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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 Topics in Subtropics and enter your email address.

Mary Bianchi

Executive Editor

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Pruning - Pruning should be carried out to prevent secondary pathogens and wood decay organisms from slowing tree recovery. Again, there should be no rush to prune. Premature pruning, at the very least, may have to be repeated and, at the worst, it can slow tree rehabilitation. It should be remembered that when pruning, all cuts should be made into living wood. Try to cut flush with existing branches at crotches. Do not leave branch stubs or uneven surfaces. Tools should be disinfected in bleach or other fungicide before moving on to the next tree. The extent of pruning is dictated by the amount of freeze damage:

Light Damage	Medium Damage	Severe Damage	Extreme Damage
Where only the foliage and small twigs are injured, pruning is not required	Where a considerable part of the top has been killed but the trunk and main crown limbs show little damage, branches should be removed back to living wood above vigorous sprouts	Where the top and crown limbs are severely damaged but there are sprouts above the bud union, the tree should be cut back to the uppermost sprout	Where trees are killed to the bud union or the rootstock has been girdled, the trees should be removed and replaced with new trees

Irrigation - Irrigate carefully! Remember that when leaves are lost, transpiration from leaves is greatly reduced. Therefore, the amount of water required is also greatly reduced. A frost-damaged tree will use the same amount of water as a much younger or smaller tree. Over-irrigation will not result in rapid recovery. Instead, it may induce root damage and encourage growth of root rotting organisms. This is particularly true for avocados. Irrigation should be less frequent, and smaller amounts of water should be applied until trees have regained their normal foliage development.

Fertilization - Fertilization of freeze-damaged trees should be carefully considered. There is no evidence that frozen trees respond to any special fertilizer intended to stimulate growth. If trees are severely injured, with large limbs or even parts of the trunk killed, nitrogen fertilizer applications should be greatly reduced until the structure and balance of the tree becomes re-established. Trees should be watched for deficiencies of minor elements - zinc, manganese, copper, and iron are most likely to develop. For citrus, these materials should be applied as sprays, and they should be used as often as symptoms are observed. Two or more applications may be required the first year.

Advances in mitigation of alternate bearing of olive: vegetative growth response to plant growth regulators

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

Alternate bearing (AB) is a phenomenon in olive where fruit production alternates between large crops consisting of smaller, lower value fruit during an '"ON' year and smaller crops consisting of larger, higher value fruit during an "OFF" year. The large swings in biennial olive production impact the overall industry, from growers to harvesters, to processors. In olive, the vegetative growth in one year produces the nodes bearing potential floral buds in the spring of the second year. Fruit suppress vegetative shoot growth resulting in fewer nodes available to bear fruit the following year. Our phenological studies have helped characterize the relationship between fruit load and vegetative growth on 'Manzanillo' olives in Tulare County, California.

Investigation of vegetative growth response to plant growth regulators

One strategy proposed to mitigate AB is to stimulate summer vegetative shoot growth to increase the number of nodes with the potential to produce floral buds. To address this strategy, our research team designed and implemented a proof-of-concept study in which plant growth regulator (PGR) treatments were injected into individual scaffold branches on opposing sides of ’ON‘ and ’OFF‘ trees. Plant growth regulators utilized in the study included two cytokinins, 6-benzyladenine (6BA) and a proprietary cytokinin (PCK), as well as two auxin-transport inhibitors, tri-iodobenzoic acid (TIBA) and a natural auxin transport inhibitor (NATI). Eight PGR treatments were included, with each PGR tested alone, and each cytokinin tested in combination with each auxin-transport inhibitor. PGR treatments were implemented in Summer (July 2012), and Summer + Spring (July 2012 and February 2013). Vegetative shoot growth was recorded monthly throughout the year to determine the influence of PGR treatments and timings on node production. The study was conducted at the Lindcove Research and Extension Center (Exeter, CA).

Plant growth regulators were applied to individual scaffolds using large syringes.

Node production in response to plant growth regulator treatments

Scaffold injection with numerous PGR treatments resulted in significant increase in vegetative shoot growth. For example, nonbearing shoots on ‘ON’ control trees, produced an average of one node between July 2012 and February 2013, whereas nonbearing shoots on PGR-treated scaffold branches exhibited almost 4 times the new growth of the control trees (Table 1, shaded). Importantly, the new growth in some cases was statistically equal to the new vegetative shoot growth of nonbearing shoots on ‘OFF’ control trees. The PGR treatments also had a positive effect in increasing vegetative shoot growth on bearing shoots of ‘ON’ crop trees. Bearing shoots on ‘ON’ control trees produced an average of 0.8 nodes between July 2012 and February 2013, whereas bearing shoots on PGR-treated scaffold branches of ‘ON’ trees produced over three-fold more nodes during this period. Some PGR treatments increased the number of new nodes on bearing shoots on ‘ON” trees to values equal to those of nonbearing shoots of ‘OFF’ crop control trees (Table 1, asterisk). Identify the better treatments. On average two additional nodes of growth were added to shoots in all treatments from February through April. Thus, in April shoots treated with some PGRS (Table 1, shaded) remained longer than bearing or nonbearing shoots on ‘ON’ crop control trees and equal to nonbearing shoots on ‘OFF’ crop control trees. This result suggests that with regard to increasing vegetative shoot growth there was no advantage derived from supplementing the Summer PGR treatment with the second Spring PGR treatment. However, the effect of the Spring PGR treatments on floral bud break and return bloom and fruit set remains to be determined.

Table 1. The effect of scaffold branch injected plant growth regulator treatments on vegetative shoot growth, as number of new nodes produced.			
		New Nodes	
Treatment	**Branch Status**	**July-February**	**July-April**
ON Control	**Fruit**	0.8 l	3.3 jkl
TIBA+6BA SUMMER	Fruit	2.3 hijk*	4.6 cdefghij
TIBA+PCK SUMMER	Fruit	2.5 ghij*	4.9 bcdefghij
NATI+6BA SUMMER	Fruit	2.7 fghij*	4.2 fghijkl
NATI+PCK SUMMER	Fruit	2.2 hijk*	3.9 hijkl
TIBA SUMMER	Fruit	2.4 hij*	4.9 bcdefghij
NATI SUMMER	Fruit	2.5 fghij*	4.3 efghijkl
6BA SUMMER	Fruit	2.2 ijkl	4.2 fghijkl
PCK SUMMER	Fruit	2.6 fghij*	4.7 cdefghij
TIBA+6BA SUMMER+SPRING	Fruit	2.4 hij*	4.5 defghijk
TIBA+PCK SUMMER+SPRING	Fruit	3.0 efghi*	4.5 defghij
NATI+6BA SUMMER+SPRING	Fruit	2.6 fghij*	5.0 abcdefghij
NATI+PCK SUMMER+SPRING	Fruit	2.2 ijk*	3.7 ijkl
TIBA SUMMER+SPRING	Fruit	2.0 ijkl	4.1 ghijkl
NATI SUMMER+SPRING	Fruit	3.1 defghi*	5.5 abcdefghi
6BA SUMMER+SPRING	Fruit	2.7 fghi*	4.9 bcdefghij
PCK SUMMER+SPRING	Fruit	1.3 jkl	2.5 l
OFF Control	No Fruit	3.6 abcdefgh	5.0 bcdefghij
ON Control	No Fruit	1.0 kl	2.7 kl
TIBA+6BA SUMMER	No Fruit	3.8 abcdefg	4.7 cdefghij
TIBA+PCK SUMMER	No Fruit	4.7 ab	5.9 abcdefg
NATI+6BA SUMMER	No Fruit	4.8 a	6.3 abcd
NATI+PCK SUMMER	No Fruit	4.5 abc	6.0 abcde
TIBA SUMMER	No Fruit	4.4 abcd	6.0 abcdef
NATI SUMMER	No Fruit	4.2 abcde	4.9 bcdefghij
6BA SUMMER	No Fruit	3.4 bcdefghi	4.0 hijkl
PCK SUMMER	No Fruit	4.3 abcde	5.5 abcdefghi
TIBA+6BA SUMMER+SPRING	No Fruit	4.2 abcde	5.2 abcdefghi
TIBA+PCK SUMMER+SPRING	No Fruit	4.8 a	5.7 abcdefgh
NATI+6BA SUMMER+SPRING	No Fruit	3.9 abcdef	5.1 abcdefghi
NATI+PCK SUMMER+SPRING	No Fruit	3.2 cdefghi	4.2 efghijkl
TIBA SUMMER+SPRING	No Fruit	4.8 a	6.5 ab
NATI SUMMER+SPRING	No Fruit	4.5 abc	6.8 a*
6BA SUMMER+SPRING	No Fruit	4.8 a	6.4 abc
PCK SUMMER+SPRING	No Fruit	3.6 abcdefgh	4.7 cdefghij
***P*-value**		**<0.0001**	**<0.0003**
Note: shading denotes treatments significantly different than ON Control + Fruit treatment. Asterisk denotes treatments significantly different than OFF Control (- Fruit).			

Summary
These preliminary data demonstrate that PGRs increase shoot growth, which might result in more nodes with the potential to produce inflorescences the following spring. Future studies are anticipated to address the use of promising treatments in foliar applications. Naturally-occurring compounds, such as PCK and NATI, may be easier and less costly to register than PGRs, which are classified as pesticides. Therefore, significant growth response to the natural compounds tested may have commercial benefit even if proven less efficacious than the synthetic PGRs.

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Fertigation – Measuring Uniformity

Larry Schwankl, Land, Air Water Resources, UC Davis

Fertigation is the injection of fertilizers through the irrigation system. Microirrigation systems are well-suited to fertigation because of their frequency of operation and because water application can be easily controlled by the manager. Applying fertilizers through a microirrigation system:

- Allows fertilizer distribution to be as uniform as the water application.
- Allows flexibility in timing fertilizer application.
- Reduces the labor required for applying fertilizer, compared to other methods.
- Allows less fertilizer to be applied compared to other fertilization methods.
- Can lower costs.

These benefits rely on the uniformity of the application. The following provides points to consider in determining some of the basic steps needed to ensure uniform fertilizer application.

The injection point for fertilizers should be located so that the injected fertilizer and the irrigation water can become thoroughly mixed well upstream of any branching of the flow. Because of concerns over fertilizers being flushed out when the microirrigation system filters are backwashed, the injection point should be downstream of the filters. To ensure that no contaminants are injected into the microirrigation system, a good quality screen or disk filter should be installed on the line between the chemical tank and the injector.

The system should be allowed to fill and come up to full pressure before injection begins. Following injection, the system should be operated to flush the fertilizer from the lines. Leaving residual fertilizer in the line may encourage clogging from chemical precipitates or organic sources such as bacterial slimes.

Fertilizer injection fertigation system for avocado trees

Once injection begins, the injected material does not immediately reach the emitters. There is a "travel time" for water and injected chemical to move through a microirrigation system. Measurements made in commercial orchards indicate that this travel time may range from 30 minutes to well over an hour, depending on the microirrigation system design. To ensure that application of any