Management Options For Fresh Fruit in the Presence of Citrus Canker

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Canker is a leaf, fruit and stem spotting disease caused by *Xanthomonas citri*
Dissemination of *Xanthomonas citri* subsp. *citri*
Bacteria exuding from a stomatal opening

5 days after infection

Cubero et al, 2004
Copper film does not protect entry points when the rain droplets exceed 18 mph.
Stomatal infections of grapefruit leaves and fruit
Site conditions that promote canker are open areas with no natural windbreaks.
Canker–induced fruit drop in Hamlin oranges is difficult to manage due to wind exposure.
Feeding by Asian citrus leafminer increases infection and multiplies inoculum for spread.

Lesions develop after mining, insect is not a vector.

Cuticle lifted by leafminer feeding.
Observations of canker susceptibility in Florida and South America
Host susceptibility & market destination

- **Highly susceptible** – grapefruit, lemons and limes, some early oranges including Navel

- **Susceptible** – Hamlins, tangelos

- **More tolerant** – tangerines, Satsuma mandarin

- Fresh (fruit blemish) vs Processing (fruit drop)
Early varieties for better juice color more susceptible than Hamlin!
Highly Susceptible Early Season Oranges

Pineapple

Navel
Mid & Late season varieties are less susceptible

Valencia

Midsweet
Mandarin hybrids are variable in susceptibility.

Sunburst

Mineola tangelo
Mandarins are least susceptible

Tankan

Miyagawa Satsuma
Vigorously flushing trees with leafminer damage are highly susceptible to infection.
Lesions on last season fruit and current season differ greatly in size depending on the time of infection during maturation.

- **Last Season fruit**
  - Lesions are large
  - Causes Fruit drop

- **Early Season inf**
  - Causes Fruit drop

- **Late Season inf**
  - No fruit drop
Early infection of Valencia fruit due to wind exposure causes premature fruit drop.
Cu sprays at 21 day interval protect fruit from \( \frac{1}{4} \) to 1.5 inch
Spray volume, tractor speed important for proper coverage.
Cu residue on fruit is depleted by 21 days due to fruit growth, and is relatively unaffected by rainfall (Cu film is stable!)
Valencias in same grove with no canker-induced drop

Hamlin with severe early season fruit infection and drop due to a missed copper spray during rains in March-April (50% crop loss)
Importance of Early Season Copper Sprays for Protection of Hamlin Orange Fruit Against Citrus Canker

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Fruit susceptibility to canker

- Fruit most susceptible 1/4 to 1.5 inch diameter
- Rains in March, April, May promote early season infection
- The rind is susceptible throughout the entire period of fruit growth
- Rind much more resistant when fruit > 1.5 inch diameter
Objectives

- Evaluate timing of copper sprays in relation to early season rains for control of fruit infection and drop in young fruiting Hamlins in a south central Florida citrus grove
- Compare soluble and fixed copper formulations for efficacy
Spray trial parameters

- 3-5 yr-old Hamlin (358 trees per ha)
- RBD with 5 blocks of 5 trees
- Airblast sprays at 21 day interval
- Disease evaluation: incidence of fruit with canker lesions
- Lesions classified as “old” if > ¼ in. diam. “young” if < ¼ in. diam.
- Periodic collection of fruit from middle 3 trees to count fruit drop due to canker 2-5 x per season
In 2011, 9 sprays from 15 April (too late) ended 27 Sept failed to reduce impact of early infection.
In 2014 April-May marked by the absence of rain events: low disease and fruit drop

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<thead>
<tr>
<th>Treatment</th>
<th>Fruit lesion incidence</th>
<th>Canker fruit drop</th>
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Fruit lesion incidence

- Old lesions
- New lesions

Canker fruit drop
In 2015, fruit were at the most susceptible stage when rain was higher than normal in April and lower in May.
Early season canker induced fruit drop due to April rains, not inoculum carry over from previous season.
Conclusions

• Inoculum in form of infected leaves and stems from the previous season is always present in the spring

• Early fruit infection resulting in fruit drop depends on coincidence of late March-April rains with the most susceptible fruit stage

• Timing of sprays in advance of rains in late March and early April is critical for protecting fruit

• In June-July, infections of fruit > 1.5 inches result in smaller lesions that do not induce premature drop but may still be of concern for fresh market
Proposed program for canker control of local varieties

• Spray 1.0 lb metallic Cu as copper hydroxide in 100 gal/acre when the spring flush reaches ½ expansion
• At 21 days after this application, when fruitlets reach 1/4 in diam. apply second spray to protect the expanding fruitlets
• For Navels and acid fruits continue Cu sprays at 21 day interval through the end of June
• For Satsumas, assess the canker status on fruit and leaves after the first 2 sprays. Apply additional sprays at 21 day interval to protect fruit as needed