



# Fruit drop of citrus in summer months

By Tripti Vashisth, Megan Dewdney and Lauren Diepenbrock

**T**his article summarizes what is known about summer fruit drop in healthy citrus trees and those with huanglongbing (HLB). Also discussed is how HLB can affect early fruit development and exacerbate fruit drop. Additionally, strategies to reduce summer fruit drop are included.

Citrus flowers profusely, but less than 2 percent of the flowers become harvestable fruit. In other words, 98 percent of the flowers seen during

bloom will end up on the grove floor at some point during fruit development — either as a flower, fruitlet, young fruit or mature fruit.

Profuse flowering is a strategy observed in many tree crops such as mango, avocado and peach. It allows trees to produce enough fruit to carry forward the seeds. However, excessive flowering and fruit development are highly dependent on tree carbohydrate levels. Often, heavily cropped trees do not produce many flowers the

following season because carbohydrates are depleted and there are insufficient carbohydrate reserves in the trees. This phenomenon leads to alternate bearing.

## **JUNE DROP**

Another way trees adjust crop load to avoid carbohydrate depletion and ensure proper carbohydrate allocation among different organs is to drop fruitlets in summer, commonly referred to as June drop. Interestingly, in Florida, June drop occurs from

late April to May, depending on the weather. June drop occurs in all citrus species, including mandarin and sweet orange. This physiological process of separation of fruit (or other plant organs) is called abscission. Developing fruit require a large amount of carbohydrates to provide energy for growth and development. These developing fruit compete with one another for carbohydrates. Chemical signals in the form of plant hormones in the developing fruit act as cues to the tree to continue carbohydrate export to the fruit. Weak fruit eventually abscise due to carbohydrate starvation, thereby adjusting crop load on the tree.

Since June drop is the natural way trees adjust their crop load, interfering with this process is not recommended. Reducing June drop may result in preharvest fruit drop later because of depleted carbohydrate reserves in trees and can affect next season's crop (which is dependent on carbohydrate reserves in the tree). However, if excessive June drop is a concern, strategies

such as frequent and increased irrigation during dry months (April–June) can be beneficial.

### SUMMER DROP AND SUMMER-FALL DROP

Other types of fruit drop are summer drop and summer-fall drop, which are common for Navel oranges in Florida but can occur in other cultivars, too. Summer drop occurs during June and July when the fruit are about golf ball-size or slightly larger, whereas summer-fall drop of Navels occurs September–October as fruits near maturity.

Like June drop, summer drop and summer-fall drop are primarily induced by physiological rather than pathological factors. In summer drop, the navel (secondary fruit) becomes yellowish, necrotic and

dies, eventually leading to separation from the main fruit. Navel abscission is concomitant with increases in the production of ethylene (a plant hormone responsible for fruit abscission/fruit drop). Production of ethylene at the styler end accelerates peel breakdown, resulting in a halo of yellow-orange color around the navel. Insects and

pathogens can invade the weakened areas of fruit as secondary problems (Figure 1, page 20).

Similarly, summer-fall drop includes splitting, styler-end decay and natural fruit abscission. Styler-end decay is caused by a weakening of the peel

due to formation of abnormal structures underneath. Styler-end decay appears to be induced by physiological and morphological causes. Splitting is also a physiological disorder where

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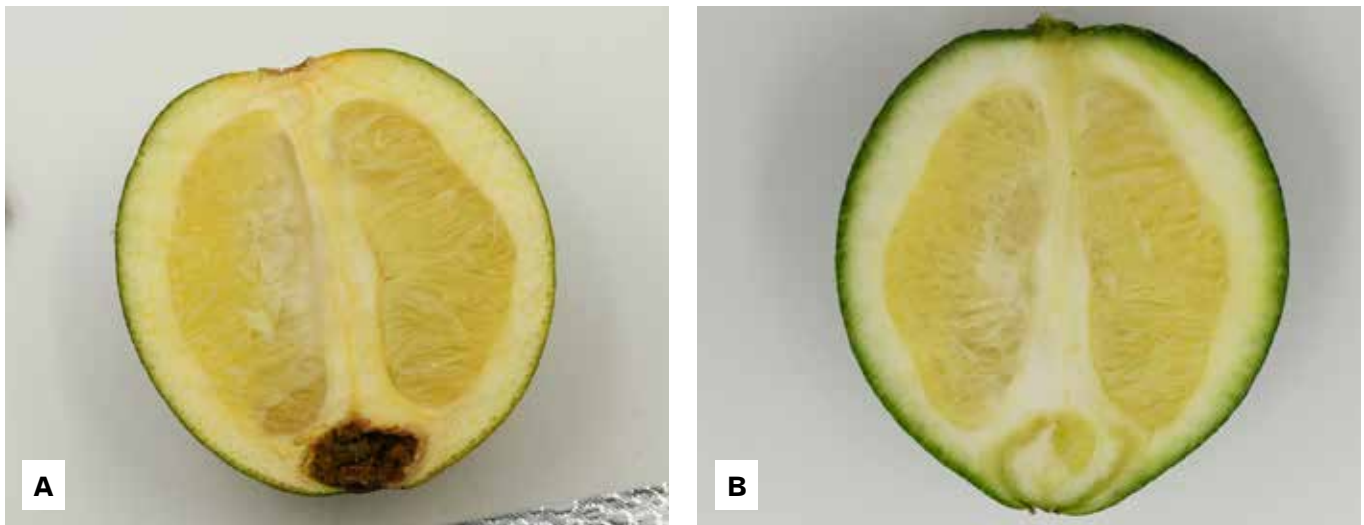
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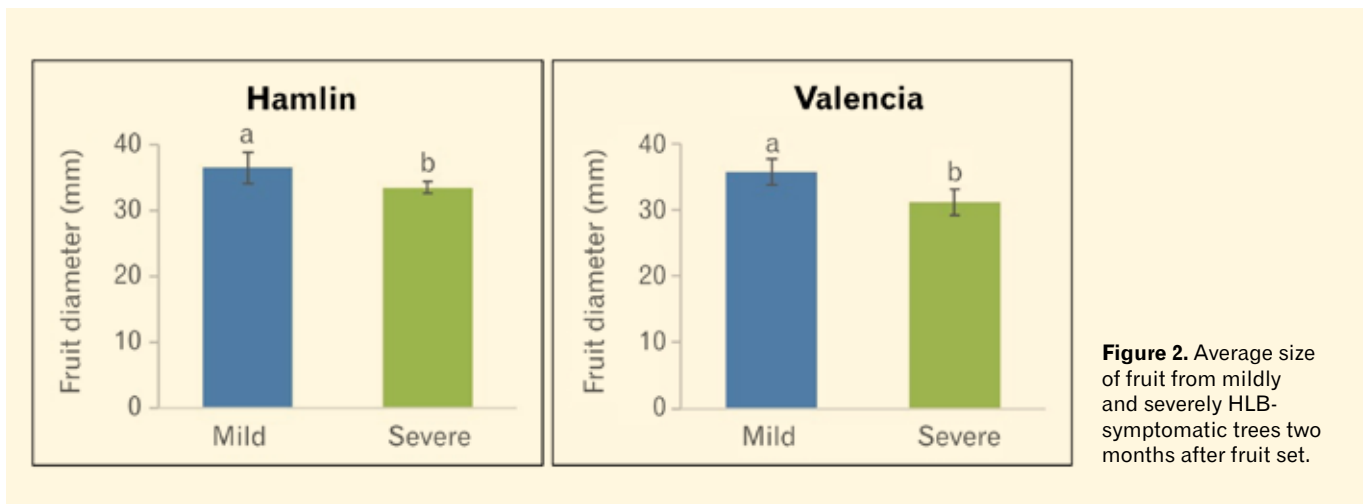
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Sources: Scientists, J. Curtis and M. Edenfield for agronomic data completed from 2014 to 2020

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**Figure 1. A:** Navel fruit with secondary fruitlet death. Note the discolored veins in the center column and the fruit attachment point, an HLB symptom regularly observed in this type of fruit. **B:** Normal Navel fruit with typical development.



**Figure 2.** Average size of fruit from mildly and severely HLB-symptomatic trees two months after fruit set.

uneven peel growth may produce structurally weak areas. Periods of dry weather followed by heavy rains or irrigation cause uneven growth of the fruit and result in splitting. The weakened area then becomes necrotic and is susceptible to secondary invasion by insects (particularly sap beetles) and diseases.

### FUNGI AND INSECTS

Fungi and insects often are blamed for the summer fruit drop or Navel decay. The fungi from the Navel fruit are a combination of organisms that generally do not cause problems until there is a wound or other form of decay. In some cases, the fungi would not be present if they had not been moved to the fruit by insects involved in the decay process.

The most common insects associated with transport of fungi to citrus

fruits are sap beetles. These small beetles are attracted to damaged, stressed or overripe fruit and sap from wounds in trees. To minimize potential damage, sanitation of dropped, decaying fruit is necessary since it serves as a breeding ground for sap beetles. Occasionally, puncture holes from stinkbug or leaf-footed bug feeding can also serve as a point of entry for fungi and other secondary pests.

In summer and summer-fall drop, the ethylene production from the abscising navel or peel breakdown and possible secondary pest/pathogen infestation result in fruit abscission. Summer and summer-fall drop can result in 15 to

25 percent yield loss, which is alarming for growers.

### REDUCING DROP

Navel summer and summer-fall drop may be reduced with the plant growth regulator (PGR) 2,4-dichlorophenoxyacetic acid (2,4-D). It should be applied six to eight weeks after bloom. 2,4-D application reduces secondary fruit abscission and thereby reduces fruit drop. Some

studies reported reduced summer drop when gibberellic acid and 2,4-D were applied in combination. For details on PGR applications, see <https://edis.ifas.ufl.edu/hs1310>.

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If fruit splitting is found to be a major contributor to Navel summer-fall drop, better irrigation management during the fruit development period can be useful. Use of soil moisture sensors and automated irrigation can ensure uniform water availability throughout the fruit-growing period, allowing peel development and expansion to occur uninterrupted.

## HLB AND FRUIT DEVELOPMENT

Several factors contribute to fruit drop in HLB-affected trees. It is well known that HLB disrupts the carbohydrate translocation within trees. Furthermore, compromised root systems of HLB-affected trees limit nutrient and water uptake, affecting fruit development. HLB also disrupts the plant hormone balance within the fruit.

A recent field study found that fruit from severely HLB-symptomatic trees were reduced in size as early as two months after fruit set (Figure 2, page 20) when compared with mildly HLB-symptomatic trees. This suggests early stages of fruit development are affected by HLB.

Based on new HLB work and existing knowledge of summer drop in citrus, it is believed that HLB exacerbates summer drop due to hormonal imbalance as well as limited carbohydrate, nutrient and water supply to the fruit. In recent years, many growers have shown concern about Navel summer drop. Secondary fruit in Navel oranges are a naturally weak fruit. Therefore, under HLB stress, abscission of these fruit very likely increases due to limited resources and translocation within the tree.

Overall, good care of trees along with intensive nutrition and irrigation management throughout the growing season can reduce fruit drop over the summer. In addition, PGRs recommended to reduce summer drop in healthy Navels can be effective for HLB-affected Navel oranges, too. 🍊

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