# Cherry (Sweet)

James Mattheis and John Fellman
Mattheis is with the Tree Fruit Research Laboratory, Agricultural Research Service, U.S. Department of Agriculture, Wenatchee, WA; Fellman is with the Department of Horticulture and Landscape Architecture, Washington State University, Pullman, WA.

## Scientific Name and Introduction

*Prunus avium* L., the sweet cherry, is a stone fruit of the Rosaceae family. The edible portion consists of outer layers of the mature ovary wall, the flesh (mesocarp) and the skin (exocarp). The pit (endocarp) encloses the seed. Numerous cultivars are grown commercially including 'Attika,' 'Bing,' 'Brooks,' 'Burlat,' 'Chelan,' 'Lambert,' 'Lapins,' 'Rainier,' 'Tieton,' 'Skeena,' and 'Sweetheart.' Sweet cherries are primarily grown in the Western United States in California, Oregon, and Washington. Fruit harvest begins in California in May and continues through mid-August in Oregon and Washington.

## Quality Characteristics and Criteria

Premium sweet cherries have a bright, shiny appearance. Fruit color can be dark red ('Bing'), red ('Sweetheart'), or yellow with a red blush ('Rainier' and 'Royal Ann'). The appearance of the stem, which should be green and free from brown discoloration, is also critical for marketing. Flavor is enhanced by highly soluble solids and titratable acid content with a firm, juicy fruit texture.

## Horticultural Maturity Indices

Fruit color is the most consistent and reliable maturity index. Different cultivars can be harvested at slightly different color stages. For example, 'Bing' cherries should be a mahogany red color rather than lighter red (immature) or purplish red (overmature). 'Lambert' cherries can be harvested at a brighter, less dark-red color, while 'Van' cherries can be harvested at a darker red color than 'Bing' (Crisosto 1991).

## Grades, Sizes, and Packaging

Grades include Washington No. 1 and 2, Northwest No. 1 and 2, and U.S. No. 1 and 2. Grades are based primarily on appearance, and the three grading systems differ in tolerance to defects. Sizes are typically expressed as row count and range from 9 to 12. Packages commonly are 20-lb cartons, though smaller units are becoming more available.

## Precooling Conditions

Sweet cherries should be cooled to below 5 ºC by 4 h after harvest. Room cooling, forced-air cooling, and hydrocooling are all used to cool sweet cherry fruit. Of these, hydrocooling is the most rapid, and chlorine compounds can be added to the hydrocooler water to reduce decay potential (Do et al. 1966).

## Optimum Storage Conditions

Recommended conditions for storage of sweet cherries are -1 to 0 ºC with RH at over 95%. Sweet cherries maintain good quality for 2 to 4 weeks under these conditions.

## Controlled Atmosphere (CA) Considerations

Reduction in the amounts of color change (darkening), acid and firmness loss, incidence of decay, and stem browning are potential benefits of CA storage and MAP (modified atmosphere packaging). The effectiveness of these technologies is determined in part by fruit quality at harvest. Fruit harvested at a more advanced stage of maturity (low acid, dark color, low firmness) will not realize as much benefit from CA or MAP. Optimal atmosphere conditions for CA range from 1 to 5% $O_2$ with 5 to 20% $CO_2$ (Chen 1981, Patterson 1982, Mattheis et al. 1997). For MAP, 5 to 10% $O_2$ with 5 to 15% $CO_2$ is effective when fruit temperature is maintained at 0 to 5 ºC (Mattheis and Reed 1994, Meheriuk et al. 1995). Temperature control for MAP systems is critical because the risk of anaerobiosis increases as packaged fruit temperature increases.

## Retail Outlet Display Considerations

Refrigeration during display is critical to reduce quality loss due to stem browning, shrivel, and development of decay. Fruit should be held at 5 ºC or less to slow deterioration. Fruit should be refrigerated but not wetted because continuous moisture on the surface can cause splitting.

## Chilling Sensitivity

Sweet cherries are not sensitive to chilling and should be stored as cold as possible without freezing.

## Ethylene Production and Sensitivity

Sweet cherries produce very low amounts of ethylene but will respond to exogenous or wound-induced ethylene with increased respiration and quality loss.

## Respiration Rates

| Temperature | mg $CO_2$ $kg^{-1}$ $h^{-1}$ |
|---|---|
| 0 °C | 6 to 10 |
| 5 °C | 16 to 28 |
| 10 °C | 20 to 36 |
| 15 °C | 28 to 64 |
| 20 °C | 40 to 90 |

Data from Gerhardt et al. (1942), Micke et al. (1965), and Mattheis (1998).

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

per ton per day or by 61 to get kcal per tonne per day.

**Physiological Disorders**

Pitting and bruising are common problems caused by harvest injury and rough postharvest handling (Facteau and Rowe 1979, Thompson et al. 1997). Fruit pitting is a manifestation of subsurface damage that develops into sunken areas near the fruit surface. Bruising can occur from excess compression, drops or large impacts during harvest, transport, or packing. Visual symptoms of pits and bruises often do not appear until well after the fruit have been packed, resulting in visible damage appearing in wholesale or retail markets.

Sweet cherries are also prone to shrivel and water loss due to the lack of a well-developed cuticle. Water loss can be minimized by prompt cooling and storage in a high-RH environment.

Stem browning is another potential physiological disorder. Stem browning can be minimized by proper temperature and RH management; however, packing procedures that scrape or injure stems create wounds that will brown. In addition to proper temperature management, use of chlorine dioxide in hydrocooler water can reduce development of stem browning (Roberts 1989).

**Postharvest Pathology**

Fungal pathogens including *Penicillium expansum* (blue mold), *Botrytis cinerea* (gray mold), *Alternaria* sp., *Monilinia fructiocola* (brown rot), *Rhizopus stolonifer, Cladosporium* sp., and *Aspergillus niger* are the main causes of sweet cherry decay (Crisosto 1991, Adaskaveg and Ogawa 1994, Dugan and Roberts 1997). Many of these pathogens infect fruit early in development and are present as quiescent infections at harvest (Dugan and Roberts 1994). Fruit can also be infected via rain splits or wounds that occur at harvest or during packing. The use of postharvest sanitation and fungicides minimizes postharvest decay (Willet et al. 1989). Low-temperature storage, fungicide application, and MAP with high $CO_2$ (5 to 20%) all slow pathogen growth (English and Gerhardt 1942, Gerhardt et al. 1942, 1956, DeVries-Patterson et al. 1991, Brash et al. 1992, Spotts et al. 1998).

**Quarantine Issues**

Fruit exported to Japan must be fumigated with methyl bromide to control codling moth larvae. Fruit shipped into California must be inspected and certified free from cherry fruit fly infestation.

**Suitability as Fresh-Cut Product**

No current potential.

**Special Considerations**

Sweet cherries must be cooled promptly after harvest and low temperatures maintained throughout packing, storage, and transport. Low temperatures minimize quality loss as well as physiological and pathological disorders. Maintenance of low temperature is critical when using

MAP systems to avoid anaerobic conditions and off-flavor development.

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