Growing Healthy Citrus and Avocados in the Backyard

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Backyard Culture is a Little Different than Commercial Culture

- We usually don't use tractors
- We certainly don't use helicopters
- We don't need "maximum" yields

- But, some things are the same
  - diseases
  - insects and mites
  - irrigation requirement
  - fertilizer requirement

Things to Consider

- Site Selection
- Varieties
- Planting
- Watering
- Training, Pruning and Thinning
- Fertilizing
- Sanitation
- Pests and Diseases
- Harvesting and Storage

Site Selection-Citrus

- Subtropical fruit trees need a warm climate
- Most citrus fruit freeze at 26F (lemons freeze at 29F)
- Citrus trees freeze at 24F
- Do not plant in a lawn that requires frequent shallow irrigation
  - Grass competes for water and nitrogen
- Plant on the south side of the house to increase heat units
- Plant in a well drained soil
  - Hard to do if you have a clay soil

Some citrus need warmer temperatures in the summer to ripen the fruit

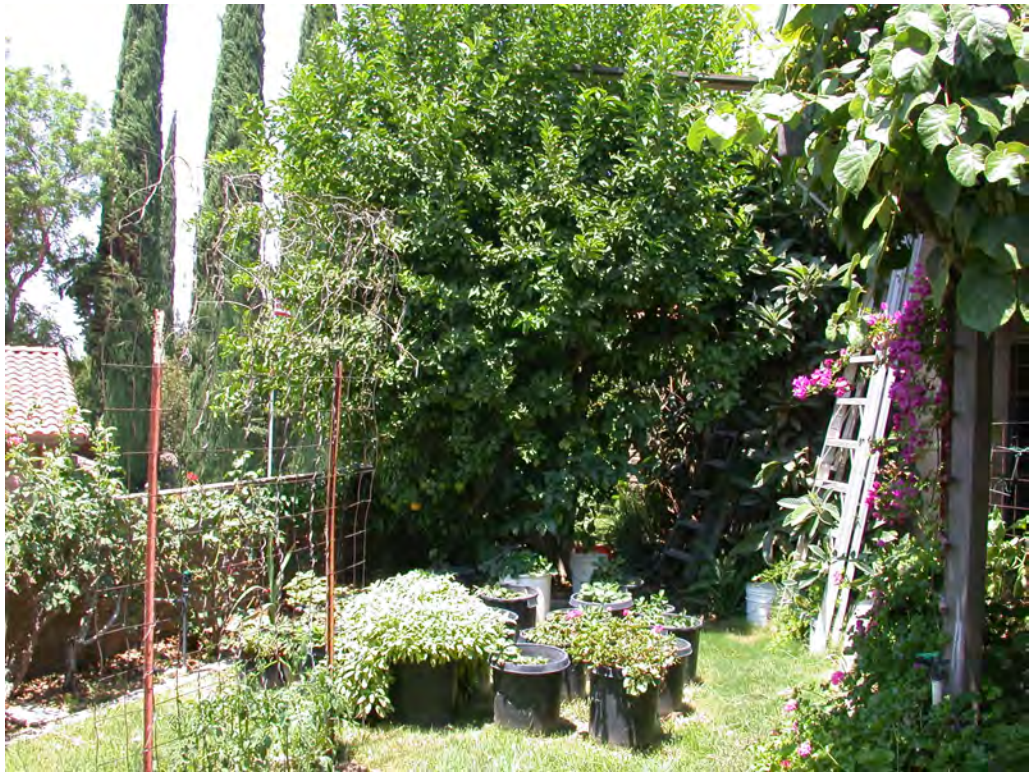
Site Selection-Avocados

- Hass avocado fruit freezes at 29 F
- Fuerte avocado fruit freezes at 26 F
- Mexican race of avocado ('Mexicola', 'Stewart') freezes at 24 F

- Avocados do not do well in clay soil- they like drainage
- Keep the leaf mulch on the ground
- Keep the trees away from houses and pools – they drop leaves
- They grow tall!

Avocados and Citrus need Full Sun and Space, this can interfere with the neighbors!

Don’t plant lemons too close to the house!



Varieties - Citrus

- In order to grow good citrus, start with the right varieties for the area
- And, know when to harvest

- "I picked my Valencia oranges in February and they aren't sweet!" What's the matter with these trees?"
  - The season for Valencia oranges is from May to September in San Diego County

Types of Grapefruit Grown in S. California (Plant the correct varieties for the area)

- Grapefruit – usually need more heat to ripen
  - Marsh Seedless
  - Ruby Red
  - Rio Red
  - Star Ruby
  - Flame
  - Oroblanco
  - Melogold
  - Cocktail

Lemons

- Lisbon – some cold resistance, heat tolerant and thorny. Bears most fruit in the fall

- Eureka – Cold sensitive, nearly thornless, bears fruit year round along coast

- Improved Meyer – lemon – sweet orange hybrid, fruit round, thin skinned, almost orange in color, less acidic

Limes

- Bearss lime (Tahitian lime)– seedless, larger and milder flavor than Mexican lime. Not as cold hearty as lemon
- Mexican lime (Key lime) – very frost sensitive, can not take any frost at all
- Limequat (lime x kumquat hybrid)

‘Bearss’ Lime

Oranges

- Navels
  - Washington. Large, seedless, eaten fresh, does not make good juice. Fruit splitting due to irrigation problems. Harvested January – April
  - Cara Cara. Reddish pink flesh
  - Lane Late. Ripens in the early summer
- Valencia – juice oranges, seeds, ripens May-September, fruit may re-green

- Be careful, cold nights in winter cause peels to turn orange, but Valencias are not ready to eat until May

Valencias have double crops

Blood Oranges

- Moro – deepest red/purple color in flesh, very alternate bearing

- Tarocco – very thorny, color may only be slight pink, best flavor

Relative Size, Blood vs Valencia

Mandarins are Good along the Coast

- Satsuma – seedless, easy-peeling, not suitable for the desert, early (October), rapidly become puffy on tree
- Dancy – juicy and seedy, holidays
- Clementines – seedy if near other citrus ('Cuties'), Dec-Feb
- Seedless Kishu – seedless and easy to peel, small fruit larger than a golf ball, Nov-Jan
- Tango – seedless, good color, delicious, Feb - April
- Gold Nugget – seedless, sweet mild flavor, March-August

‘Tango’ mandarin

The ‘Ojai Pixie’

"New" varieties of interest that growers are asking about

- Meyer lemon
- Variegated lemon
- Seedless lemon
- Cara Cara navels
- Australian fingerlime

Avocado Varieties - Hybrids

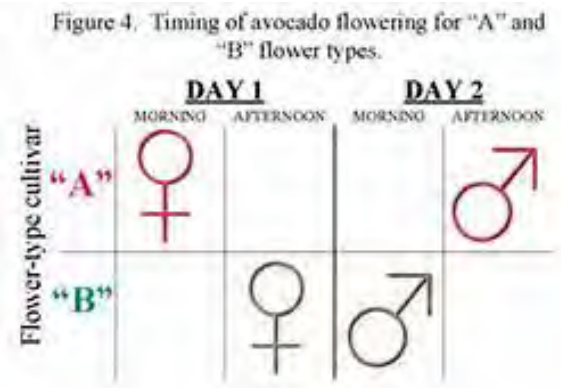
- 'Hass' and 'Fuerte' (and most of the better commercial varieties) are hybrids of **Mexican** and **Guatemalan**

- The **West Indian** varieties and grown in the more tropical countries, and in Florida and Hawaii. They are large, have short harvest seasons, and are more watery in flavor.

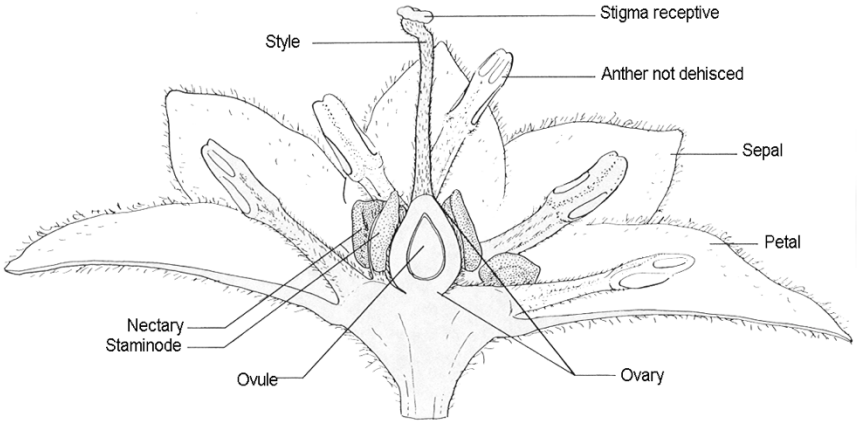
A and B Flower Types

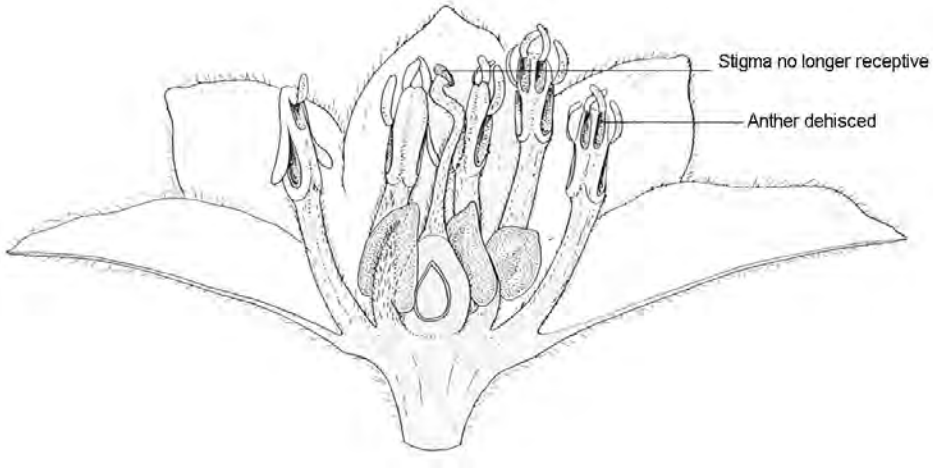
- **A flower type** – opens as a female in the morning, closes overnight, then opens as a male in the afternoon of the second day

- **B flower type –** opens as a female in the afternoon, closes overnight, then opens as a male in morning of the second day



Female vs Male





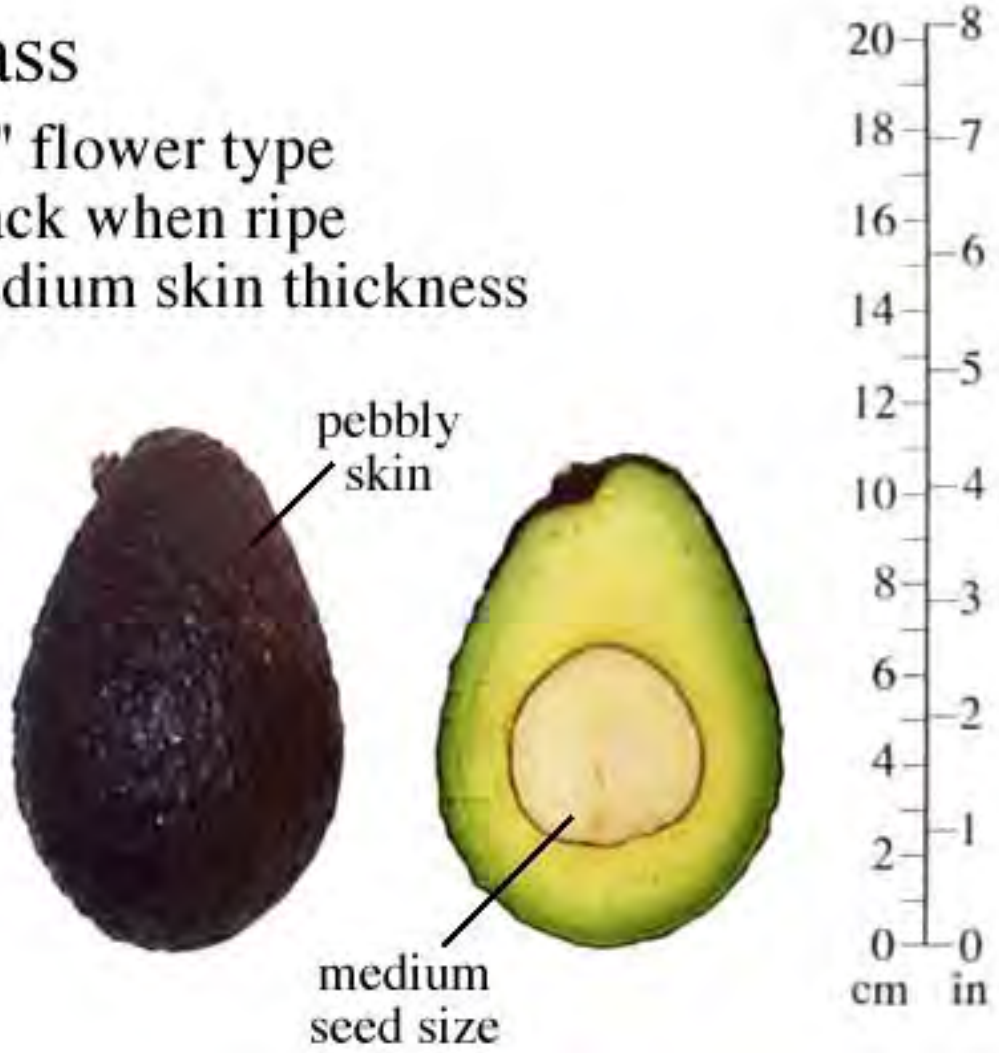
Flowering

- A flowers – Hass, Reed, Lamb Hass, Pinkerton, Harvest, Holiday
- B flowers – Bacon, Zutano, Fuerte, Nabal, Sir Prize
- Avocado is a bee pollinated crop
- Could we improve fruit set in a single tree in the backyard by providing a double-grafted tree?

Varieties - Hass

Hass

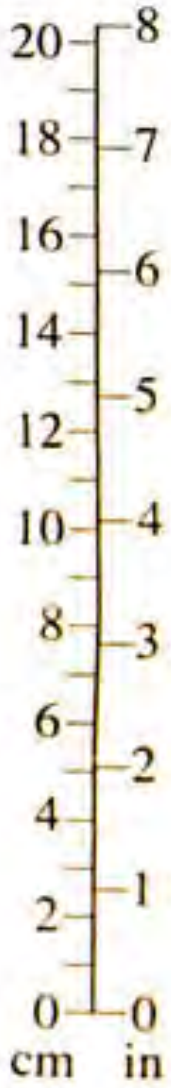
"A" flower type
Black when ripe
Medium skin thickness



Varieties – Lamb Hass

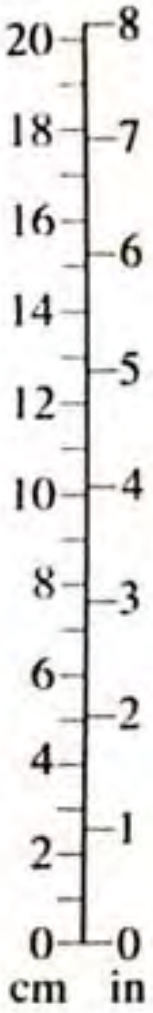
Lamb Hass

"A" flower type
Black when ripe
Medium skin texture



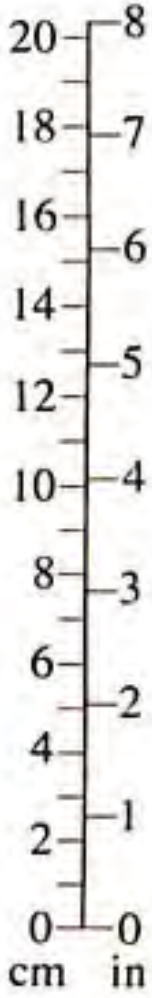
Reed

"A" flower type
Thick ovate shape
Green when ripe



Fuerte

"B" flower type
Green when ripe
Medium skin thickness



Planting

- Best time to plant is during the Spring
- Dig the hole twice as wide as the root ball
- Plant at the same depth as the container
  - If the graft union is planted too low the scion may become infected with *Phytophthora* gummosis
  - If planted too high the roots might dry out

Use the native soil to backfill and tamp it in slightly with the shovel handle to get rid of air pockets

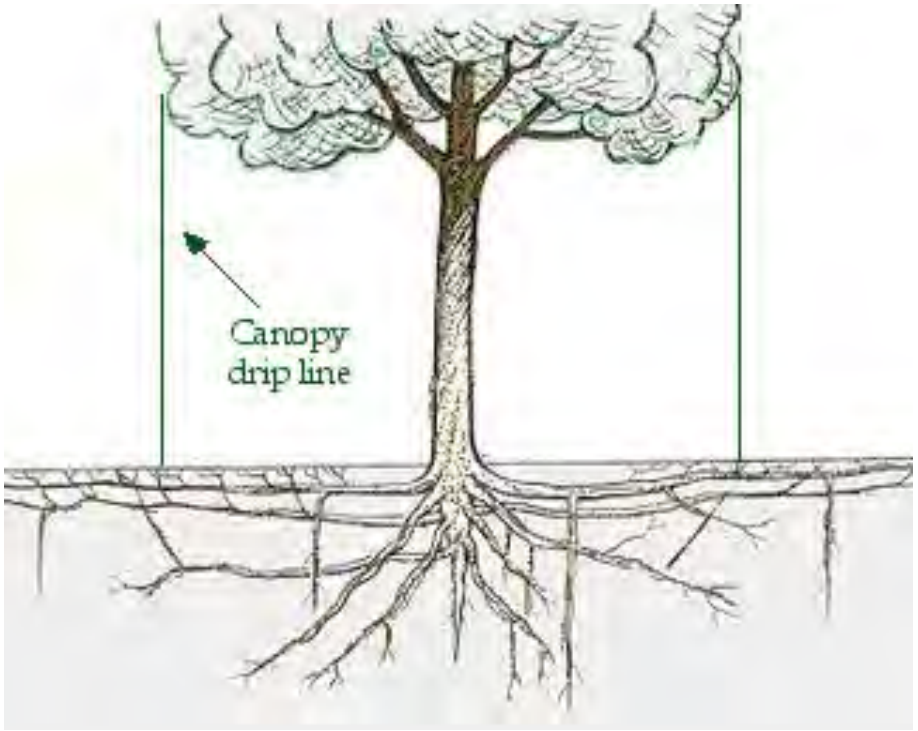
Don't add mulch to backfill!

Watering

- Young tree – situate drippers close to the root ball and gradually move them out as tree ages
- Mature tree – may require 4-6 inches of water per month in the summer
  - Clay soil water less often
  - Sandy soil water at least once a week and maybe sooner
  - Mature tree may need 6-8 drippers per tree, or one mini-sprinkler
  - Bubblers-difficult to contain water inside the berm

Location of Water

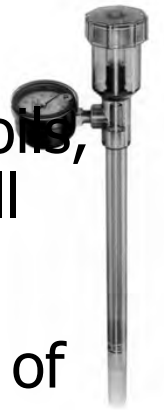
- Move drippers out to the drip line as tree ages
- Mini-sprinkler should be located on the uphill side of the tree



Special Challenges in Avocado Irrigation

The root system is shallow, 80-90% of the feeder roots are in the top 8-10 inches of the soil

- The feeder roots have few root hairs and are inefficient in extracting water
- Many groves are on hillsides with decomposed granite soils, these drain rapidly (good) but don't store water very well (bad)
- Soil moisture should be checked to determine frequency of irrigation
- Leaching salts below the root zone



Special Challenges in Avocado Irrigation

- Avocados do not tolerate clay soils very well
- Trees may have to be planted on a mound

Irrigation Requirement - Avocados

- Mature tree uses 8 gallons of water per tree per day in January
- Up to 50-70 gallons of water per day in July-August

- Commercial Growers:
- Irrigation frequency, determined by tensiometer or soil probe
- Irrigation amount determined by tables or website: http://avocadosource.com/tools/irrigation scheduling calculator

Tip-Burn (salt damage)

Where are the roots?

Where is the water coming from?

Fertilization - Citrus

- Trees require nitrogen every year
- First application in late Jan-Feb before bloom
- Second application in May
- Third application in June

- Trees usually need a zinc spray (especially with too much manure for an organic nitrogen program)

- **Suggested application rates of nitrogen**
- (Divide into 2 or 3 applications)
- **1st year**: 1 tablespoon nitrogen fertilizer 3 times per year, per tree.
- **2nd year**: 0.25 lb actual nitrogen per tree
- **3rd year**: 0.5lb actual nitrogen per tree
- **4th year**: 0.75lb actual nitrogen per tree
- **5th year**:1 lb actual nitrogen each year

Fertilization - Avocados

- Mature tree uses 1.5 to 2 lbs actual nitrogen per tree per year
- Split monthly into 8 applications
- Or, 2/3 applied before bloom and 1/3 applied in June
- Or, (Bender suggestion),
  - 6 lbs triple 15 applied late Feb, 3 lbs calcium nitrate in June and 3 lbs calcium nitrate in September = 1.87 lbs actual N

Organic Nitrogen Fertilization

- Commercial growers generally use a 50 lb bag of EZ Green (composted chicken manure) per tree per year, ½ applied before bloom and ½ in late summer
- EZ Green is about 3% nitrogen
- Animal manures usually make zinc deficiency worse, due the high phosphorous content
- Do not apply during bloom!!

"Actual Nitrogen"

- 1 pound of actual nitrogen equals about 5 lb of ammonium sulfate per year, or 100 lb of composted cow manure each year. Organic fertilizers such as manure, bloodmeal, etc. could be applied in the fall under the tree canopy.

- 15-15-15 has 1.5 lbs N in 10 lbs

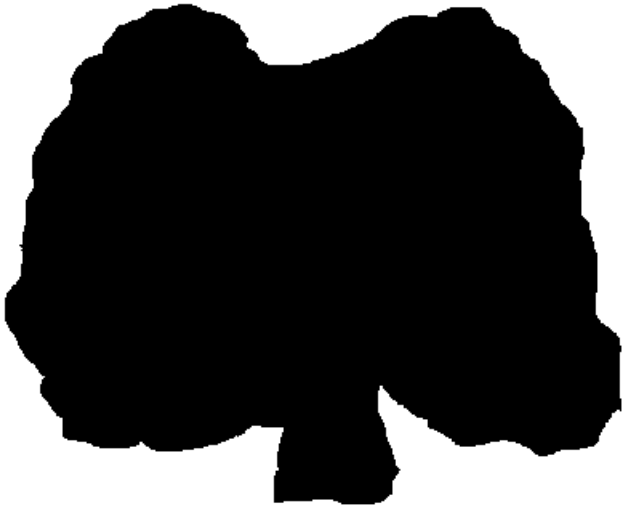
Zinc Deficiency, Mottlling between Veins

Training, Pruning and Thinning - Citrus

- Young citrus (and mature citrus) don't require much pruning, make sure suckers are pruned off from below the graft
- Fruit thinning is not required, but you should expect
- small pea-sized fruit to fall off in June
- Prune up the skirts 18"to allow you to get under the tree to apply copper bands to repel snails, or sticky materials to catch ants
- Exception: Lemons are topped every two years

Pruning - Avocado

Single Leader vs Cal Poly Style



Top 10 Pests and Diseases of Citrus (as seen at our office)

- Pests
  - Leaf miner
  - Ants
  - California red scale
  - Mealybugs
  - Snail damage
  - And the most worrisome: Asian Citrus Psyllid
- Diseases
  - Phytophthora gummosis
  - Phytophthora root rot
  - Dry root rot
  - Alternaria fruit rot
  - Penicillium fruit rot
  - An even more worrisome: Huanglongbing disease

Asian Citrus Psyllid

- This tiny insect spreads a bacterial disease in Citrus.
- The disease has killed millions of citrus trees in Florida
- The insect is spreading in California and is now being found in traps in Northern San Diego County groves
- About 1/16” long

Distribution of Asian Citrus Psyllid in California

Affected counties include:
Tulare, Kern, Santa Barbara, Ventura, Los Angeles, San Bernardino, Orange, Riverside, San Diego, and Imperial.

UC RIVERSIDE University of California | Center for Invasive Species Research

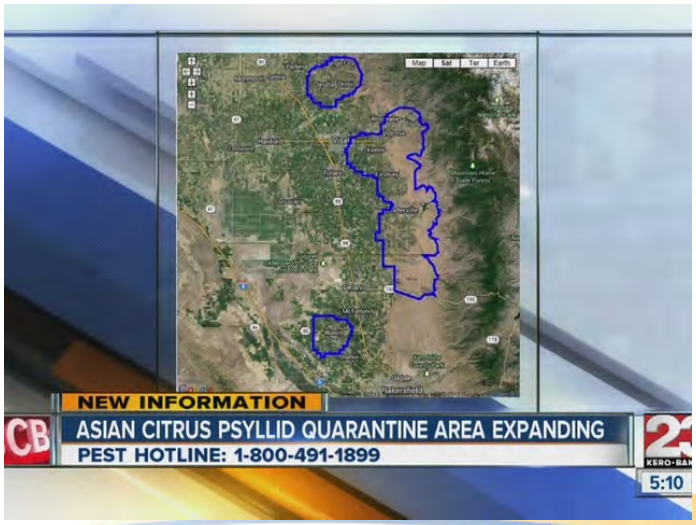
Updated November 2013

ASIAN CITRUS PSYLLID ADULT

ASIAN CITRUS PSYLLID EGGS

VARIOUS LIFE STAGES

NYMPHS AND WAXY TUBULES WITH HONEYDEW



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A Celebration of

We have to keep this insect under control: this means we have to treat!

- Conventional growers
  - Winter/spring knock down the adults with a spray of Sevin
  - Summer apply a systemic, Bayer Advanced Tree and Shrub Spray (contains imidacloprid)
- Organic growers
  - Pyganic (3 applications 10 days apart)
  - Plus 1% Oil (nr 415 or nr 440)

  Or (other things being tested by farm advisor Jim Bethke)

Huanglongbing Disease (Citrus Greening)

- Bacterial Disease spread by ACP, plugs up phloem cells
- Only one tree found so far in California (Hacienda Heights)
- But maybe trees grafted from this tree are out there somewhere

There is no cure for this disease

- In the future:
  - Spinach gene inserted into citrus genome makes citrus resistant to HLB
  - Troyer citrange is resistant…Can we breed it into an edible fruit?

The Florida Citrus Industry

- Florida's citrus industry valued at US $9.3 billion
- ACP first found in 1998
- HLB detected in 2005
  - Now infects all 32 citrus producing counties in FL
- ~621,000 acres of citrus in Florida
  - >60,000 acres of trees destroyed by 2009
- Three pronged management approach
  - Produce new plants in screened facilities
  - Area wide insecticide management of ACP
  - Removal of infected trees

Slowed not eliminated HLB spread

Mining trails through leaves and young twigs

- Citrus leafminer

How to Treat for Citrus Leaf Miner

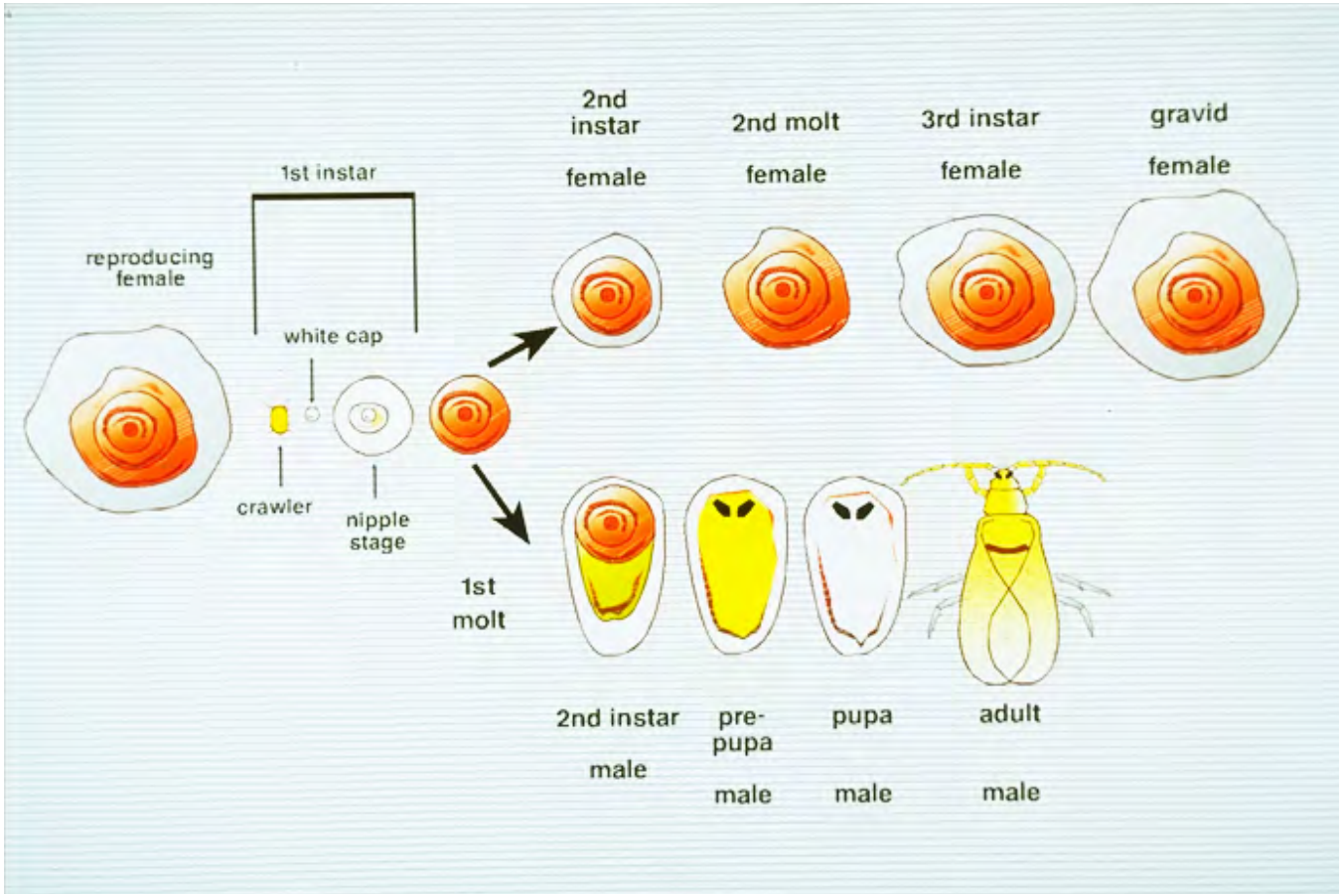
– Mature Orchards:

- Treatments are not necessary for mature trees.
- The foliage will look bad, but damage will NOT affect yield.
- Insecticide treatments will disrupt natural enemies
- We have released natural enemies (parasitic wasps) and they are spreading naturally

--New plantings and citrus nurseries:

- Treatments are needed for the first two years
- New plantings rely on systemic imidacloprid (Bayer)
- Nurseries rotate between Admire and foliar insecticides (Assail, Intrepid)

Citrus Red Scale



Parasite (*Aphytis melinus*) laying eggs into red scale

Argentine Ant (*Iridiomyrmex humilus*)

- Argentine worker ants travel in distinct trails.
- Ants feed on honeydew excreted by soft scales, mealybugs, aphids, cottony cushion scales and whiteflies. Ants can interrupt biological control of these pests.

- Argentine ant Control ants by denying access to the canopy.
- Apply a band of sticky material to base to trunk that mechanically impedes ants.

Ants feeding on twigs, bark, leaves and honeydew excreted by other insect pests.

- Prune the canopy up 30 inches off ground.
- Use boric acid/sugar baits that the worker ants can take back to the nest and kill out the queen.

Boric acid bait placed along building foundation

Fruit and leaves covered with honey dew and sooty mold. Mealybugs present.

- Mealybugs.
- Soft, oval distinctly segmented insects covered with a mealy white wax.
- Adults about 1/8 to ¼ inch long. Mealybugs extract plant sap reducing tree vigor.
- If a cluster of mealybugs feeds along a fruit stem, fruit drop can occur. Natural enemies usually control.

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Eliminate ants

- **At home hand pick or wash off insects.**
- **Mealybug destroyer (a predator) is available commercially for purchase and release**

Adult Mealybug Destroyer

Mealybug Destroyer Larvae (*Cryptolemus*)

Mealybugs between two grapefruit

Citrus Mealybug

Comstock Mealybug

Brown Garden Snail

Holes in leaves and fruit and slimy trails

- Brown garden snail (*Helix aspera*), gray garden slug (*Agriolimax reticulata*)
- Brown garden snail is about 1 inch diam.
- With distinct color pattern; gray garden slug is a snail relative, lacks shell.
- Most active at night and early morning when it's damp.

Manage by skirt pruning and trunk treatment. Release predatory decollate snails in counties where it is legal. Copper barriers, such as trunk-banding of citrus trees, can be effective.

Skirt-Pruned Citrus

Decollate Snail feeds on young brown garden snails and their eggs

Copper band on citrus
(see snails below)

Leaves turn yellow and drop. Beads of sap ooze from trunk lesions. Gumming is more pronounced in spring. Bark can harden, dry and crack.

- Phytophthora gummosis (*P. parasitica or P. citrophthora*)
- When infection is just above the bud union it is often called foot rot; when infection is higher up on the trunk it is often called gummosis.
- When it spreads down into the crown, it is referred to as foot rot. Fungus infects the bark and phloem of the tree trunk and may spread to crown and woody roots.
- Keep trunk dry. Do not allow sprinkler water to hit the trunk.
- Scrape away all diseased bark and include a buffer strip (about 1 inch) of healthy light brown to greenish bark around margins. Allow to dry. Repeat if infection recurs. Keep mounded soil and water away from trunk. Improve ventilation by removing branches that touch ground.
- Avoid injuring bark with lawn mowers, weed whackers (the worst) and pruning tools, since wounds give fungus an easy entry.

Phythophthora gummosis

Leaves turn yellow and drop. Root bark of infected roots slides off easily when pinched. Feeder roots destroyed.

- Phytophthora root rot (P. citrophthora), however symptoms may be difficult to distinguish from nematode, salt or flood damage.
- Caused by the same fungus that causes gummosis, but it infects the root system in this disease. Survives in soil a long time. Disease can occur when water is in direct contact with the base of the trunk and the trunk is allowed to stay wet. Shorter less frequent irrigations may help if damage is not severe. Avoid waterlogging. If damage is severe, remove tree.
- Use tolerant rootstock such as trifoliate orange, Troyer/ Carrizo citrange or C-32/C-35. Do not plant citrus in the lawn where it will be watered too frequently.

Phytophthora root rot

Dry Root Rot

- Caused by *Fusarium solani*
- This fungus infects weak roots and trunks injured by fertilizer burns, gophers, weed wacking
- Also infects roots weakened by poor graft unions or any other type of major girdling action
- The tree can go from healthy to dead in six weeks due to xylem plugging in the crown

- **There is no cure, the tree must be removed**

Dry Root Rot


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Internal black rot in navel orange fruit. Rot starts at stem end, extends into core. Can occur on lemons in storage.

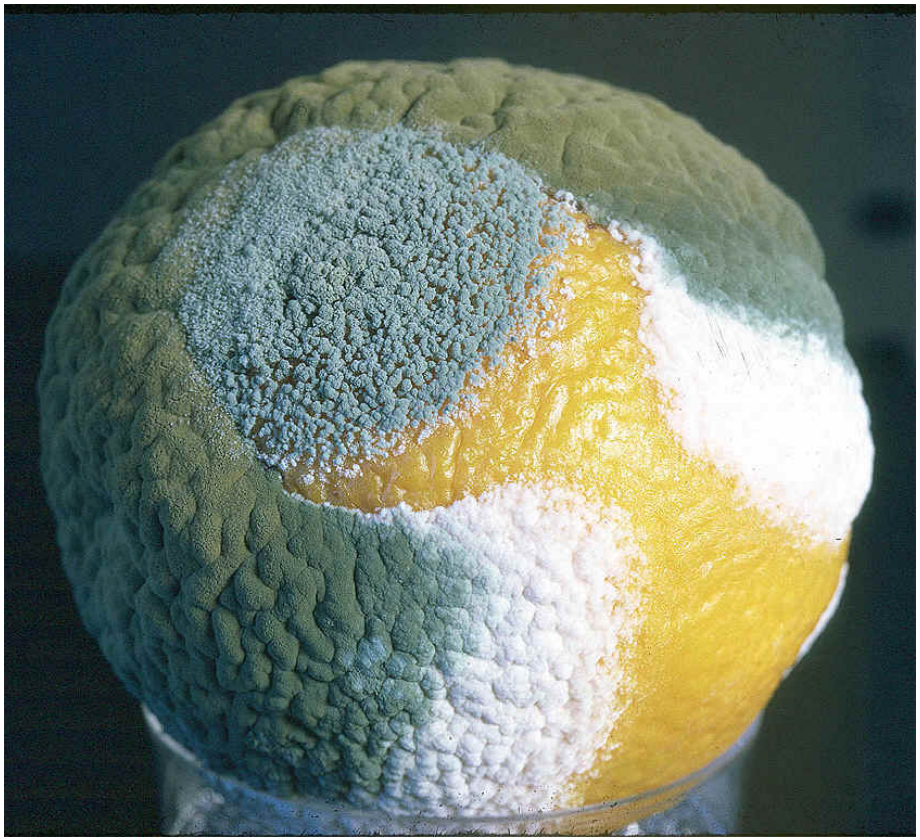
- **Alternaria rot (*Alternaria citri*)**
- **A fungus disease. Also known as black rot on navels. More of a problem when the navel is split. Preventing stress (especially drought stress) reduces susceptibility. No chemical control.**

Alternaria rot in a split navel orange

Whitish mycelium on fruit; blue and/or green spores appear on fruit

- Blue mold (*Penicillium digitatum*) or Green mold (*P. italicum*)
- May occur on injured fruit in the field but more often is a storage, postharvest disease.
- Early infections are almost impossible to detect. Easily recognizable when whitish mycelium and blue or green spore appear. Both types may occur together. To reduce infection, do not pick wet fruit and handle fruit carefully during picking. Immediately discard infected fruit and wash all stored fruit nearby in soapy water.
- Do not pick up fruit on the ground as they may have tiny injuries that quickly may become infected.

Penicillium
blue mold and green mold



Avocado Root Rot

Infection starts at the root tips

Root Rot

Healthy

Avocado Root Rot

- By far the most common avocado disease
- Found in almost all of the older avocado areas of Fallbrook, Escondido, Vista, Carlsbad, Encinitas, Lemon Grove, La Mesa, El Cajon (formerly commercial groves)
- Fungus spreads by water flow, or soil on shoes shovels and ladders

Avocado Root Rot - Treatment

- Easiest – Replace with a non-host, like citrus or cherimoya
- Injection of trunk with phosphorous acid twice a year for life, registered as a fertilizer but not a fungicide
- Mulch heavily with greenwaste mulch, must be a wood-based mulch
- Replace with a better rootstock – 'Dusa' is the best on the market now – Sold only at Brokaw Nursery in Ventura and C and M Nursery in Nipomo, and they sell only to commercial growers
- However! They will sell to a garden club with one order put together

Avocado Root Rot
Avoidance

- Plant trees with healthy roots
  - Don't plant trees until you have checked the roots! Once planted, you cannot bring them back to the nursery and you have doomed your soil!

Clean shovels, clean boots, clean ladders etc

Don't let water run down the hill from your neighbors, they may have root rot

Methods of Moving *Phytophthora*

Boots

Avocado Sunblotch (sunken yellow lesions)

- Other symptoms: stunted weeping growth, crocodile bark, yellow streaking on young branches.
- Symptoms will often appear after stress, topworking or freeze damage.
- In severe cases, no or little fruit production.
- Spread by infected graft wood, infected rootstocks, root grafting, pollen, and possibly pruning.

What can you do about Sunblotch?

- Remove the infected trees
- Make sure the nurseries are not using budwood and seeds from non-infected trees.

Polyphagous Shothole Borer, Fusarium Complex

Fusarium Dieback
Pest/Disease Complex
Slow dieback of canopy
Localized to LA and Israel

Tea shot hole borer

Avocado Fruit Set

Avocado Thrips

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A Celebration of

Beneficials – Predatory Thrips *Franklinothrips* adult and larvae

Persea Mites

Predatory Mites
Amblyseius californicus

Spider Mite Destroyer

Stethorus beetle

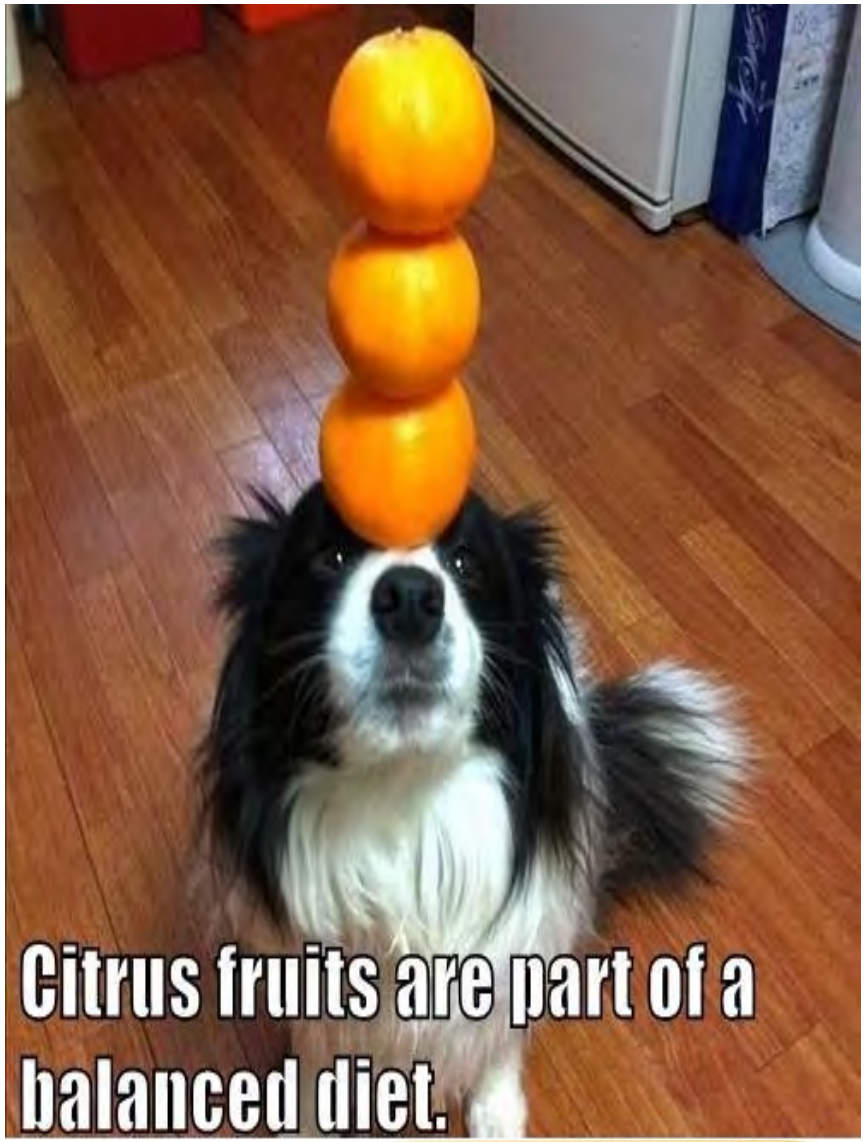
Loopers

Harvesting and Storage

- **The best place to store the fruit is on the tree**. Citrus: Once you pick the fruit, it does not increase in sweetness or ripen more fully. However, if you do pick the fruit, it will keep for about 4 to 6 weeks under refrigeration

- Avocado: Pick in the proper season when fruit is mature, let it sit a few days to soften, put it in a paper bag with an apple to speed up the ripening

- **Harvest fruit with a clipper**. Unless you want to eat the fruit immediately, **do not pull** the fruit off the tree because it injures the peel, and the fruit will rot if stored.



Questions??

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