Persimmon

Carlos H. Crisosto
Crisosto is with the Pomology Department, University of California, Davis, CA.

Scientific Name and Introduction

Persimmon is the species *Diospyros kaki*, a tree belonging to the family Ebenaceae and native to the Far East. Originally cultivated in China and Japan, it is also known as Chinese date plum. Fruit are grown throughout warmer parts of the world, including southern France, other Mediterranean countries, and the United States. Fruit are a good source of carotenoids, dietary fiber, and vitamins A and C.

The fruit is a berry, but the seeds are large, almond-shaped, and few in number. The epidermis is thin, and an enlarged calyx adheres to the base of the fruit. Persimmon has a delicious flavor and may be eaten fresh as a dessert or may be consumed dried or candied. In the United States, a native species—*Diospyros virginiana*—occurs, but its fruit are inferior to *D. kaki*. Another well known species is *D. lotus*, which yields fruit called date plums and is grown in Asia and Italy.

Quality Characteristics and Criteria

High-quality persimmons are medium to large in size, with uniform skin color from yellow to orange. Fruit should be firm, (penetration force [8-mm tip] >22.2 N [5 lb-force] for 'Fuyu' and similar cultivars). Fruit should be free from growth cracks, mechanical injuries, and decay. Recommended SSC is 21 to 23% in 'Hachiya' and 18 to 20% in 'Fuyu' and similar nonastringent cultivars. Astringent cultivars must be treated to remove astringency by polymerizing tannins.

Horticultural Maturity Indices

Minimum maturity is based on change in skin color from green to orange or reddish-orange ('Hachiya') or to yellow or yellowish-green ('Fuyu,' 'California Fuyu,' 'Jiro'). In California, the minimum maturity indicators for 'Hachiya' persimmon are a blossom-end color of orange or reddish equal to or darker than Munsell color chart 6.7YR 5.93/12.7 on at least one-third of the fruit's length with the remaining two-thirds a green color equal to or lighter than Munsell 2.5GY 5/6. For other varieties, fruit must have attained a yellowish-green color equal to or lighter than Munsell 10Y 6/6.

Optimum Storage Conditions

The optimum temperature for storing persimmons is 0±1 °C (32±2 °F). The freezing point is -2 °C (28.4 °F), but may vary depending on SSC. RH should be maintained at 90 to 95%.

Controlled Atmosphere (CA) Considerations

Low O_2 of 3 to 5% delays ripening; CO_2 at 5 to 8% helps retain firmness and can reduce chilling injury symptoms on 'Fuyu' and similar cultivars. Postharvest life under optimum temperature

and RH in ethylene-free air is 3 mo, whereas fruit can be stored up to 5 mo using ethylene-free CA (3 to 5% O_2 and 5 to 8% CO_2).

Retail Outlet Display Considerations

Cold-table display is recommended.

Chilling Sensitivity

Sensitivity varies by cultivar. 'Hachiya' is not chilling sensitive while 'Fuyu' and similar nonastringent cultivars are sensitive at temperatures between 5 ºC and 15 ºC (41 ºF and 59 ºF); they will exhibit flesh browning and softening. Exposure to ethylene aggravates chilling injury at these temperatures.

Ethylene Production and Sensitivity

Persimmons produce <0.1 µL kg^{-1} h^{-1} at 0 °C (32 °F) and 0.1 to 0.5 µL kg^{-1} h^{-1} at 20 °C (68 °F). They are very sensitive to ethylene. Exposure to 1 and 10 µL L^{-1} ethylene at 20 °C (68 °F) accelerates softening to less than 4 lb-force (17.8 N), the limit of marketability, after 6 and 2 days, respectively. Thus, removing or excluding ethylene from transport and storage facilities is recommended.

Respiration Rates

Temperature	mg CO_2 kg^{-1} h^{-1}
0 °C	4 to 8
20 °C	20 to 24

To get mL CO_2 kg^{-1} h^{-1}, divide the mg kg^{-1} 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 mg kg^{-1} h^{-1} by 220 to get BTU ton^{-1} day^{-1} or by 61 to get kcal $tonne^{-1}$ day^{-1}.

Physiological Disorders

Chilling injury is the main physiological disorder. The incidence and severity depend on temperature, cold temperature duration, and the cultivar. For example, 'Fuyu' is chilling sensitive while 'Hachiya' is not. Chilling injury can be a major cause of deterioration of 'Fuyu' persimmons during marketing. Symptom development is greatest at 5 to 7 °C (41 to 45 °F) and slowest at 0 °C (32 °F), which is the recommended storage and transport temperature for persimmons. 'Fuyu' fruit exhibit symptoms if held between 2 °C (36 °F) and 15 °C (59 °F). On transfer to higher temperatures, symptom severity (flesh softening, browning, and water-soaked appearance) increases and renders fruit unmarketable. Respiration and ethylene production rates of chilled 'Fuyu' persimmons are higher than those of nonchilled fruits. Exposure to ethylene at 0.1 µL L^{-1} or higher aggravates chilling symptoms of 'Fuyu' persimmons, while CA ameliorates symptoms. Chilling injury is controlled by avoiding exposure of 'Fuyu' fruit to temperatures between 2 °C (36 °F) and 15 °C (59 °F). The optimum storage and transport temperature is 0 °C

(32 °F). Exposure to ethylene >1 µL L^{-1} during postharvest handling should also be avoided. CA of 3 to 5% O_2 and 5 to 8% CO_2 at temperatures <5 °C (<41 °F) reduces chilling injury.

Exposure to O_2 levels <3% during storage for longer than 1 mo can result in failure of fruit to ripen and development of off flavors. *Exposure to CO_2 >10%* during storage for longer than 1 mo can cause brown discoloration of the flesh and lead to development of off flavors.

Calyx separation is a problem with some cultivars. It has caused losses in New Zealand. Growing conditions are all-important, and excessive nitrogen fertilization should be avoided. Thinning trees early in the season will enhance calyx growth and help prevent this disorder.

Postharvest Pathology

Alternaria rot is caused by *Alternaria alternata,* which attacks developing fruits. Infections remain quiescent until after harvest, when black spots become apparent during ripening. Wound infection results in earlier appearance of symptoms. Other causes of decay in persimmons include species of *Botrytis, Cladosporium, Colletotrichum, Mucor, Penicillium, Phoma,* and *Rhizopus.*

Quarantine Issues

Currently, there is a limited trade exchange for persimmons. The United States exports persimmons to the Middle East and Mexico and imports persimmons from Chile without specific requirements. APHIS issues rules regarding import requirements and provides information to assist exporters in targeting markets and defining what entry requirements a particular country has. APHIS, in cooperation with State plant boards, developed a database called "Excerpt" to track phytosanitary requirements for each country. APHIS also provides phytosanitary inspections and certifications that declare fruit are free of pests to facilitate compliance with foreign regulatory requirements.

Suitability as a Fresh-Cut Product

Nonastringent persimmon cultivars can be prepared as fresh-cut wedges or slices. Wright and Kader (1997) reported that the shelf-life of 'Fuyu' persimmon slices was 7 days in air and 8 days in a CA of 2% O_2 and 12% CO_2 at 5 °C (41 °F). A longer shelf-life can be expected at 0 to 2 °C (32 to 36 °F). Protecting slices from ethylene helps firmness retention.

Special Considerations

The best method of harvesting fruit is to cut them from the tree, leaving the calyx attached to the fruit. It is possible to snap fruit from the tree by hand, but this practice is not recommended as it can injure the fruit and adjoining shoot. Fruit must be handled very carefully to avoid bruising, which is likely to become unsightly as fruit ripen. Two or three harvests are usually required, depending on fruit size and color. A desirable size for 'Fuyu' is 230 to 250 g; 200 g is the minimum marketable size.

Astringency can be removed from 'Hachiya' persimmons using 10 µL L^{-1} ethylene at 20 ºC (68 ºF), but the excessive softening that results can make marketing the fruit difficult. Exposure to air enriched with 80% CO_2 for 24 h at 20 ºC (68 ºF) is also effective, and fruit maintain firmness.

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