Oil Spotting (Oleocellosis) of Citrus Fruit

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What Is Oil Spotting?

Oil spotting (Plate 1) is a common peel injury of citrus fruit that is usually caused by mechanical damage. It causes extensive financial loss to growers, shippers, and handlers, not only in Florida, but everywhere in the world, particularly in humid areas or arid areas with heavy dew during harvesting, where citrus fruit are grown for the fresh fruit market.

Oil spotting is also known as oleocellosis, oleo, bruising, green spot, and, erroneously, as “gas burn.” It can occur at any time during harvesting, handling, and marketing, but it usually occurs at or near harvest. Mechanical injury forces the toxic oil out of the oil glands. This oil kills nearby parenchyma, epidermal and subepidermal cells of the flavedo. Citrus peel oil from injured fruit can also cause oil spotting on the surface of adjacent fruit.

Fresh oil spotting is barely visible. With time, the damaged areas will sink and darken, and thus cause the oil glands to become prominent (Plate 2). Symptoms may be seen as the fruit arrive at the packinghouse, but are often not noticed until after degreening or shipment. Cells killed by oil are readily invaded by fungi resulting in increased decay.

Oil spotting is distinct from pitting observed during postharvest storage. Postharvest pitting results from high temperature storage of waxed fruit and typically requires 3 to 7 days after packing to appear. Pitting is characterized by clusters of collapsed oil glands. Cells between the oil glands are often not affected or only slightly collapsed. In contrast, oil spotting typically damages outer layers of cells, and the underlying oil glands often remain intact.

What We Know about Oil Spotting

Susceptible Varieties

All types and varieties of citrus can suffer damage from oleocellosis, but those with numerous, prominent oil cells are particularly vulnerable. Oleocellosis occurs on all varieties of citrus, but in Florida it is most severe on Parson Brown and Navel oranges, grapefruit, Temples, tangerines, lemons, and limes.

Turgid and Small Fruit

Turgid fruit, particularly when harvested under foggy, wet, or humid conditions, are most likely to develop oil spotting. Small sizes tend to be more susceptible to oil spotting than large sizes.

Time of Day

Fruit turgidity is greatest, and hence the danger of oil spotting is most serious, early in the morning. It is particularly hazardous to pick susceptible crops when the dew is still on them. Even after visible dew on the fruit surface has evaporated, time must be allowed for turgor...
pressure to decrease. Evaporation time may be minutes in hot windy weather or hours on humid overcast days.

**Ethylene Degreening**

Since ethylene does not cause oil spotting, the term “gas burn,” which is sometimes used to describe oleocellosis, is incorrect. Oil spotting of early season fruit is often characterized by a dark green coloration of the affected areas (Plate 2). The green color results from oil damage that prevents the conversion of chloroplasts to chromoplasts during degreening. During ethylene exposure, the damaged areas remain green while the surrounding, non-affected areas degreen. Holding fruit in high, rather than low, humidity after degreening makes oil spotted regions lighter, and thus less obvious.

**Color-Add**

The color-add process does not cause oil spotting. However, the color-add dye preferentially stains the injured areas and makes them more obvious.

**The Importance of Oil Spotting**

Losses from oil spotting are common and are usually associated with rough handling during harvest. Fruit harvested for the fresh fruit market, but rejected due to oleocellosis and sent to the processor as eliminations, represent an economic loss. Packed fruit subsequently rejected by the wholesale buyer or retail consumer represent even greater economic losses.

**Oil Spotting Can Be Reduced or Eliminated**

Oil spotting can be avoided or greatly minimized if a few simple rules are followed.

- Never pick up fresh fruit which has touched the ground.
- Require pickers to handle fruit carefully, particularly tender specialty varieties. Avoid using processing-fruit picking crews who are accustomed to handling fruit roughly.
- Pick dry fruit. Delay harvesting if fruit are wet from dew, fog, rain, or irrigation, particularly early in the morning.
- Use a pressure tester to determine the rind oil release pressure (RORP) as a guide to estimate when a crop is likely to suffer ruptured oil cells, causing oil spotting. Tissue paper placed between the fruit and tester will aid in the detection of released oil. A pressure tester is absolutely necessary to judge when it is safe to harvest lemons. The rule of thumb (using a 3/8 inch cylindrical tip) is: when less than 3 pounds of pressure ruptures oil cells, harvest is impossible; 3 to 7 pounds, harvest with extreme caution; over 7 pounds, harvest like other citrus varieties. These values have been used successfully by some to harvest Navel oranges. Track RORP values from year to year for each grove or block to project fruit susceptibility to oleocellosis.
- Leave lemons in the grove or at roadside for 24 hours before transporting to the packinghouse. **Note:** This instruction is for lemons only: all other citrus varieties should be transported to the packinghouse as soon as possible.
- Use metal-shielded, deciduous-fruit-type picking bags (smaller than common citrus bags) for lemons and particularly tender crops of specialty fruit.
- Do not overfill pallet bins.
- Avoid getting sand on fruit. This causes abrasions resulting in oil spotting. Check pallet boxes for broken or splintered wood and protruding nails, staples, or bolts. Plastic pallet bins will reduce many of these problem areas. In the packinghouse, eliminate sharp corners, rough welding spots, areas where stems and twigs can accumulate, and unnecessarily stiff or fast brushes.
- Keep relative humidity in degreening rooms high (90 to 96% RH) to reduce the darkening of oil spots. This will not eliminate or reduce oil spotting, but will make it less obvious. When there is a delay before packing in the non-degreening season, hold fruit in high humidity rooms at ambient temperatures without ethylene to minimize the darkening of oleocellosis lesions.
- Avoid abrasions of the peel at any time in the handling and marketing sequence. Remember that the susceptibility of citrus fruit to oil spotting decreases as the time between harvest and handling increases.
Further Information

The Cooperative Extension Service, the Florida Department of Citrus, and the University of Florida continue to evaluate oil spotting and other peel injuries and postharvest diseases of citrus fruit. Individual conferences on these and other harvesting, packing, and marketing problems can be arranged for Florida citrus packers by contacting the Harvesting and Handling Section, Citrus Research and Education Center, 700 Experiment Station Road, Lake Alfred, FL 33850, phone (941) 956-1151.