Figure 1. Valencia leaves show early greasy spot symptoms. The yellow areas will eventually regreen, leaving brown oil-appearing lesions if the leaf does not fall off.

Fungal foliar disease concerns for 2019

By Megan Dewdney

The Florida citrus-growing seasons of 2017 and 2018 were quiet in terms of fungal foliar disease outbreaks. Small pockets of severe disease occurred sporadically, but there were no widespread reports of diseases like postbloom fruit drop, much to the relief of the industry. Greasy spot has flared up in a few locations on cultivars like Valencia, and melanose severity is tied to rainfall in the spring.

HLB continues to be the number-one concern on every grower's mind, but foliar fungal diseases can nibble away at productivity by reducing overall tree health. In the case of postbloom fruit drop (PFD), it can eliminate a substantial part of a crop.

GREASY SPOT

Greasy spot and rind blotch, caused by the fungus *Mycosphaerella citri*, affect all Florida citrus. Ascospores, the spores responsible for infection, form in the leaf litter beneath the trees. If greasy spot or rind blotch symptoms were common in the previous year, it is advisable to increase control efforts. Two options to enhance control are to increase the number of gallons per acre to 250 and slow the tractor speed for more thorough wetting of the canopy and/or apply a third spray in August.

If leaf drop was sizable over the winter, an enhanced greasy spot program is advised as more greasy spot inoculum will form. *M. citri* is most vulnerable to chemical control in the early summer because it is in the phase when it grows on the surface of the leaves and fruit. The fungus does not actually infect plant tissues until late summer, and symptoms are most often seen from November to February. Symptoms (Figure 1) develop most rapidly when it is warm. Severe greasy spot outbreaks cause major defoliation on non-treated trees, leading to small, marred fruit and fruit drop.

For greasy spot control, copper remains effective and economical, especially for rind blotch and groves with canker. However, with high temperatures (> 94 F) and dry conditions, copper phytotoxicity can occur on the fruit. When copper is combined with petroleum oil, rind defects can occur during the summer months, which is most problematic for fresh fruit production. Copper is best applied on moderately warm days without any additives, especially petroleum oil, at 2 pounds per acre or less. On processing oranges, where fruit blemishes are not

as important, petroleum oils are a good alternative or additive to copper for controlling greasy spot on leaves.

If phytotoxicity is of particular concern, strobilurin-containing fungicides [Fungicide Resistance Action Committee (FRAC) 11; see Table 1, page 17] or the demethylation inhibitor fungicide Enable (FRAC 3) are also effective control options with or without oil. The strobilurin-containing fungicides are most appropriate in late May to early June because they also control melanose. No more than one application of a strobilurin, alone or in a mixture, should be made within a season to avoid fungicide resistance in *M. citri*. Enable is especially effective for mid- to late-season control of rind blotch, but should not be followed by Quadris Top because of resistance management as they share the same mode of action (Table 1, page 17).

MELANOSE

Diaporthe citri, the melanose-causing fungus, rapidly colonizes and sporulates on small twigs (< 0.25 inch) that die from freeze damage and other causes of shoot dieback, including HLB. The fungus also infects live twigs, which produce spores after twig death. The more dead twigs that are present, the more spores there will be. Hedging will reduce dead wood and lower disease pressure, even though it is impossible to remove all dead twigs.

Previously, groves less than 10 years old have had lower melanose levels since not many dead twigs were present in the canopy. However, a freeze or HLB can cause young blocks to be affected earlier. Fortunately, spore numbers do not remain high from year to year. So if there is not a significant freeze event, melanose inoculum should return to lower levels.

Melanose is not usually severe, unless there are extended leaf wetness periods. Only 10 to 12 hours of leaf wetness are needed for infection if temperatures are between 70 and 80 F. If temperatures are cool, longer leaf wetness periods of up to 24 hours are needed. No spores are produced from leaf and fruit lesions to continue infections and are a dead end for the fungus.

Copper is still the most economical melanose control tool because of the long residual activity, but residues

Table 1. Fungicides with modes of action to aid rotation for resistance management

Fungicide	Mode of Action[a]
Abound (azoxystrobin)*	11
Amistar Top (azoxystrobin + difenoconazole)*	11 + 3
Copper	M01
Enable 2F (fenbuconazole)	3
Ferbam*	M03
Gem 500 SC (trifloxystrobin)	11
Headline SC (pyraclostrobin)*	11
Luna Sensation (trifloxystrobin + fluopyram)	11 + 7
Petroleum oil	—
Priaxor (pyraclostrobin + fluxapyroxad)*	11 + 7
Pristine (pyraclostrobin + boscalid)*	11 + 7

[a] Mode of action class from the Fungicide Resistance Action Committee Code List 2018
* Fungicides recommended for postbloom fruit drop. Ferbam is best mixed with a strobilurin (Mode of Action 11).

decline with fruit expansion and rainfall. The Citrus Copper Application Scheduler (agroclimate.org/tools/citrus-copper-application-scheduler) estimates the copper residue on the fruit surface and improves copper application timing for optimal coverage for better control of melanose and other diseases. Otherwise, copper applications should be made every three weeks to the whole canopy from early May until fruit become resistant in early July. This is especially important for grapefruit, which is the most susceptible to melanose.

With off-season fruit, the timing will be different and it may be difficult to achieve adequate control on these fruit for the fresh market. If copper is applied in early June, it can also serve as the first greasy spot application. In hot weather when copper phytotoxicity is problematic, strobilurin-containing fungicides give good control but should never be used more than twice in a row because of possible development of fungicide resistance (Table 1). The residual activity of strobilurins is not as long as copper, so applications need to be more frequent than every 21 days.

BLACK SPOT

Black spot is still concentrated in Collier and Hendry counties, but the affected area continues to expand. Most citrus cultivars and species are susceptible to the disease. The spore type found in Florida is formed on dead twigs, on certain fruit symptom types, and in the leaf litter where it is present all year. These spores are spread by rain splash similarly to melanose. There is a second spore type that is formed in the leaf litter and spread by wind, but it is not yet found

in Florida. We continue to monitor for the presence of the second spore type. Fruit infection occurs mainly from May to September. However, applications are advised in April if it is a wet month.

Black spot infection requires long wetting periods of at least 18 hours. With the heavy dews that occur in Florida, such prolonged periods are not unusual. There are several fungicides recommended for black spot management. These include the strobilurin fungicides, Enable, copper, and the premixes Amistar Top and Pristine.

If canker is problematic in a grove, the copper applications used for canker control will also control black spot. However, in most late-harvest oranges, especially Valencia, additional applications will be needed for black spot. Any of the non-copper containing fungicides are recommended where phytotoxicity is a concern or where there was severe disease the previous season.

PFD

PFD was a problem from 2014 to 2016, especially on Navel and Valencia, which are the most susceptible cultivars. Hamlin, grapefruit and tangerines are less susceptible to the disease but can still be affected.

There is an 80 percent chance to have another El Niño winter. This means that the risk of PFD is elevated compared to 2017 and 2018. Growers should not be complacent and will need to scout their flowers for the reddish, brown discoloration that is indicative of infection, particularly if there are persistent calyxes from previous years (Figure 2, page 19).

The inoculum stays dormant on the tree surfaces and the fungus, *Colletotrichum acutatum*, is stimulated to grow and produce spores by flower exudates. Off-season or prolonged bloom periods favor the disease and make control more difficult. Many blocks have multiple bloom periods because of HLB, so applications should be concentrated on the bloom that is most likely to provide the major crop.

Fungicide efficacy is greatly improved when well timed. A new PFD forecasting tool released in January 2018 is simple to use and will improve application timing. All recommended

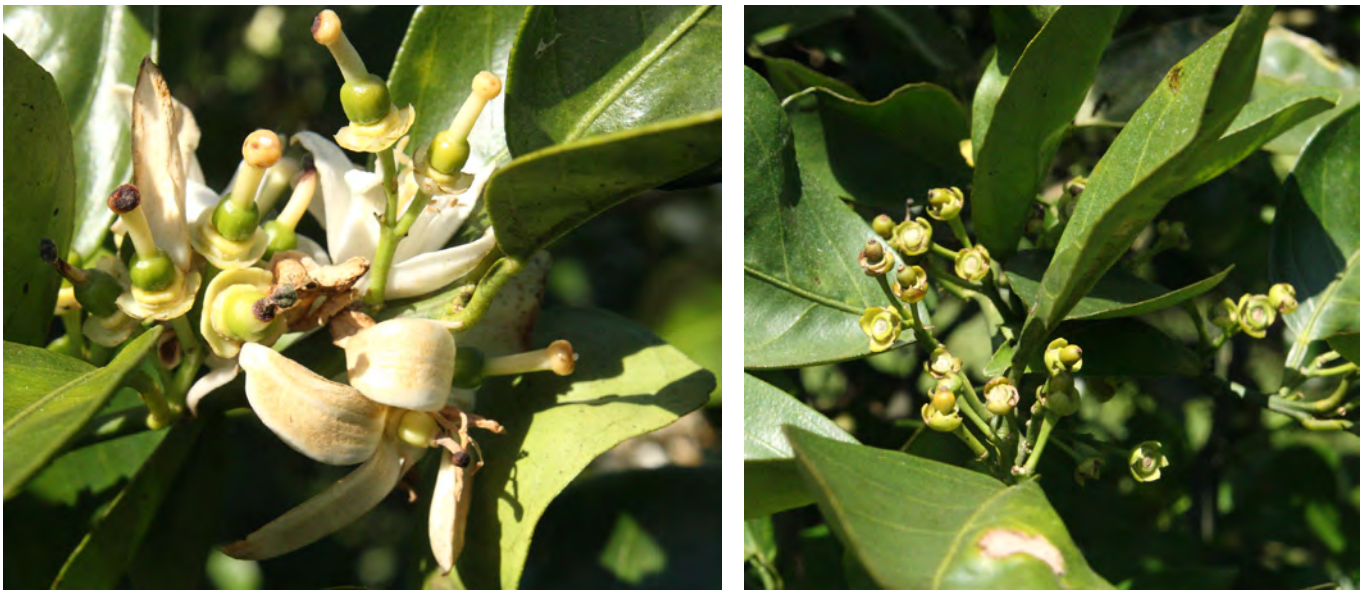

Figure 2. Brown postbloom fruit drop lesions on petals in a flower cluster (left) and buttons (right) have resulted from infection by *Colletotrichum acutatum*.

treatments contain a strobilurin. Strobilurin fungicides, tank mixed with ferbam, are currently the best option (Table 1, page 17). These fungicides have resistance risks, but trials in the last five years have not yielded any further modes of action. Copper is generally considered ineffective.

Further information on the control and biology of foliar fungal diseases is available on the Citrus Research and Education Center website as well as in the Florida Citrus Production Guide (crec.ifas.ufl.edu/extension/pest) and Electronic Data Information Source (edis.ifas.ufl.edu). Assistance is also available from your county agent or statewide specialist.

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