Olive

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Scientific Name and Introduction

A member of the Oleaceae family (*Olea europaea* L.), the olive is a small tree native to the eastern Mediterranean region. The ancient Egyptians, Greeks, Romans, and other Mediterranean nations cultivated olives for their oily drupes. The part used for consumption is the fleshy mesocarp, from which edible oil is extracted, or fruit may be pickled and the mesocarp and exocarp eaten.

Olives are a drupe, botanically similar to cherry and other stone fruits. It consists of carpel, and the wall of the ovary has both fleshy and dry portions. The skin (exocarp) is free of hairs and contains stomata. The flesh (mesocarp) is the tissue eaten, and the pit (endocarp) encloses the seed. Fruit shape, size and pit size, and surface morphology vary greatly among cultivars.

Quality Characteristics and Criteria

For green olives, criteria are color and freedom from mechanical damage, shriveling, surface blemishes, scale and other insect injury, and decay. These are processed according to California black-ripe style or Spanish green style fermented olives. For black olives, criteria are color, freedom from defects, and oil content of 12 to 25% (depending on cultivar). These are processed (Greek or Italian style) or used for oil extraction.

Horticultural Maturity Indices

For green olives, size and color (even coloration of pale green with a minimum of whitish spots [lenticels] through a straw color) indicate when to harvest. An olive is considered mature if it exudes a characteristic white juice when squeezed. For black olives, skin color and removal force are used; fruit reach this stage 3 to 4 mo after the green stage.

Grades, Sizes, and Packaging

Harvesting of olives represents 50 to 70% of the total production labor cost and 30 to 40% of the gross returns from the crop. Harvested fruit begin to lose moisture immediately. When harvested during hot, sunny weather, olives should be put in the shade until hauled away. Sun-exposed fruit gets sunburn and will grade as culls. Rough handling causes bruises and grade reduction.

A few growers harvest their fruit mechanically, using tree shakers and catching frames. The use of mechanical harvesting is likely to increase in the future. Olives are harvested for pickling in California from mid September to mid November, depending on cultivar, local conditions, and needs of the canneries. Optimum harvesting time is determined by the color and texture of the olive. Overmature or badly bruised fruit frequently spoils during processing. To get the best return, fruit should be delivered to the cannery as soon as possible after harvest.

Optimum Storage Conditions

Olives should be stored at 5 to 7.5 °C (41 to 46 °F) with 90 to 95% RH. Temperatures <5 °C (41ºF) cause chilling injury of fresh olives.

Controlled Atmosphere (CA) Considerations

Optimum CA is 2 to 3% O_2 and 0 to 1% CO_2, which delays senescence and softening for up to 12 weeks at 5 °C (41 ºF) and 9 weeks at 7.5 °C (46 °F). Atmospheres with <2% O_2 can cause off flavors, and CO_2 >5% may increase severity of chilling injury if olives are stored below 7.5 ºC (46 ºF). This information is for fresh green olives. Fresh black olives should be processed as soon after harvest as possible, but if necessary black olives can be kept in 2% O_2 at 5 °C (41 °F) for up to 4 weeks.

Chilling Sensitivity

Olives are sensitive to temperatures <5 °C (41 °F). Symptoms in 'Ascolano,' 'Manzanillo,' 'Mission,' and 'Sevillano' fruit are a slight, tannish to brown discoloration which develops in the flesh adjacent to the pit. Over time, the discoloration becomes more intense and progresses through the flesh into the skin, at which time the olive has the appearance of having been boiled.

Chilling injury becomes visible on olives stored for >2 weeks at 0 °C (32 °F), 5 weeks at 2 °C (35 °F), or 6 weeks at 3 °C (38 °F). The order of susceptibility to chilling injury, from most to least susceptible, is 'Sevillano,' 'Ascolano,' 'Manzanillo,' and 'Mission.'

Ethylene Production and Sensitivity

Green olives produce <0.1 µL kg^{-1} h^{-1} ethylene, and black olives produce 0.5 µL kg^{-1} h^{-1} at 20 °C (68ºF). Though olives produce very little ethylene, they are moderately sensitive to ethylene at concentrations >1 µL L^{-1}, which causes a loss of green color and flesh firmness.

Respiration Rates

Temperature	mg CO_2 kg^{-1} h^{-1}
5 °C	10 to 20
7.5 °C	16 to 24
10 °C	24 to 32
20 °C	40 to 80

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

Nailhead is characterized by surface pitting and spotting. It results from death and collapse of

epidermal cells, creating air pockets underneath the skin. Symptoms are observed on olives kept at 10 °C (50 °F) for >6 weeks or at 7.5 °C (46 °F) for >12 weeks. CO_2 injury is evidenced by internal browning and increased incidence and severity of decay. It results from exposure to >5% CO_2 for more than 4 weeks.

Postharvest Pathology

Postharvest diseases occur if olives have been chilled at temperatures below 5 °C (41 °F), mechanically damaged, not cooled promptly after harvest to 5 to 7.5 °C (41 to 46 °F), or exposed to undesirable atmospheres (>5% CO_2 or <2% O_2).

Quarantine Issues

Since olive fruit fly *(Bactrocera oleae)* is present in many California olive-growing areas, a limited amount of fresh olives is imported from Mexico and Argentina. A very limited amount is exported to Canada. These exported and imported fresh olives are not fumigated with methyl bromide.

Issues associated with exotic pest quarantines addressing either imported or exported fresh olives can change rapidly. APHIS issues rules regarding import requirements. This agency provides information to assist exporters in targeting markets and defining what entry requirements a particular country might have for fresh olives. APHIS, in cooperation with the State plant boards, developed a database called “Excerpt” to track phytosanitary requirements for each country. APHIS provides phytosanitary inspections and certifications that declare fresh olives free of pests to facilitate compliance with foreign regulatory requirements.

Suitability as Fresh-Cut Product

Fresh olives are not edible or suitable as a fresh-cut product.

Special Considerations

Olives for pickling are harvested either unripe, in which case they remain green, or ripe, when they are purple and turn black during pickling. Olives for oil extraction can be harvested from the straw-color stage through the black-ripe stage.

Further Reading

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Acknowledgments

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

The editors of this Handbook will appreciate your input for future editions of this publication. Please send your suggestions and comments to HB66.Comments@ars.usda.gov.