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Postbloom Fruit Drop[1]

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The first occurrence of postbloom fruit drop (PFD) in Florida was in 1983, when the disease was found on Tahiti limes in the southern part of the state. By 1988, PFD was widely observed on sweet oranges and other citrus fruits in southwest Florida, in the southern Ridge area, and on the Indian River. Outbreaks occurred in many areas in subsequent years, especially in 1993 and 1998. Whenever rainfall was widespread during an extended bloom period growers experienced significant losses on many species and varieties throughout the citrus production areas of the state.

The disease was first described in Belize in Central America in 1979. Subsequently, PFD has been reported in many other countries in Central America; in Argentina, Brazil and Mexico; and on many islands in the Caribbean. The disease is now established in many of the humid, citrus-producing areas in the Americas. Production losses vary with the amount of rainfall that occurs during bloom. Some countries have reported complete crop failure during certain years.

Symptoms

The first symptoms of PFD are peach to reddish brown necrotic spots on open petals (Figure 1). Pinhead to half-grown flowers may also be attacked if inoculum levels are high (Figure 2). Necrotic spots on petals often coalesce, producing a blight of the entire inflorescence. Senescent petals on healthy flowers usually are light tan in color or dry from the tip downward (Figure 3), but diseased petals are dark brown to orange and dry first in the areas affected (Figure 4). Affected petals become hard and dry, persisting for several days after the healthy flowers have fallen (Figure 5). After petal fall, the young fruit show a slight yellowish discoloration and usually abscise, leaving the calyx and floral disc intact. These structures are commonly called buttons (Figure 6) and stay green for a year or more and callous tissue begins to form around the abscission zone. Occasionally, young fruit remain attached to the button but never develop. Leaves around buttons are usually small and twisted with enlarged veins.

Disease Cycle

PFD is caused by the fungus *Colletotrichum acutatum*. This species can be separated both morphologically and pathologically from the common *C. gloeosporioides*, which resides saprophytically in all Florida citrus groves. Morphologically, the PFD pathogen is nearly identical to the fungus originally described as

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Figure 1. Postbloom fruit drop lesions on petals of navel orange flowers.

Figure 2. Postbloom fruit drop lesions on flower buds of navel orange.

Figure 3. Senescent petals with no PFD.

Gloeosporium limetticola, which causes anthracnose of Key lime. That species is now also called *C. acutatum*. When sweet orange flowers are inoculated with isolates of the Key lime anthracnose fungus, all the symptoms of PFD are reproduced. However, the PFD isolates from sweet orange cause only mild spotting on Key lime leaves.

Figure 4. Senescent petals affected by PFD.

Figure 5. Postbloom fruit drop affected petals shriveled onto infloresences of navel orange.

Figure 6. Persistent calyces (buttons) on Tahiti lime affected by PFD.

We suspect that PFD may have arisen when the Key lime anthracnose fungus moved into sweet orange groves. The widespread appearances of PFD in many countries may have resulted from movement of the Key lime anthracnose fungus to sweet orange. Alternatively, the PFD pathogen may also have been introduced into some countries by various means.

Asexual spores of *C. acutatum* are produced in abundance on infected petals. These spores are dispersed by rain splashing onto adjacent healthy flowers; they germinate in the presence of moisture in 12 to 24 hours, infect petals in 24 to 48 hours and produce symptoms and new spores in four to five days. Long-distance spread may occur by windblown rain, by bees, or other insects that visit flowers or by plant debris carried on equipment or in picking sacks or boxes.

The fungus survives between blooms on the surface of leaves, twigs, and buttons as appressoria (single-celled, thick-walled structures). The following spring, these structures germinate in the presence of moisture and substances present in flower petals to produce new asexual spores. These spores may then be dispersed to the new flowers by splashing rain.

Losses due to PFD are sometimes overestimated because of the large number of buttons formed. Affected flowers form buttons, regardless of whether they will have set fruit. Thus, the number of fruit lost may represent only a small percentage of the buttons formed. Trees may compensate for PFD losses by shedding less fruit during June drop or by producing larger fruit. When severe disease occurs, however, many pinhead to half-grown flowers are shed without forming buttons. Many tangerines and hybrids tend to form few buttons, even when disease incidence is high.

Losses in Florida have been greatest on navel oranges and Tahiti limes and, to a lesser extent, on Valencia oranges. Hamlin and Pineapple oranges and tangerines have experienced less damage. Grapefruit is rarely affected by PFD.

Disease Management

The increase in incidence of PFD is very high under optimum conditions making the disease difficult to control. Overhead irrigation should be avoided during bloom, if possible, or trees should be irrigated at night and allowed to dry during the day. Trees declining because of blight, tristeza or other factors often flower out of season, thus maintaining high levels of inoculum. Such trees should be removed prior to bloom in PFD-affected blocks.

For fungicides registered for citrus which control PFD see the *Florida Citrus Pest Management Guide*. The number of buttons remaining from the previous year and the presence of disease on early bloom should be used as early indicators of potential PFD problems.

Fungicide application should be initiated at the onset of the first major bloom if conditions warrant. The incidence of PFD is highly dependent on the amount of available inoculum as well as on rainfall. The percentage of flowers that will be affected can be predicted four days in advance using the formula (Equation 1):

$$y = -13.63 + 1.16\sqrt{TD} + 0.48\sqrt{R \times 2500} + 1.77\sqrt{LW \times 5}$$

Equation 1.

Where y = the predicted percentage of flowers affected, TD = the total number of diseased blossoms on recently opened bloom on 20 trees (which represents the inoculum), R = rainfall in inches for the last 5 days, and LW = average number of hours of leaf wetness for the last 5 days-10 hours. If the formula predicts more than 20% infection, a spray is indicated. If not, groves should be checked twice weekly and the formula applied each time. Groves should be checked again about 10 days after a fungicide application.