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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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TOPICS IN THIS ISSUE:

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Blossom End Rot of Citrus

Ben Faber, Subtropical Horticulture Advisor, University of California Cooperative Extension-Ventura/Santa Barbara

Another impact of the drought? There have been reports of a sunken, leathery patch around the blossom end (opposite of the stem end) of citrus fruit. This has been reported on lemons, limes and mandarins, but I am sure growers are seeing it on orange varieties, as well as other citrus relatives. This is an abiotic problem caused by a lack of calcium to the fruit, a problem with the plant's growing conditions, not a disease. This is a serious disorder found in various fruits and vegetables, such as tomatoes, melons, peppers and eggplants.

Blossom-end rot begins as small tan, water soaked lesions on the blossom end of the fruit. The lesion enlarges and becomes sunken, dark, and leathery. On peppers, the lesion is more commonly found on the side of the fruit towards the blossom end. Also, on peppers it can be sometimes confused with sun scald. Fruit infected by blossom-end rot ripen often become infected with secondary organisms such as Alternaria spp (most likely the surrounding tissue in the photo below.

This is a physiological disorder of low calcium in the fruit. Calcium is required for normal cell growth and in relatively high concentration for new tissue growth. Rapidly growing fruit will begin to breakdown at the blossom end because that is the last place of the fruit tissue to receive calcium and also the area with the lowest concentration of calcium.

In rapidly growing plants, calcium cannot move to those rapidly growing areas quickly enough. Because calcium moves with water, fluctuations in water supply can cause blossom-end rot. Large fluctuations in soil moisture inhibit uptake and movement of calcium within the plant. Excessive nitrogen promotes rapid plant growth, which can cause low concentrations of calcium to occur in plant tissue. Leaf tissue can often not disclose a low calcium in fruit because of the lag in movement of leaf calcium to the rapidly growing fruit tissue.

Other causes such as low calcium levels in the soil or high amounts of cations in the soil which compete with calcium uptake can also cause blossom-end rot and tissue collapse. This is especially true in areas of soils derived from serpentine rock that are high in magnesium. The magnesium competes with calcium uptake. With drought, there is an accumulation of salts in the root zone, and these salts can compete with calcium uptake. Reducing salinity in the root zone will increase calcium uptake as well as the return of “adequate” rainfall.

Proper fertilization and water management help to minimize this problem. Avoid over fertilizing the crop. Also avoid allowing the soil to become too dry and then overly wet. Wide fluctuations in soil moisture inhibit calcium uptake and movement. If calcium is deficient or high salts occur in the soil, gypsum applications can help, but delayed uptake may not help fruit tissue content. Often, foliar applications of calcium may be beneficial, but as new tissue develops in leaves and fruit, frequent applications are needed to keep calcium moving to expanding tissue.

Using Organic Herbicides in Production Fields and Non-Crop Areas

Oleg Dagouvish, Strawberry and Vegetable Crop Advisor, University of California Cooperative Extension, Ventura County

The forecasts call for rainy winter and that means a lot of weeds. During dry times perennial weeds tend to grow better than annual weeds, since perennial structures such as underground rhizomes or tubers can support them and give competitive advantage. Seed of annual weeds in dry soil may have been losing viability, senescing or eaten during this time, but many have remained dormant and look forward to the wet winter.

Controlling weeds 'organically' is always an extra challenge whether you are in a certified field or in an area where synthetic herbicides are not desired. Hand-weeding, already expensive, is even a greater burden with limited labor availability, and frankly not much fun either. Of course sanitation and prevention, mechanical and cultural management are essential in organic systems. That requires time and commitment and can quickly become your not-so-favorite pastime.

Organic herbicides have traditionally been contact materials with no systemic activity. This means that they only affect tissue that they contact and do not translocate through the plant like most synthetic herbicides. Thus, good coverage is critical for these contact materials. Many years ago the first herbicides were sulfuric acid and diesel fuel, current organic materials are often acids or oils, although a lot more benign.

Recent trials by the University of California weed scientists showed that several organic herbicides provided decent control of easy to control pigweed and nightshade when they were small. When weeds were 12 days old, a mixture of 45% clove and 45% cinnamon oil, 20%-acetic acid and d-limonene gave 61%-89% control; however only d-limonene controlled 19-day old weeds and none was effective on one-month old ones. As weeds get bigger they also develop a protective cuticle that minimizes efficacy of these herbicides.

This year we conducted trials with a recently OMRI (what does the acronym stand for? Organic Material Review Institute) approved herbicide for row crops, trees and vines that is a mix of caprylic and capric acids. It disrupts cell membranes of plants and causes the contents to leak and plants to desiccate. It worked well at 6% to 9% by volume mixture with water and gave 90% control of little mallow and >95% of annual sowthistle compared to untreated checks. We have also tested it in organic strawberry furrows before planting the crop to prevent potential injury from drift. Furrow cultivation does not get close to the plastic mulch that covers the beds to prevent tears, so the weeds in that zone are good target for the herbicide. This fatty acid herbicide provided excellent control of common lambsquarter, reduced the growth of common purslane but didn't do much for yellow nutsedge - one of our notoriously difficult to control perennial weeds (Figure). The bigger weeds need higher rates (9% is the maximum labeled rate) and better coverage. When you have multiple layers of weed leaf canopy and diverse architecture, some plants or their parts may be protected by others that intercept the deposition of the herbicide. When on target, this contact material acts fast – you can see results within 2-3 days, however, it does nothing to weed propagules in soil and has no residual activity against wind-dispersed weed seed that fly in after application. This means the control does not last and you will need additional applications or other control measures. Repeated application is not a problem in a non-

crop area and is a great way to deplete your weed seedbank, but crop protection from drift, such as shielded sprayers, is necessary to avoid off target plant injury.

Figure. Weed control in strawberry furrows prior to planting with 9% by volume of fatty acid herbicide (left) and weeds in untreated check (right)

Pocket gopher and ground squirrel control: management options for citrus and avocado groves

Sonia Rios, Area Subtropical Horticulture Farm Advisor, UCCE, Riverside and San Diego Counties

Niamh Quinn, Area Vertebrate Pest Advisor, UCCE, Orange, Los Angeles and San Diego Counties

Avocado and citrus groves provide abundant food and shelter for vertebrate pests that can cause significant damage. Pocket gophers and ground squirrels are the major vertebrate pests in these groves. Young trees can be easily damaged by rodents as they can cause trees to stunt and die (Dreistadt 2008).

Prior to establishing a grove

A grove's location influences whether certain vertebrates are likely to be pests of concern. Often groves adjacent to natural or unmanaged areas experience more vertebrate pest problems (Dreistadt 2008). When preparing land and planting a grove, take steps to prevent or reduce potential vertebrate pest problems. Habitat modification, fencing, shooting, burrow fumigation, trapping and toxic baiting programs are easier and usually more effective if employed before you plant the grove instead of after (Dreistadt 2008).

Managing a current problem

According to the UC IPM Vertebrate Citrus and Avocado Pest Management Guidelines, management programs for vertebrate pests involve 4 basic steps:

1. Correctly identify the pest species.

2. Alter the habitat where feasible to make the area less favorable to the pest species. Remove wood and brush piles as they can harbor a

variety of vertebrate pests, not just ground squirrels.

3. Implement appropriate control for the orchard and time of year.

4. Establish a monitoring system.

It is important to correctly identify the species that is causing the damage. Watch for the animals or indications of their presence, such as burrows, soil mounds or gnawing marks on trunks. Vertebrate control equipment and supplies (baits, fumigants, traps etc) are available at local retail outlets such as farm supply and hardware stores. In addition, many County Agricultural Commissioner's offices make certain rodent pesticides available to growers (Rex et al. 2004). Currently, pocket gophers and California ground squirrels damage is very prevalent in both avocados and citrus.

Pocket gophers

Pocket gophers live almost entirely underground. They are antisocial and solitary except while breeding (Rex et al. 2004). Pocket gophers cause damage by feeding on tree roots and gnawing the bark of the trees just below the soil line, often girdling the trees. This may also expose damage roots to soil-borne pathogens such as phytophthora root rots: these may infect your tree resulting in dying trees and declining yields. Their burrows may divert irrigation water and contribute to soil erosion (Flint 1991).

Management Guidelines

Although pocket gopher presence is easy to detect, pocket gopher damage is frequently invisible as it often goes undetected until a tree exhibits stress. By this time, the tree may be beyond saving. Gopher activity is readily detected by the presence of fresh mounds of soil in greatest numbers in the spring and fall, when the soil is amply moist (Rex et al. 2004). Gopher mounds are generally crescent-shaped and can be distinguished from mole mounds which are usually uniformly circular.

Traps

The most popular gopher traps are the two-pronged pincher traps. Choker-type box traps are also available and quite popular. Trapping is a safe and effective management alternative to baiting and fumigation. Even though trapping can be time consuming and costly, often this is offset by the effectiveness of a trapping program. Recent advancements in gopher management have shown that no attractants are needed to increase capture success (Baldwin et al. 2014). Baldwin also demonstrated that it was not necessary to cover trap sets, particularly in the autumn. It has also been shown that some traps are more effective (Baldwin et al. 2013) and that human scent has no effect on trap success (Baldwin 2015).

Fumigants

The most common fumigants used in gopher control are gas cartridges (sodium nitrate and charcoal) and aluminum phosphide. Gas cartridges have been shown to be largely ineffective (Matschke at al 2000). Aluminum phosphide is an effective fumigant. It is a restricted-use material and can only be used by or under the direct supervision of a Certified Applicator. Aluminum phosphide cannot be applied if application sites are within 100 ft of a structure. There are special posting requirements for the use of this product and a fumigation management plan is required. It is important to consult the label.

Carbon monoxide producing machines can also be effective at controlling pocket gopher populations. This control option is very time consuming but not as effective as baiting or other fumigation programs (Baldwin et al 2013). However, in organic orchards, where many

management options are not available, this may be a good alternative.

Toxic baits

Diphacinone and chlorophacinone are the main active ingredients in gopher anticoagulants baits. These are first generation anticoagulant rodenticides (FGAR). FGARs are multiple meeting toxicants that require pocket gophers to consume the bait multiple times over the course of 3 to 5 days to receive a toxic dose. This means that greater amounts of bait are required to maintain a ready bait supply over this time period compared with nonanticoagulant rodenticides.

Strychnine and zinc phosphide are the two most commonly used nonanticoagulant rodenticides for gopher control. These toxicants kill gophers after a single feeding (acute toxicant). However, strychnine is difficult to acquire due to current supply issues. Zinc phosphide has a very distinctive taste that gophers may become adverse to.

California ground squirrels

California ground squirrels gnaw on fruit and bark and girdle trunks, scaffold limbs and occasionally chew on plastic irrigation lines. When digging burrows, squirrels bring soil and rock to the surface and deposit it in mounds near burrow openings. They enlarge burrow systems each year by constructing new interconnecting tunnels, so the longer the squirrels occupy the burrow, the more extensive and complex it becomes.

Ground squirrels emerge from hibernation about late January in the southern part of the Central Valley and about a month later in the northern part. However, in Southern California and the coastal areas, ground squirrels can be active throughout the year (Dreistadt 2008).

Management Guidelines

When even one or two ground squirrels are present in or immediately adjacent to an avocado grove, control them; otherwise, damage is inevitable. Burrow fumigants, toxic baits, and traps are the current means of management (Rex et al. 2004).

Traps

Traps are somewhat practical for ground squirrel control when squirrel numbers are low to moderate. There are several types of traps that kill ground squirrels, including box traps, tunnel traps, and Conibear traps. There are also multiple-catch traps available for ground squirrel management

Fumigants

Studies have shown that aluminum phosphide is an excellent material for controlling California ground squirrels (Baldwin and Holtz 2010). Programs utilizing aluminum phosphide are also considerably cheaper. Fumigation using gas cartridges is only moderately effective. Fumigation is generally most effective in the spring and early summer. High pressure carbon monoxide machines have also proven to be moderately effective for ground squirrel control.

Toxic baits

FGARs are also available for ground squirrel control. FGARs are applied above ground for ground squirrel management and can be applied using broadcasting, spot-baiting, or bait stations. It is important to always consult the labels as some products are only registered for use in bait stations. Bait acceptance trials may also be required before using these products.

Zinc phosphide is also available for California ground squirrel management. Its effectiveness has been described as mediocre (Marsh 1994).

Fig 1

In summary, managing pocket gophers and ground squirrels in citrus and avocado groves can be challenging. Regular monitoring of these pests in and around orchards should form the basis of a management program. Historical records of pest population levels, control measures implemented, and the effect of management methods, can be used to help determine the best management approach.

Fig 2

Fig 4

Fig 3

Figure 1: Photograph of California ground squirrel. Photo courtesy of Jack Kelly Clack.

Figure 2: Photograph of pocket gopher. Photograph courtesy of Ed Williams.

Figure 3: California ground squirrel burrow openings in a citrus orchard. Photo courtesy of Sonia Rios.

Figure 4: California ground squirrel burrow openings in an avocado orchard. Photo courtesy of Sonia Rios.

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What is that in my grove, Horseweed or Hairy Fleabane?

Sonia Rios, UCCE Riverside/San Diego Counties

Elizabeth Mosqueda, California State University, Fresno

As a farm advisor many growers will ask, "What is that in my grove- horseweed or fleabane?" These two weeds have been running ramped in Southern California, as well as other parts of the state and can be seen in every cropping system imaginable. Their population numbers can be alarming and can start to become troublesome to growers as they can easily become a challenge to control if left untreated. These two members of the of the *Conyza* family are particularly fond and thrive in permanent tree crop environments due to lack of tillage and lack of a crop rotation schedule due to the trees permanent status.

Horseweed (*Conyza canadensis*) and hairy fleabane (*Conyza bonariensis*) are summer annuals. The temperature and light requirements for germination, soil type preference, and depth of soil emergence of these two species are fairly similar and can usually be found growing side by side in a grove (Shrestha et al. 2008).

Biology

Horseweed and hairy fleabane plants are difficult to distinguish from each other until about the 12- leaf stage (Photo 2). Once the plants bolt, it is easy to differentiate the two species. When horseweed bolts, it sends up a single, or primary, vegetative stem that is erect with dark green leaves that are 4 inches long and are crowded together with an alternative arrangement on the stem. The stem is either smooth or covered with shaggy hairs (Shrestha et al. 2008).

Hairy fleabane, unlike horseweed, develops multiple lateral branching without a central stem, and has leaves that are much narrower with rigid hairs. The distance between leaves is greater in hairy fleabane than in horseweed. At maturity, horseweed can be 10 feet tall, whereas hairy fleabane is usually 1.5 to 3 feet tall.

Photo 1: Hairy fleabane in an avocado grove

Horseweed and hairy fleabane seeds cannot survive more than ~3 years under field conditions. Controlling plants before they produce seed is critical for long-term management. Action should be taken when weeds are young, generally before they start producing seeds.

For more information regarding the differences between these two weeds, please see Shrestha et. al. (2008) UC ANR Publication: http://anrcatalog.ucanr.edu/pdf/8314.p

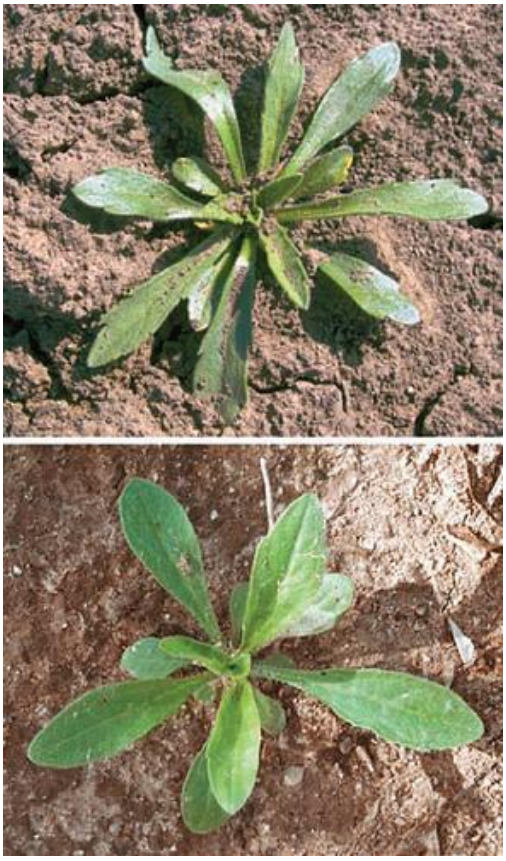

Photo 2. Seedlings of hairy fleabane (top) and, horseweed (bottom). (Photo: Shrestha et al. 2008).

Management

Herbicides used in a grove are generally divided into two groups: 1) soil-applied (preemergence) herbicides that should be applied to fairly clean soil surfaces prior to weed emergence, and 2) foliar-applied (postemergence) herbicides that are applied after weeds have emerged (Futch and M. Singh 2014). Preemergence herbicides are generally applied two to three times per year, so the maximum amount of herbicide is present in the upper soil profile (0 to 2 inches) slightly before weeds emerge (Table 1). Herbicides applied too early, before weeds emerge, will not provide adequate weed control due to herbicide leaching or degradation on the soil surface or within the soil profile. Preemergence herbicides must also be incorporated into the soil (mainly by rainfall or irrigation) and are usually broadcast on the entire orchard floor as growers cannot predict where weeds will emerge (Rios et al. 2015). Growers using drip irrigation or micro-sprinkler irrigation have a difficult time adequately incorporating preemergence herbicides, so applications are generally scheduled around predicted rainfall (Rector et al. 1998). Consideration of soil type is important, as it may influence herbicide selection and rate used. Once weeds are under control, treatments should be applied every 2nd or 3rd year to maintain these conditions. Also, consideration to make split-applications in Oct./Nov. should occur, and again in Jan./Feb. if weed emergence is observed during these periods. If farming takes place in a groundwater protection area, a permit to use some of these products may be required (refer to your county agricultural commissioner for regulations). It is important to acknowledge that while most of the effective materials on these weeds fall under specific regulations, they can still be used in many cases and should be considered.

Postemergent herbicides can be effective against these weeds, however application should occur when weeds are young (before the 14 leaf stage) and the appropriate dose according to the label should be applied. Tank-mixing may help (Preemergent + Postemergent maybe the most useful), especially if one is trying to control other weeds that are present in the grove. In general, when applying postemergent herbicides in a spray volume of 30 to 50 gallons per acre, adequate coverage of the weed foliage is necessary for good control (Shrestha et al. 2008). **Caution should be used when using most postemergent herbicides around trees as many are broad-spectrum and do discriminate as to what they kill upon contact.**

If one decides to mow weeds, s/he can try this approach before weeds produce seed. Also, weeds should not be mowed before applying herbicides. Mowing will simply stimulate additional branching from the crown of the plant and only delay seed production. In addition, mowing will also harden off these plants, making it almost impossible to control with a postemergent herbicide, as most postemergents are systemic and require movement by some type of circulation within the plant in order for effects to take place. The same goes for drought stressed weeds. These plants will not uptake herbicides in order to prevent loss of resources during a crises.

However, applicators beware! Relying on the same mode of action, such as glyphosate (Roundup) or same combinations of treatment after a few years increases the chance of selection for resistant populations (Photo 3). Rotating other effective products (even when you spot spray) when possible can prevent or delay herbicide resistance from occurring (Table 1). In the California Central Valley, populations of both weeds have now been shown to be resistant to glyphosate and paraquat. It has been predicted that we also have these two resistant biotypes here in Southern California, however screening research needs to be done to confirm.

Photo 3. Signs of herbicide resistance.

In summary, weed management can be an expensive part of the total subtropical crop production program, but resources invested can provide significant economic returns. Weeds can impact cultural operations, tree growth, and yields by altering the spray pattern of low-volume irrigation systems, intercepting soil-applied chemicals (fertilizer and agricultural chemicals), reducing grove temperatures during freeze events, and interfering with pruning and harvest operations. The presence of weeds in groves can also affect insect populations. Weeds growing around tree trunks may also create a favorable environment for pathogens that infect the trunk and roots (Futch and Singh, 2010).

Scouting for weeds should be conducted in all areas in and near groves, including tree rows, row middles, water furrows, ditch banks, fence rows, and adjacent perimeter locations. These sites may receive different cultural practices which can facilitate the persistence and spread of different weed species. Small isolated weed patches should be managed before they spread to other areas of groves. Since weeds emerge all year long, weed surveys should be scheduled throughout the year, especially after rains or soil disturbances.

Preventive programs are often overlooked, but are an important component of cultural practices and are cost-effective. Practices, such as sanitation, spot spraying, and/or hand removal of weed escapes before they produce new seed are examples of prevention. While preventive programs may not stop the spread of all weed species, these practices may slow the spread of undesirable species, thereby reducing long-term weed control costs.

Photo 4: Hairy Fleabane in a young citrus Grove

Table 1. Preemergence herbicides for horseweed and hairy fleabane control in tree and vine crops in California	
Herbicide	**Notes**
Bromacil (Hyvar X)	Citrus >4 years, GWPA permit needed, 3-4 lb/A in fall and winter, HW=C, HF=C
Bromacil + Diuron (Krovar)	Citrus >3 years, GWPA permit needed, 3 lb/A in fall and winter, HW=C, HF=C
Diuron (Karmex, Direx, etc.)	Established fields, GWPA permit needed, 2 lb in fall and winter, HW=P, HF=P
Isoxaben (Gallery T&V)	NB fields only, 10.6 oz/A, HW=C, HF=C does not control grasses
Flumioxazin (Chateau)	Bearing almond/pistachio/grape, NB others, 6 oz/A fall and winter, HW=C, HF=P
Norflurazon (Solicam)	Established fields, GWPA permit needed, 2.5-5 lb, adjust to soil type, HW=P, HF=P
Oxyfluorfen (Goal, etc.)	NB citrus, bearing/NB others, 6-8pt/A, HW=P, HF=P
Simazine (Princep, etc.)	Established fields, GWPA permit, 2 qt or 2 lb fall + winter, mix w/diuron, HW=C, HF=P
Thiazopyr (Visor)	Bearing/NB citrus, NB others, 4 pt/A winter or 2 pt in fall and winter, HW=P, HF=P

HW = horseweed C = effective control NB = non-bearing only
HF = hairy fleabane P = partial control

This is not a complete list of registered products available. Check with your pesticide dealer for other products available. It is not a written recommendation for herbicide use. Always read and follow all label recommendations.

Upcoming Meetings and Programs:

1. Sustainable Agriculture in Riverside County and California

- Develop a vision for the future of sustainable agriculture in California
- Contribute to scientific understanding of what it means for agriculture to be sustainable
- Discuss social media opportunities for outreach

2. Avocado Grower Seminar Series program and schedule will soon be announced

Date
January 20, 2016
10:00 a.m. – 2:00 p.m.

Location
Cooperative Extension Riverside County, Indio Office
81-077 Indio Blvd. Suite H
Indio, CA 92201-2552

We are holding a spot for you! Please RSVP:
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This newsletter is published three to four times a year with educational subjects in subtropical horticulture. Please let us know topics you would like to be addressed in this Newsletter!

We wish you a Happy New Year!

Topics in Subtropics

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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 <u>are not</u> a recommendation from the University of California for use. Consult the label and use it as the basis of all recommendations.