Citrus 101:
Everything you wanted to know about citrus, but didn’t want to ask!

Stephen H. Futch, Ph.D., Extension Agent, Multi-County
shf@ufl.edu
Greasy Spot
(Mycosphaerella citri)
Greasy Spot

- Swelling on lower leaf surface
- Yellow mottle appears at corresponding point on upper surface
- Swollen tissue starts to collapse, turns brown and eventually black in color
- Infection causes premature leaf drop
  - occurs mostly in winter and early spring
Greasy Spot Rind Blotch
(Mycosphaerella citri)
Greasy Spot Rind Blotch

- Pinpoint black specks between oil glands with infection on grapefruit
- Specks coalesce, gives rise to symptom called pink pitting or greasy spot rind blotch
- Living cells adjacent to the specks often retain green color longer than normal
Life Cycle of Greasy Spot

Leaf drop

Dead leaves orchard floor

Spring

ASCOPORES forcibly ejected airborne

PSEUDOTHECIUM with ASCI

Underside of leaf Epiphytic growth

Infection through stomates

CONIDIA

Nov.-Dec.

Leaf & fruit symptoms

Late winter
Greasy spot seasonal development on Florida citrus.

Number of nights in the month relative humidity exceeded 90% more than 6 hours and temperature exceeded 72°F more than 6 hours.
# Greasy Spot Management

## Recommended Chemical Control for Greasy Spot

<table>
<thead>
<tr>
<th>Pesticide</th>
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<tbody>
<tr>
<td>Petroleum Oil 97+% (FC 435-66, FC 455-88 or FC 470)</td>
<td>Use label rates. Do not apply when temperatures exceed 94°F.</td>
</tr>
<tr>
<td>Copper fungicide</td>
<td>Use label rate.</td>
</tr>
<tr>
<td>Copper fungicide + Petroleum Oil 97+% (FC 435-66, FC 455-88 or FC 470)</td>
<td>Use label rate of each. Do not apply when temperatures exceed 94°F.</td>
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</tbody>
</table>
Citrus Scab
(*Elsinoe fawcetti*)

Foliage Symptoms

Fruit Symptoms
Citrus Scab

- Small, somewhat circular, elevated spots on leaves and fruit
- Infection becomes wart-like structures, covered with a corky pale tissue
- Pustules may group together
- Can be severe on Temples, lemons, Murcotts, Minneola, grapefruit
Life Cycle of Citrus Scab

Symptoms: fruit & leaves 6-7 days

Tender fruit & leaves
Infection with 5-6h wetting at 70-80°F

ACERVULUS with CONIDIA

Scab infested fruit & leaves

Airborne

Splash dispersed

SPINDLE-SHAPED CONIDIA

HYALINE CONIDIA

UF UNIVERSITY of FLORIDA

IFAS Extension
Recommended timing of fungicide applications to control sour orange scab on Florida citrus.

- **Delayed dormant application.** This treatment is required only on groves with a history of severe scab problem.
- **Two-thirds petal fall application.** This is the only treatment necessary with light infestation. This treatment is also needed in conjunction with delayed dormant spray on groves with severe scab problem.
- **Melanose spray.** Treatment at this time for melanose also reduces scab infection.
## Citrus Scab Management

**Recommended Chemical Control for Scab**

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Melanose

(*Diaporthe citri*)
Melanose on Fruit

- Lesions are small, raised, superficial dots, pustules and irregularly shaped spots ranging from brick red to black
- Feels like sandpaper when touched
- Pustules are larger on grapefruit than other varieties
- Fruit becomes resistant to infection at about 12 weeks after petal fall
- Spores develop on twigs that have recently died
Melanose

(*Diaporthe citri*)
Melanose on Leaves

- First appears on young leaves as minute, dark circular depressions with yellow margins
- Later become raised, brown in color
- Young infected leaves become distorted
- Difficult and not economical to try to control on foliage
Star Melanose
Star Melanose

• Occurs when copper is applied late during hot, dry weather and is due to copper damage to leaves
• Has no relationship to melanose
• Copper causes the developing tissue to become more corky and darker than normal and shape of the lesion often resembles a star
Life Cycle of Melanose

Twig death
PYCNIDIA on twigs
Splash-dispersed to fruit leaves and twigs
Old dead twigs
PERITHECIA
ASCOSPORES
Symptoms twigs
Symptoms leaves and fruit
Infection 10-12h at 77-85°F free water
airborne
5-7 days
MELANOSE

Melanose development and recommended timing of fungicide applications.

Schedule A
- Single fungicide application required under most conditions.
- Second application required in years of extended or delayed bloom.

Schedule B
- Two applications per year to minimize infection in groves with history of severe melanose problem.
- Average number of days per month favorable for melanose infection.
## Melanose Management

### Recommended Chemical Control for Melanose

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Alternaria Brown Spot
(Alternaria alternata)

Foliage Symptoms

Fruit Symptoms
Alternaria Brown Spot

• The fungus attack fruit, leaves and young shoots of susceptible varieties
• First appears as small, slightly depressed black spots which can cause young fruit and leaves to fall
• Fruit usually immune to infection after reaching 3-4 months of age
• Infests Dancy, Minneola, Murcotts and other varieties
Life Cycle of Alternaria Brown Spot

Symptoms

Infection

Conidia on dead tissues in canopy and orchard floor

Airborne

Young leaves, fruit, and stems
Recommended timing of fungicide applications to control Alternaria brown spot on Florida citrus.
Alternaria Brown Spot Management

Recommended Chemical Control for Alternaria Brown Spot

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Foot Rot

(Phytophthora nicotianae)
Foot Rot
*(Phytophthora nicotianae)*

- Lesions on tree trunk usually on the bark at or just above the budunion on susceptible scions
- Lesions first appear as a drop of gum on the surface of the bark
- Brown, discolored, necrotic, slippery areas will be found under the bark
- Lesions can eventually girdle the entire tree trunk
- Can occur when bark is damaged with tools as this allows easy entry of the disease into the tree
- Planting at proper height in soil minimizes problem
Life Cycle of Foot Rot

Disease cycles of Phytophthora diseases affecting the roots, bark, and fruit of citrus trees.
### Foot Rot and Root Rot Management

**Recommended Chemical Control for Foot Rot and Root Rot**

<table>
<thead>
<tr>
<th>Pesticide</th>
<th>Rate/Acre</th>
<th>Method of Application</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper-Wettable Powder</td>
<td>0.5 lb (metallic) Cu gal water</td>
<td>Trunk paint</td>
<td>Protectant</td>
</tr>
<tr>
<td>Copper-Count-N</td>
<td>1 qt in 3 qt water</td>
<td>Trunk paint</td>
<td>Protectant. Do not apply to green bark; may cause gumming.</td>
</tr>
</tbody>
</table>
Brown Rot on Fruit  
(*Phytophthora* species)
Brown Rot on Fruit

- Infected fruit exhibit a light brown, leathery decay
- Has a characteristic pungent, rancid odor
- Fruit may become infected via soil contact, splash dispersal with soil particles or fruit-to-fruit spread by windblown rain
- Infected fruit fall from tree
- Greater problem in late summer (Aug.-Sept.) if conditions are wet
- Early varieties more susceptible than late maturing varieties
# Brown Rot on Fruit Management

Recommended Chemical Control for Brown Rot on Fruit

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- **Pesticide**: Copper fungicide
- **Rate/Acre**: Use label rate.
Citrus Canker

(*Xanthomonas citri* subsp. *citri*)
Citrus Canker
(Xanthomonas citri subsp. citri)
Citrus Canker

- Lesions are produced on young fruit and leaves of citrus
- Bacteria are produced under moist conditions and dispersed by windblown rains
- Bacteria enters leaf stomates or wounds on leaves, twigs or fruit
- No chemical control
- Can use copper to suppress disease
Citrus Greening
Huanglongbing (HLB)

Greening has been found statewide.
Citrus Black Spot

- Caused by one fungal pathogen with two names
  - *Guignardia citricarpa* (sexual)
  - *Phyllosticta citricarpa* (asexual)

- Affects all citrus varieties
  - Sweet oranges, grapefruit and lemons are highly susceptible

- Fungus spreads in warm wet conditions in the presence of susceptible fruit when inoculum is present
Life Cycle of Citrus Black Spot

• Primary inoculum is from leaf litter
• Spores are ejected when leaf litter is wet
• Spores move with wind current
Citrus Black Spot-Fruit Symptoms

- Symptomatic fruit is not acceptable in fresh markets
- Lower fruit often have more symptoms
- Does not cause internal decay
- Symptoms will most likely appear about a month before harvest on sunny side of tree
- Four symptom types: hard spot, cracked spot, false melanose and virulent spot
These photos are from an article by

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Available as EDIS document number CH159 or as Horticultural Sciences Fact Sheet HS-798.

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Citrus Mites
Citrus Rust Mite  
(*Phyllocoptruta oleivora*)

Sun spot resulting from where citrus rust mite avoids feeding on most sun exposed portion of the fruit
Citrus Rust Mites

- Damages epidermal cells of leaves and fruit using piercing-sucking mouthparts.
- Elongated, wedge-shaped body.
- Magnification is required.
- Color ranges from light yellow to straw.
- Peak populations usually occur during June and July.
Citrus Rust Mite Damage to Fruit

Bronzing
(summer or fall injury)

Sharkskin
(spring injury)
Citrus Rust Mite Damage to Fruit

- Extensive CRM feeding on fruit surface will result in surface blemishes, lower external grade, reduce fruit size and increase fruit drop.
- When fruit is injured in summer or fall, the injured surface is smooth and dark in color, “bronzing.”
- When fruit is injured in the spring, damage is lighter in color than later damage, “sharkskin.”
Citrus rust mite curve showing population density by month for a typical year.
## Citrus Rust Mite on Fruit Management

### Recommended Chemical Controls for Citrus Rust Mite

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<tr>
<th>Pesticide</th>
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<td>Petroleum Oil 97+% (FC 435-66, FC 455-88 or FC 470)</td>
<td>Does not control citrus snow scale. Do not apply if trees are wilting or in a near wilt state. Do not apply within 3 weeks of sulfur. Some early maturing specialty fruit varieties may experience degreening problems with fall applied petroleum oil. Can be tank-mixed with any recommended mite material except where prohibited under the comment section. Do not apply when temperatures exceed 94°F.</td>
<td>Scale, whitefly, spider mites, greasy spot, sooty mold.</td>
</tr>
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Citrus Red Mite
(Panonychus citri) (McGregor)
Citrus Red Mite

- Deep red to reddish purple in color
- About 0.5 mm long, white setae (hairs) arising from dorsal body surface
- Adult male has long legs, tapering abdomen and is smaller than the female
- Round, red eggs have a vertical stalk projecting upward with webbing often between the stalk and leaf surface
Citrus Red Mite Damaged Leaf
Citrus Red Mite Damaged Leaf

- Feed on leaves, green twigs and fruit using piercing-sucking mouthparts
- Visible injury is characterized by light colored, scratched (etched) areas which giving upper leaf surface a silvery appearance
- Mite feeding and environmental stress can lead to mesophyll collapse and leaf abscission
- Fruit damage by citrus red mite is rarely seen
Texas Citrus Mite
(*Eutetranychus banksi*) (McGregor)
Texas Citrus Mite

- About 0.5 mm long with males more slender than females
- Tan to brownish green with dark green to black spots on upper side of body
- Adults and nymphal mites have eight legs and the larval stage has only six legs
- Prefers the upper leaf surface with eggs primarily along midrib and lateral veins
- Highest number in spring when humidity conditions are low
Six-Spotted Mite
Eotetranychus sexmaculatus (Riley)
Six-Spotted Mite

- Pale yellow, oval, 0.35 mm long, with one to three pairs of dark spots on the upper surface of the body
- Long setae are visible on the dorsal surface of the mite
- Found mostly along the petiole, midrib, or lateral veins on the lower leaf surface usually in dense colonies covered with webbing
- Eggs are round and light yellow, with a short stalk or mask extending vertically
Six-Spotted Mite
Damage to Leaf Surface

[Image of leaves showing damage]
Six-Spotted Mite
Damage to Leaf Surface

- Highest population commonly found in early spring
- Prefer the underside of the leaf, producing extensive webbing
- Usually damage is first observed on lower canopy leaves between March and May
- Feeding causes discoloration of leaf surface in response to cell damage which collapses inward causing the leaf to bulge upward
- Extensive feeding can induce defoliation
## Six-Spotted Mite
### Recommended Chemical Control

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<td>Citrus rust mite, whitefly, sooty mold</td>
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</table>
These photos are from an article by

S. H. Futch¹, C. C. Childers² and C. W. McCoy²
University of Florida,
Citrus REC, Lake Alfred, Florida

Available as EDIS document number CH179 or
Horticultural Sciences Fact Sheet HS-806.

¹Multi-County Citrus Agent
²Professor of Entomology
A Guide to Scale Insect Identification
Citrus Snow Scale
*Unaspis citri* (Comstock)
Citrus Snow Scale

• Adult female is 1.5 – 2.25 mm long
• Female armor is shaped like an oyster shell, brownish purple to black
• Immature male scale armor is white with parallel sides and three longitudinal sections, one central and two marginal ridges
• Adult male is winged and light yellow
• Primarily attack the trunk and large limbs, but can be found on leaves, twigs, and fruit
Florida Red Scale

*Chrysomphalus aonidum* (L.)

Florida red scale; larger scales contain parasite emergence holes

Florida red scale on fruit
Florida Red Scale

• Has circular armor made up of three concentric rings
• Dark reddish brown with a conspicuous light brown center
• Adult male is gnat-like and free flying
• Under biological control
Caribbean Black Scale
*Saissetia neglecta* DeLotto
Caribbean Black Scale

- Female is 3-5 mm long and brown to black in color
- Ridges along outer scale body form an ‘H’
- Adult males are free flying
- Crawlers are 0.34 mm long and light brown
- Found on young fruit, stems, and twigs
- Scales secrete prolific amounts of honeydew which support the growth of sooty mold
- Usually under biological control
## Scale Insects

### Recommended Chemical Controls

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<th>Other Pests Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malathion 5 EC</td>
<td>Glover and yellow scale. Does not control chaff or black scale.</td>
<td>Plant bugs, crickets</td>
</tr>
<tr>
<td>Petroleum Oil 97+%</td>
<td>Does not control citrus snow scale. Do not apply if trees are wilting or in a near wilt state. Do not apply within 3 weeks of sulfur. Some early maturing specialty fruit varieties may experience degreening problems with fall applied petroleum oil. Can be tank mixed with any recommended mite material except where prohibited under the comment section. Do not apply when temperatures exceed 94°F.</td>
<td>Citrus rust mites, whitefly, greasy spot, sooty mold</td>
</tr>
<tr>
<td>Sevin 80 S</td>
<td>May increase citrus red mite and Texas citrus mite populations. Do not exceed 20 lb a.i./acre/year for all uses.</td>
<td>Adult root weevils, orangedog, crickets, katydids, grasshoppers</td>
</tr>
<tr>
<td>Sevin 4 F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sevin XLR</td>
<td></td>
<td></td>
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</table>
These photos are from an article by

S. H. Futch¹, C. W. McCoy² and C. C. Childers²
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Available as EDIS document number CH195 or as Horticultural Sciences Fact Sheet HS-817.

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Identification of Insect Pests
Eastern Lubber Grasshopper
Romalea microptera (Beauy)
Eastern Lubber Grasshopper

- Native grasshopper
- Adult is brilliant yellow with red and black markings, approximately 2 inches long
- Nymphs are solid black
- Female lays eggs in soil in generally wet areas or in woodland areas
- Can defoliate young citrus trees
Southern Green Stinkbug

*Nezara viridula* (L.)
Southern Green Stinkbug

- Bright green with broadly oval, shield-shaped body
- Approximately 1 inch long
- Damage to fruit is by piercing-sucking mouthparts
- When peel is damaged, a discolored and dry area often appears in the flesh below the damaged area
Orangedog

*Papilio creshones* (Cramer)
Orangedog

- Larval stage feed on young foliage causing extensive damage and defoliation
- Larval stage is brown and white caterpillar that resembles bird droppings
- Approximately 1-2 inches in length
- Adult stage is the swallowtail butterfly
Citrus Leafminer

*Phyllocnistis citrella* (Stainton)
Citrus Leafminer

- Adults are minute moths, with $\frac{1}{4}$-inch wingspread
- Females lay eggs in evening or early morning on young foliage
- Larvae are translucent greenish
- Upon larva entering the leaf, they begin to feed producing a serpentine larval mine
- Damage results in leaf distortion, leaf drop, and possible stem dieback
These photos are from an article by

S. H. Futch¹, C. W. McCoy² and C. C. Childers²
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Available as EDIS document number HS142 or as Horticultural Sciences Fact Sheet HS-893.

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Identification of Soft-Bodied Insects (Homoptera)
Sooty Mold

- Dense, black fungus that grows on the honeydew secreted by insects like aphids, scales, whiteflies and mealybugs
- Found on leaves, stem, and fruit
Aphids

• Produce live young asexually allowing for rapid population increases
• Infest newly expanding citrus terminals, sucking sap from the growing leaves and stems
• Does not produce significant damage to mature trees but can damage young trees
• Honeydew is excreted by aphids stimulating the growth of sooty mold that may reduce photosynthesis
• Under biological control by ladybeetles, hoverflies, and lacewings
• Populations usually decline under high summer temperatures and during periods that lack new flushes
Brown Citrus Aphid
Toxoptera citricida (Kirkaldy)
Aphid Damaged Twig
Brown Citrus Aphid

- The most abundant aphid in Florida citrus and a vector of citrus tristeza virus (CTV)
- Feeds only on citrus and related species
- Large colonies form on new flushes where they deposit large amounts of honeydew that stimulates the growth of sooty mold
- Growing terminals may be stunted by high populations
- Glossy black appearance with dark body fluid when squeezed
Spirea or Green Citrus Aphid

*Aphis spiraecola* (Patch)
Spirea or Green Citrus Aphid

• Spirea aphid is quite small and matches the color of new flushes of citrus leaves
• Can feed on a wide host range including citrus
• A weak vector of CTV
• Its feeding causes permanent damage to growing citrus terminals
• Injury is characterized by shortening of internodes, cupping and twisting of leaves
Asian Citrus Psylla
\textit{Diaphorina citri} (Kuwayama)
Asian Citrus Psylla

• Primary vector of citrus greening disease
• Adult psylla are sexual and can survive for extended periods of time feeding on mature leaves and forego reproduction until new leaves are available
• Eggs are laid only on new flushes
• Juvenile psylla deform flush terminals, causing a distinctive pinching and twisting of leaves
• Honeydew is waxy and viscous, forming curly white strands producing less sooty mold than aphids
Citrus Whitefly
*Dialeurodes citri* (Ashmead)
Citrus Whitefly Nymph
Citrus Whitefly

- Adults are about 1-2 mm long, moth-like with males smaller than females.
- Wings are covered with a white waxy powder, abdomen is yellow.
- Eggs laid primarily on the underside of the leaf, yellow in color and on stalks.
- Populations increase on spring and summer leaf flushes.
- Whiteflies produce honeydew which supports the growth of sooty mold.
- Attacked by fungal pathogens and various wasps.
Aschersonia Fungi

• Infests whitefly nymphs, producing a red or yellow raised growth in and over the nymphs
• As the fungi ages, the colors will fade
• Friendly fungi
Citrus Mealybug

*Planococcus citri* (Risso)
Citrus Mealybug

*Planococcus citri* (Risso)

- White with a segmented body which is covered by a powdery wax covering
- Underneath the covering is a yellowish, oval soft body
- Wax covering will increase with age.
- Adult female is approximately 3 mm in length and will produce 300-600 eggs
- Nymphs are light yellow to cream
- Common in the spring and early summer and are found in sheltered location within the citrus tree
- Produce large amounts of honeydew
These photos are from an article by

S. H. Futch¹, C. W. McCoy², J. P. Michaud² and C. W. Childers²
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Citrus REC, Lake Alfred, Florida

Available as EDIS document number HS133 or as Horticultural Sciences Fact Sheet HS-870.

¹Multi-County Citrus Agent
²Professor of Entomology
A Guide to Soil Insect Pests Identification
Citrus Root Weevils

Weevils are, left to right: Diaprepes, southern citrus root weevil, northern citrus root weevil, Fuller rose beetle and little leaf notcher
• Most common species from left to right:
  • Diaprepes, *Diaprepes abbreviatus* (L.)
  • Southern citrus root weevil, *Pachnaeus litus* (Germar)
  • Northern citrus root weevil, *Pachnaeus opalus* (Olivier)
  • Fuller rose beetle, *Asynonychus godmani* (Crotch)
  • Little leaf notcher, *Artipus floridanus* (Horn)
Weevil Larva with Neonates
Weevil Larva and Neonates

- All weevils have similar life cycle
- The immature stages are egg, larva and pupa
- After hatching, the larvae enter the soil to feed on roots
- The adults weevils emerge from the soil, feed on foliage
Diaprepes Larvae Feeding

Root system damaged by Diaprepes larvae feeding
Diaprepes Larvae Feeding Root System Damage

• Large larvae cause damage by channeling the outer root bark tissue including the cambium layer, or by girdling a root, thereby causing root death
• Feeding damage by older larvae may be seen on major lateral roots and in crown region when tree is removed from the soil
Diaprepes Adult Feeding
Damaged Leaves
Diaprepes Adult Feeding
Damaged Leaves

- Adults feed on the margins of newly emerged leaves, producing a notched margin to the leaf
- Notching patterns will vary with species and can be confused with grasshopper injury
- Adults are semi-nocturnal; they can be found in the early morning or late afternoon on the outer foliage
- When disturbed, they fall from the branch to the ground and fake death
Subterranean Termite

Reticulitermes flavipes (Kollar)
Subterranean Termite

• Usually do not feed on living plants and can be found on dead and decaying woody plant material
• Subterranean termites are 0.20 inch in length, white to yellow in color
• They are similar to ants in appearance
Termite Damage to Tree
Termite Damage to Tree

• When food supply becomes limited, termites may feed on bark of the live tree trunk in a ring between the soil line and crown roots, causing girdling and possible tree death
• Feeding may advance above the soil line
• If termites are found, check other areas as a possible host site
Red Imported Fire Ant
*Solenopsis invicta* (Fabricus)
Red Imported Fire Ant

- Fire ants are reddish-brown to black in color and 0.13-0.25 inch long
- Fire ant colonies may contain upwards of 250,000 individuals in mound measuring 3-12 inches high and up to 3 feet in diameter
Fire Ant Damage

Fire ant damage to young citrus tree
Fire Ant Damage
to Young Citrus Tree

- Ants may feed on bark and tender new flush
- Once feeding occurs on the bark, the tree can be girdled or wound opened, which allow pathogens to enter the tree with possible tree death to follow
These photos are from an article by

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Available as EDIS document number HS130 or as Horticultural Sciences Fact Sheet HS-868.

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A Guide to Citrus Nutritional Deficiencies and Toxicities
Nitrogen Deficiency

Normal

Nitrogen Deficiency
Nitrogen Deficiency

- Deficiency is expressed by light green to yellow foliage over entire tree in absence of any distinctive leaf patterns
- As deficiency progresses leaves become lighter in color
- Nitrogen deficiency will limit tree growth and fruit production
- Excessive nitrogen produces excessive vegetative growth at the expense of fruit production, reducing fruit quality
Nitrogen Deficiency

Aging, senescing leaves
Nitrogen Deficiency on Aging, Senescing Leaves

• Nitrogen deficiency is associated with senescing foliage, which can develop a yellow-bronze appearance prior to leaf abscission
Yellow Vein Chlorosis
Yellow Vein Chlorosis

- With yellow vein chlorosis, the midribs and lateral veins turn yellow while the rest of the leaf remains a normal green
- This chlorosis is frequently attributed to girdling of individual branches or tree trunk
- May also occur with the onset of cooler weather in the fall and winter due to reduced nitrogen uptake by the plant from the soil
Potassium Deficiency

3 levels of potassium deficiency with the smallest fruit being the most deficient
Potassium Deficiency

- Fruit are smaller, have smoother, thinner rinds and may be subject to splitting and/or fruit drop
- Potassium deficiency is likely to occur on calcareous soils due to elemental antagonism
- Easily corrected by soil applications except in areas of extremely high soil pH
Magnesium Deficiency
Magnesium Deficiency

- First symptom is a yellowish green blotch near the base of the leaf between the midrib and the outer edge
- The yellow area enlarges until the only green remaining is at the tip and base of the leaf as an inverted V-shaped area on the midrib
- Dolomite will correct mild foliage symptoms in soils with low to neutral pH
- Magnesium deficiency occurring in calcareous soils may have to be corrected with foliar sprays
Manganese Deficiency
Manganese Deficiency

- Deficiency appears as dark green bands along the midrib and main veins surrounded by light green interveinal areas giving a mottled appearance
- As severity increases, the light green interveinal areas give way to a yellow-bronze coloration
- Deficiency occurs on calcareous soils
- Soil and foliar application may be effective in correction of manganese deficiency
Zinc Deficiency
Zinc Deficiency

- Early stages appear as small blotches of yellow between green veins on the leaf
- With severe deficiency, leaves may become increasingly yellow except for the green veinal areas
- Under severe conditions, leaves will also be small with narrow pointed tips on terminal growth
- Foliar fertilizer applications are usually recommended for correcting zinc deficiency
- Trees with citrus blight also show leaf zinc deficiency
Iron Deficiency
Iron Deficiency

- In mild cases, leaf veins are slightly darker green than interveinal areas with symptoms appearing first on new foliage
- In severe cases, interveinal areas become increasingly yellow with the entire area eventually becoming ivory in color
- Usually a greater problem on calcareous soils
- Trees which have been flood damaged will also show iron deficiency
Copper Deficiency
(Ammoniation)
Copper Deficiency

- Mild copper deficiency is usually associated with large, dark green leaves on long soft angular shoots.
- Twigs can develop blister-like pockets of clear gum at nodes.
- As twigs mature, reddish brown eruptions may occur in the outer portion of the wood.
- Severely affected twigs commonly die back from the tip with new growth appearing as multiple buds.
Copper Deficiency

Copper deficiency showing gum pocket at node
Copper Toxicity

- Feeder roots may become darkened, and show restricted growth
- When extractable copper exceeds 100 pounds per acre, trees begin to decline
- High copper levels may be ameliorated by liming to pH 6.5
- Swingle citrumelo is known to be quite susceptible to high soil copper
Boron Deficiency
Boron Deficiency

- Fruit symptoms most indicative of boron deficiency include darkish-colored spots in the white albedo (white portion of the peel) of fruit and sometimes the central core
- Fruit may be somewhat misshapen with lumpy surface
- Slight excess can cause toxicity
- Can be corrected by soil or foliar applications, but not both
Salt Injury
Salt Injury

- Chloride toxicity, consisting of burned necrotic or dry appearing edges of leaves
- Many salinity-induced symptoms are similar to drought stress symptoms, including root growth, decreased flowering, smaller leaf size and impaired leaf growth
- Excessive fertilizer applications, highly saline irrigation water, and storm-driven ocean sprays can all result in salinity-induced phytotoxic symptoms
These figures are from an article by

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Available as EDIS document number CH142 or
as Horticultural Sciences Fact Sheet HS-797.

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Identification of Fruit Varieties
Citrus Varieties

• Oranges
  – Navel
  – Red Navel
  – Hamlin
  – Pineapple
  – Valencia

• Grapefruit
  – Duncan
  – Marsh
  – Mixed red varieties

• Tangerines & Hybrids
  – Satsuma
  – Fallglo
  – Sunburst
  – Dancy
  – Temple
  – Orlando
  – Minneola
  – Murcott
Naval Orange

- Seeds per fruit: seedless
- Average diameter: 3-3.5 inches
- Appearance of secondary fruit (navel)
- Use: fresh
Cara Cara Red Navel Orange

- **Season:** Oct. - Jan.
- **Seeds per fruit:** 0-6
- **Average diameter:** 3-3.5 inches
- **Appearance of secondary fruit (navel)**
- **Use:** fresh
Hamlin Orange

- Seeds per fruit: 0-6
- Average diameter: 2.75-3 inches
- Peel texture: somewhat smooth
- Use: fresh and processing
Pineapple Orange

- Seeds per fruit: 15-25
- Average diameter: 2.75-3 inches
- Peel texture: somewhat coarse
- Use: fresh and processing
Valencia Orange

- Season: Mar. - June
- Seeds per fruit: 0-6
- Average diameter: 2.75-3 inches
- Peel texture: somewhat coarse
- Use: fresh and processing
Duncan Grapefruit

- Season: Dec. - May
- Seeds per fruit: 30-70
- Average diameter: 3.5-5 inches
- Use: fresh and processing, popular for sectionizing
- Disadvantage: seed number
Marsh Grapefruit

- Season: Nov. - May
- Seeds per fruit: 0-6
- Average diameter: 3.5-4.5 inches
- Use: fresh and processing
Citrus Varieties
Tangerines and Tangerine Hybrids-Satsuma

• Season: Sept. - Nov.
• Seeds per fruit: 0-6
• Average diameter: 2.25-2.5 inches
• Use: fresh and processing
• The tree is more cold hardy than most citrus varieties
• Fruit quality is dependent on cool fall and winter temperatures.
Tangerines and Tangerine Hybrids-Fallglo

- Seeds: 20-40
- Size: 2.75-3.25 inch in diameter
- Use: fresh
- Comment: does not store well on tree, does not require cross-pollination
Tangerines and Tangerine Hybrids-Sunburst

- Season: Nov. - Dec.
- Seeds: 1-20
- Size: 2.5-3 inches in diameter
- Use: fresh
- Comments: self-incompatible and must be cross-pollinated, green internal seed color
Tangerines and Tangerine Hybrids-Dancy

- Seeds: 6-20
- Size: 2.5-3 inches in diameter
- Use: fresh
- Comments: older tangerine variety, easy to peel
Tangerines and Tangerine Hybrids-Temple

- Season: Jan. - March
- Seeds: 15-20
- Size: 2.75-3 inches in diameter
- Use: fresh or juice
- Comments: more cold tender tangerine hybrids, susceptible to scab, does not require cross-pollination
Tangerines and Tangerine Hybrids-Orlando

• Season: Nov. - Jan.
• Seeds: 0-35
• Size: 2.75-3 inches in diameter
• Use: fresh
• Comments: requires cross-pollination, requires higher N levels, susceptible to Alternaria and scab
Tangerines and Tangerine Hybrids-Minneola (Honeybell)

- Seeds: 0-12 depending on cross pollination
- Size: 3-3.5 inches in diameter
- Use: fresh
- Comments: requires cross-pollination, susceptible to scab and particularly Alternaria brown spot
Tangerines and Tangerine Hybrids-Murcott (Honey Tangerine)

- Season: Jan. - March
- Seeds: 10-20
- Size: 2.75 inches in diameter
- Use: fresh
- Comments: use Cleopatra mandarin as rootstock, susceptible to scab and Alternaria brown spot
Miscellaneous Citrus Problems
Sunburned Fruit

- Exposure to sun can cause damage to some varieties, esp. Murcott, Ambersweet
Sunburned Leaves

- When the underside of the leaf is exposed to direct sunlight, it can be damaged
- Brown gum spots are irregular in shape and have a hard, smooth, raised surface
Lichens

• Lichens may occur on the trunk, branches, and twigs of the tree
• Usually on old or neglected trees
• Does not harm the tree
• Color varies, but gray-green is the most common
Chimera

• A genetic mutation that occurs on a twig, branch, or fruit
• Can differ in color, texture or shape
• Generally, mutations are of inferior quality
Bird/Thorn Puncture

- May have single to multiple puncture sites that vary in depth and size
- In severe cases, the fruit may fall from the tree before reaching maturity
Glyphosate Injury
Roundup and other brands

• Results from the material being absorbed and translocated by the green tissue
• New growth after application will appear as small, narrow, strap-shaped leaves
• Multiple bud growth may also appear
Fertilization of Citrus
## Suggested Fertilization Schedule

<table>
<thead>
<tr>
<th>Tree Age</th>
<th>Lbs N/tree/yr</th>
<th>Lbs Fertilizer/tree/yr</th>
<th>Applications/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>6-6-6</td>
<td>8-8-8</td>
</tr>
<tr>
<td>1</td>
<td>0.15-0.30</td>
<td>2.5-5.0</td>
<td>1.8-3.8</td>
</tr>
<tr>
<td>2</td>
<td>0.30-0.60</td>
<td>5.0-10.0</td>
<td>3.8-7.5</td>
</tr>
<tr>
<td>3</td>
<td>0.45-0.90</td>
<td>8.0-15.0</td>
<td>5.6-11.3</td>
</tr>
<tr>
<td>4</td>
<td>0.80-1.0</td>
<td>13.0-17.0</td>
<td>10.0-12.5</td>
</tr>
<tr>
<td>5+</td>
<td>1.1-1.4</td>
<td>18.0-23.0</td>
<td>13.8-17.5</td>
</tr>
</tbody>
</table>

Tree age = years planted, with year 1 beginning right after planting.
Do not use a fertilizer with higher than an 8-8-8 analysis on young trees during years 1-3.
When to Fertilize

- Young trees
  - Apply at 6-week intervals
  - Fertilizer should be applied beginning in
    - Late February-early March
    - Ending in late September
When to Fertilize

• Mature trees
  – Apply 3 applications per year
    • Late February-early March
    • Mid May
    • Mid-late September
  – Avoid applications during summer rainy months due to potential leaching
How to Apply Fertilizer

• Young trees
  – Apply fertilizer uniformly in a 3-foot diameter circle around the tree

• Mature trees
  – As the tree becomes older, increase area covered with fertilizer
  – Fertilize an area twice the diameter of the tree canopy

• Do not apply against the tree trunk
Soil pH

• Adjust soil pH up to approximately 6.0-6.5
  – Materials for pH adjustment include
    • Dolomite
    • High calcium lime
• For high pH soils, > 7.0-7.5
  – Very difficult to reduce soil pH
  – Many micro nutrients may need to be applied to the foliage of the tree
Questions?