lists" at the bottom left-hand corner).

Smog in the air in the San Joaquin Valley

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