Olives
Postharvest Quality Maintenance Guidelines

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Scientific Name and Introduction

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

The olive fruit is 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

Green olives: Color, freedom from mechanical damage, shriveling, surface blemishes, scale and other insect injury, and decay. These olives are processed according to the California black-ripe style or Spanish green style canned olives.

Black olives: Color, freedom from defects, oil content (12 to 25% depending on cultivar). These are processed (Greek or Italian style) or used for oil extraction.

Horticultural Maturity Indices

Green olives: size and color (even, pale green with a minimum of whitish spots (lenticels) through a straw color. An olive is considered mature if it exudes a characteristic white juice when squeezed.

Black olives: skin color and removal force is used. Fruits reach this stage about 3-4 months after the green stage.

Grades, Sizes and Packaging

Harvesting olives represents 50 to 70 percent of the total production labor cost, and 30 to 40 percent of the gross returns from the crop.

Picked fruit begins to lose moisture immediately. When harvested during hot, sunny weather, the fruit should be set in the shade while waiting to be hauled away. Sun-exposed fruit sunburns and will be graded as culls. Rough handling causes bruises and a reduction in grade.

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.

Over-mature or badly bruised fruit frequently develops spoilage during processing. To get the best returns, the fruit should be delivered to the cannery as soon as possible after picking.

Optimum Storage Conditions

5.0 - 7.5ºC (41-45.5ºF); temperatures below 5ºC (41ºF) cause chilling injury of fresh olives. Relative humidity of 90-95% is suggested.

Controlled Atmosphere (CA) Considerations

- Optimum CA: 2 - 3% O_2+ 0 - 1% CO_2; delays senescence and softening for up to 12 weeks at 5ºC (41ºF) or 9 weeks at 7.5ºC (45.5ºF).
- O_2 below 2% can cause off-flavors.
- CO_2 greater than 5% may increase the severity of chilling injury if olives are kept below 7.5ºC (45.5ºF).

The above information is for fresh green olives; fresh black olives should be processed as soon after harvest as possible, but, if necessary, can be kept in 2% O_2 at 5ºC (41ºF) for up to 4 weeks.

Chilling Sensitivity

Olives are chilling sensitive. Temperatures below 5ºC (41ºF) cause chilling injury of fresh olives. The symptoms of chilling injury in 'Ascolano', 'Manzanillo', 'Mission' and 'Sevillano' fruits are as follows: a slight, tannish to brown discoloration develops in the flesh of the fruit adjacent to the pit. With the passage of time, the brown discoloration becomes more intense and progresses through the flesh to the skin. By this time the fruit has the appearance of having been boiled.

Chilling injury symptoms become visible on olives stored for longer than 2 weeks at 0ºC (32ºF), 5 weeks at 2ºC (35ºF), or 6 weeks at 3ºC (38ºF). The order of susceptibility to chilling injury is 'Sevillano' – 'Ascolano' – 'Manzanillo' – 'Mission' (least susceptible cultivar).

Rates of Ethylene Production and Sensitivity

Green olives	<0.1 µl/kg•hr at 20ºC (68ºF)
Black olives	0.5 µl/kg•hr at 20ºC (68ºF)

Olives produce very little ethylene but are moderately sensitive to ethylene action above 1ppm (loss of green color and flesh firmness).

Respiration Rates:

Temperature	5ºC(41ºF)	7.5ºC(45.5ºF)	10ºC(50ºF)	20ºC(68ºF)
ml CO_2/kg•hr	5 – 10	8 – 12	12 - 16	20 - 40

To calculate heat production multiply ml CO_2/kg•hr by 440 to get Btu/ton/day or by 122 to get kcal/metric ton/day.

Physiological Disorders:

Nailhead.

This disorder is characterized by surface pitting and spotting. It results from the death and collapse of epidermal cells, which create air pockets underneath the fruit skin. Symptoms are observed on olives kept at 10ºC (50ºF) for 6 weeks or longer or 7.5ºC (45.5ºF) for 12 weeks or longer.

Carbon dioxide injury.

Symptoms (internal browning and increased decay incidence and severity) result from exposure to more than 5% CO_2 for longer than 4 weeks.

Postharvest Pathology:

Postharvest diseases occur if the olives have been chilled, [exposed to temperatures below 5ºC (41ºF)], mechanically damaged, not cooled promptly to the optimum temperature range of 5 to 7.5ºC (41 to 45.5ºF), or exposed to undesirable atmospheres (above 5% CO_2 and/or below 2% O_2).

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 the pickling.

Olives for oil extraction can be harvested at the straw color stage and subsequent ripeness stages until the black-ripe stage. Partially-ripe olives produces better quality oil than fully-ripe olives.

References

Agar, I.T., B. Hess-Pierce, M.M. Sourour, and A.A. Kader. 1998. Quality of fruit and oil of black-ripe olives is influenced by cultivar and storage period. J. Agr. Food Chem. 46:3415-3412.

Ferguson, L., G. S. Sibbett and G. Martin. 1994. Olive production in California. Univ. Calif., Division of Agricultural Natural Resources, Publication 3353.

Fernandez, A.G., M.J. Fernandez-Diez, and M.R. Adams. 1997. Table olive production and processing. Chapman and Hall, London, 495 p.

Kader, A.A., G. Nanos, and E. Kerbel. 1990. Storage potential of fresh 'Manzanillo' olives. California Agriculture 44(3):23-24.

Maxie, E.C., P.B. Catlin, and H.T. Hartmann. 1960. Respiration and ripening of olive fruits. Proc. Amer. Soc. Hort. Sci. 75:275-291.

Maxie, E.C. 1963. Storing olives under controlled temperature and atmospheres. California Olive Assoc. Annual Technical Report 42:34-40.

Maxie, E.C. 1964. Experiments on cold storage and controlled atmosphere. Calif. Olive Assoc. Ann. Tech. Rpt. 43:12-15.

Olias, J.M. and J.M. Garcia. 1997. Olive. p.229-243, In: S. Mitra (editor). Postharvest physiology and storage of tropical and subtropical fruits. CAB International, Wallingford, UK.

Acknowledgments

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