

Fig

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Scientific Name and Introduction

Edible figs are the multiple or compound fruits of *Ficus carica* L., a member of the family Moraceae. The plant is a tree or shrub native to Asia Minor, from where it spread into the Mediterranean region. It was known to the ancient Egyptians in 4000 B.C., and later Herodotus (c. 485 to 425 B.C.) wrote about its cultivation.

Figs were introduced from Europe to North America as early as 1600, but commercial cultivation did not start until about 1900. The largest center of cultivation in the United States is in California. Figs thrive only in the hotter parts of the moderate zones, while in tropical countries they can be cultivated only at higher altitudes.

The best-known cultivated varieties are the common, or Adriatic, fig and the Smyrna fig. The common fig produces seedless fruit by parthenocarpy (production of fruit without fertilization), while the Smyrna fig must be pollinated in spite of the fact that it does not develop any male flowers. The figs are pear-shaped structures formed from the rolled-up discs of the capitula so that the florets of the capitulum occur inside the aperture and are not visible from the outside. The capitulum is connected to the outside by a small aperture at the top of the fig. The female florets develop into tiny achenes. The achenes inside the fig represent the infructescence, and the edible part is the swollen, fleshy disc of the capitulum forming the fruit wall.

Quality Characteristics and Criteria

Skin color and flesh firmness of fresh figs are related to their quality and postharvest life. Flavor is influenced by stage of ripeness, and overripe figs can become undesirable due to fermentative products. Other quality indices include absence of defects (such as bird-peck, sunburn, scab, skin break, and stem shrivel), insects, and decay.

Horticultural Maturity Indices

Fresh market figs must be harvested when almost fully ripe and firm to be of good eating quality. Skin color and flesh firmness are dependable maturity and ripeness indices. 'Black Mission' figs should be light to dark purple rather than black, and should yield to slight pressure. 'Calimyrna' figs should be yellowish white to light yellow and firm. Figs for drying should be allowed to fully ripen and partially dry on the tree before harvesting and drying to about 17% moisture using either solar drying or a dehydrator at 60 °C (140 °F).

Grades, Sizes, and Packaging

Fully mature fresh figs are soft, easily bruised, and highly perishable. Figs are hand-picked and packed in a one-layer box. Pickers wear gloves to protect against fig juice. 'Mission' fig, a black fig with distinctive flavor, and 'Calimyrna' fig, a large yellowish fig, are the main cultivars sold

fresh in the United States.

Optimum Storage Conditions

Store at -1 to 0 °C (30 to 32 °F) with 90 to 95% RH. Expedited forced-air cooling to 0 °C (32 °F) is strongly recommended.

Controlled Atmosphere (CA) Considerations

CA combinations of 5 to 10% O₂ with 15 to 20% CO₂ are effective in decay control, firmness retention, and reduction of respiration and ethylene production. Postharvest life at optimum temperature and RH depends on cultivar and ripeness at harvest, but ranges from 1 to 2 weeks in air and 3 to 4 weeks in CA for California-grown 'Black Mission' and 'Calimyrna' figs.

Retail Outlet Display Considerations

Figs should be displayed at 0 to 2 °C (32 to 36 °F) and dried with an RH of 90 to 95%.

Chilling Sensitivity

Figs are not chilling sensitive.

Rates of Ethylene Production and Sensitivity

Temperature	$\mu\text{L kg}^{-1} \text{ h}^{-1}$
0 °C	0.4 to 0.8
5 °C	0.8 to 1.5
10 °C	1.5 to 3.0
20 °C	4.0 to 6.0

Figs are climacteric fruit and are slightly sensitive to ethylene action on stimulating softening and decay severity, especially if kept at 5 °C (41 °F) or higher temperatures.

Respiration Rates

Temperature	$\text{mg CO}_2 \text{ kg}^{-1} \text{ h}^{-1}$
0 °C	4 to 8
5 °C	10 to 16
10 °C	18 to 24
20 °C	40 to 60

To get $\text{mL CO}_2 \text{ kg}^{-1} \text{ h}^{-1}$, divide the $\text{mg kg}^{-1} \text{ h}^{-1}$ rate by 2.0 at 0 °C (32 °F), 1.9 at 10 °C (50 °F), and 1.8 at 20 °C (68 °F). To calculate heat production, multiply $\text{mg kg}^{-1} \text{ h}^{-1}$ by 220 to get BTU per ton per day or by 61 to get kcal per tonne per day.

Physiological Disorders

Extended storage in CA can result in loss of characteristic flavor. Figs exposed to <2% O₂ or >25% CO₂ develop off flavors due to fermentative metabolism.

Postharvest Pathology

Alternaria rot, caused by *Alternaria tenuis*, appears as small, round, brown to black spots over the fruit surface. Any cracks on the skin make the fruit more susceptible to the rot.

Black mold rot, caused by *Aspergillus niger*, appears as dark or yellowish spots in the flesh with no external symptoms. At advanced stages the skin and flesh turn a slightly pink color and white mycelia with black spore masses follow.

Endosepsis (soft rot), caused by *Fusarium moniliformis*, appears in the cavity of the fig making the pulp soft, watery, and brown with sometimes an offensive odor.

Souring is a preharvest problem resulting from yeasts and bacteria carried into figs by insects, especially vinegar flies, resulting in odors of alcohol or acetic acid.

Recommendations to reduce postharvest diseases are the following: controlling orchard insects to reduce fruit damage and transmission of fungi; using effective control of preharvest diseases; enforcing strict sanitation of picking and transporting containers; supervising careful handling to minimize abrasions, cracks, and other physical damage; avoiding picking figs from the ground for fresh market; and enforcing prompt cooling to 0 °C (32 °F) and maintaining the cold chain all the way to the consumer.

Quarantine Issues

Currently, there is limited export to Canada. There is no import of fresh figs into the United States. Issues associated with exotic pest quarantine addressing both imported and exported fruit change rapidly. The USDA Animal and Plant Health Inspection Service (APHIS) issues rules regarding import requirements. APHIS provides information to assist exporters in targeting markets and defining what entry requirements a foreign country might have for fruit. In cooperation with State plant boards, the agency developed the database “Excerpt” to track phytosanitary requirements for each country. APHIS also provides phytosanitary inspections and certifications that declare that fruit are free of pests to facilitate compliance with foreign regulatory requirements.

Suitability as Fresh-Cut Product

Fresh figs are not well-adapted for use as a fresh-cut product.

Special Considerations

Handling figs to avoid infection with *Aspergillus* species is very important to minimize formation of mycotoxins. Solar heating reduces insect infestations in ripening and drying figs.

References

- Bolin H.R., and A.D. King. 1980. Fig. *In* S. Nagy and P. Shaw, eds., Tropical and Subtropical Fruits - Composition, Properties, and Uses, pp. 492-505. AVI Publishing Co., Westport, CT.
- Chossa, I. 1997. Fig. *In* S. Mitra, ed., Postharvest Physiology and Storage of Tropical and Subtropical Fruits, pp. 245-268. CAB Intl., Wallingford, U.K.
- Colelli, G., F.G. Mitchell, and A.A. Kader. 1991. Extension of postharvest life of 'Mission' figs by CO₂-enriched atmospheres. HortScience 26:1193-1195.
- Condit, J.J. 1947. The Fig. Chronica Botanica Co., Waltham, MA.
- Obenauf, G., M. Gerdt, G. Leavitt, and J. Crane. 1978. Commercial dried fig production. Leaflet 21051, University of California, Division of Agricultural Sciences, Davis, CA.

Acknowledgments

Most of the information included is from the University of California, Davis, website on "Fresh Produce Facts" at http://postharvest.ucdavis.edu/produce_information.

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