Endive and Escarole

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Scientific Name and Introduction: Endive (*Cichorium endiva* L) has two forms, a narrow leafed endive called curly endive that resembles Dandelion leaves, and a broad leafed endive called escarole. This herbaceous plant is a member of the Asteraceae family as are its relatives chicory (*Cichorium intybus* L), lettuce (*Lactuca sativa* L., Cichorium tribe), and radicchio (*Cichorium intybus* L.). The outer leaves of endive are dark green and bitter. The inner leaves are light green to creamy-white and milder in flavor. It is used to spice-up salads made from blander flavored lettuces. Endive is grown and handled like leaf lettuces.

Quality Characteristics and Criteria: High quality endive heads should be clean, free of browning, crisp and bright green. Young, tender leaves are preferred over tough, older leaves.

Horticultural Maturity Indices: Harvesting is usually by hand when the heads reach mature size. The plants are cut at the ground level when they are fully developed, at 25 to 30 cm (10 to 12 in) across and the center leaves are blanched. The heads are packed into corrugated paper cartons in the field. The leafy heads should be kept clean of soil and mud. The leaves should have a spicy and mildly bitter taste. Toughness and a strong bitter taste develop if harvest is delayed and the crop becomes over-mature. The product then becomes unmarketable.

Grades, Sizes and Packaging: Similar to those of leaf lettuces.

Pre-cooling conditions: Vacuum-cooling and hydro-cooling to 0 °C (32 °F) are preferred.

Optimum Storage Conditions: Recommended conditions for commercial storage of endive and escarole are 0 °C (32 °F) with 95 to 100% RH (Hardenburg et al., 1986). They are not adapted to prolong storage and will not keep longer than 2 to 3 weeks even at the optimal storage temperature of 0 °C (32 °F), and about half that time at 5 °C (41 °F). Proper RH is essential to prevent wilting. Although endive, specialty lettuces and other leafy greens have usually been hand harvested. Some mechanical harvesters are available for product destined for bag mixes, but the greater damage to the tissue requires greater attention to maintaining the optimal storage conditions of temperature and RH. Top-ice or package-ice is desirable for maintaining proper temperature and RH. Endive and escarole are often shipped in mixed loads with other produce since most orders for these products are less than truckload lots.

Controlled Atmosphere (CA) Considerations: There are presently no recommended CA atmospheres for endive and escarole. However, a CA useful to maintain the quality of packaged fresh-cut lettuce may be beneficial for either whole or fresh-cut endive and escarole.

Retail Outlet Display Considerations: Maintain cold conditions to maximize storage and shelf-life, minimize dehydration with periodic sprays of cold water. Conditions should be similar to those used with leaf lettuces.

Chilling Sensitivity: Endive and escarole are not chilling sensitive, but freezing at - 0.1 °C (31.8 °F) must be avoided.

Ethylene Production and Sensitivity: Production is very low, but exposure can result in leaf yellowing.

Respiration Rates:

Temperature	mg CO_2 kg^{-1} h^{-1}
0 °C	45
5 °C	52
10 °C	73
15 °C	100
20 °C	133
25 °C	200

To get mL 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 metric ton per day.

Physiological Disorders: Similar to those of leaf lettuces.

Postharvest Pathology: Similar to those of leaf lettuces.

Quarantine Issues: None.

Suitability as Fresh-cut Product: Very high, especially in salad mixes with other leafy greens and lettuces.

Special Considerations: Endive and escarole must be handled with care to avoid mechanical damage and to minimize discoloration and pathological problems. Temperatures must be kept low and RH high to prevent loss of turgor and wilting.

References:

Hardenburg, R.E., A.E. Watada and C.Y. Wang. 1986. The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks. USDA Agric. Hndbk. 66, 136 pp.

Ryall, A.L. and W.J. Lipton. 1979. Handling, transportation and storage of fruits and vegetables. Vol. 1, 2nd edition, Vegetables and Melons. AVI Pub., Westport CT, ISBN 0-87055-115-9.

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