

Greens for Cooking

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Scientific Name and Introduction: Leafy greens that are normally eaten cooked include collards and kale (*Brassica oleraceae* L. var. *Acephala* DC.), rape (*Brassica napus* L. var. *napus*), spinach (*Spinacia oleraceae* L.), mustard (*Brassica juncea* (L.) Czerniak) and turnip (*Brassica rapa* L. var. (DC.) Metzger. *utilis*) (Maynard and Hochmuth, 1997). Since the intended use is for immediate processing (canning or freezing) for later sale, or for cooking at a later date, some handlers do not give the attention to quality maintenance that would normally be provided to fresh salad greens. However, managers should recognize that quality at the point of sale is of primary concern for all vegetables, whether they are to be cooked or eaten raw.

Quality Characteristics and Criteria: Leaves should be of similar varietal characteristics, fresh, fairly tender and clean, well trimmed, of characteristic color for the variety or type of greens, free from decay, discoloration, freezing injury, foreign material, disease, insects, and damage caused by coarse stalks or other mechanical means (Hurst, 1999; USDA, 1953a, 1953b)

Horticultural Maturity Indices: Spinach leaves are typically harvested at about mid-maturity, while other types of greens may be allowed to grow until the leaves have reached nearly full-size but have not begun to senesce. Hand harvesting allows a greater degree of selection of leaf size, while mechanical harvesting simply takes every leaf of sufficient size to reach the cutting blade.

Grades, Sizes and Packaging: All greens for cooking, except spinach, are classified either as Grade U.S. No. 1 or as Unclassified. The term "Unclassified" is not a Grade within the meaning of official U.S. Standards, but is simply provided as a designation that no specific Grade has been assigned (USDA, 1953a, 1953b). Since spinach is often consumed uncooked, more flexibility is included in its classification than in other leafy greens. Thus, the Grades for spinach are U.S. Extra No. 1, U.S. No. 1, and U.S. Commercial (USDA, 1946). The leaf size of the various types of greens offered for sale depends primarily on the requirements of the buyer and the physiological condition of the product. Obviously large, over-mature leaves would not be marketed.

Leaf collards, kale, turnip greens and mustard are commonly bunched using rubber bands or twist ties. The size of the bunch may vary but is generally approximately 0.5 kg (1 lb). Direct packing of loose leaves may be done at the request of the buyer. Head collards are not usually bunched, but rather packed loose into cartons with 8 to 16 bunches per container. Waxed fiberboard cartons or wire-bound crates are commonly used (Hurst, 1999; Sanders et al., 1999). Spinach leaves, which are smaller and more tender, may be packed loose or bunched, but require more care to avoid handling injury (Suslow and Cantwell, 1999).

Pre-cooling Conditions: Field heat should be removed from greens as quickly as possible. Hydro-cooling, hydrovac-cooling, liquid-icing, package-icing, and top-icing all have been used. Water that is used for washing or cooling should contain approximately 200 ppm chlorine (Kasmire and Cantwell, 1999). When package-iced, approximately 1 kg (2.2 lb) of ice is recommended per 1.8 kg (4 lb) of product (Hurst, 1999).

Optimum Storage Conditions: Greens should be stored near 0 °C (32 °F) with 95 to 98% RH. Crushed ice may be placed in the baskets or boxes to help maintain low temperature and high RH. When properly handled, greens in general may be kept for about 2 weeks (Hardenburg et al., 1986; Sanders et al., 1999;

Suslow and Cantwell, 1999). Turnip greens are particularly perishable, in contrast to kale that has been kept in excellent condition for up to 3 weeks under ideal storage conditions (Hardenburg et al., 1986).

Controlled Atmosphere (CA) Conditions: Spinach benefits slightly from storage at 7 to 10% O₂ + 5 to 10% CO₂ (Saltveit, 1997). When prepackaged in plastic bags, films should allow the generation of 1 to 3% O₂ and 8 to 10% CO₂ (Suslow and Cantwell, 1999). Rushing (unpublished data) has observed excessive decay and off-odors in packaged spinach and other greens unless the bags were perforated. Neither CA nor modified atmosphere packaging is commonly used commercially leafy greens other than spinach.

Retail Outlet Display Considerations: Although greens are sometimes displayed on unrefrigerated counters, they should be placed on ice or refrigerated counters. Intermittent misting with water is beneficial.

Chilling Sensitivity: Leafy greens are not sensitive to chilling temperatures and should be stored as cold as possible without freezing.

Ethylene Production and Sensitivity: The ethylene production rate for fresh spinach is < 0.1 μL kg⁻¹ h⁻¹ at 20 °C (68 °F) (Suslow and Cantwell, 1999). Similar data are not available for other greens, but their ethylene production rate could reasonably be expected to be in the same general range as spinach (Kader, 1992). All leafy greens are sensitive to ethylene in the postharvest environment, which causes rapid yellowing (Sanders et al., 1999; Suslow and Cantwell, 1999).

Respiration Rates: The data provided below are for spinach. Similar data are not available for other types of leafy greens.

Temperature	mg CO ₂ kg ⁻¹ h ⁻¹
0 °C	19 to 22
5 °C	32 to 58
10 °C	82 to 138
15 °C	134 to 223
20 °C	172 to 287

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. Data are from Hardenburg et al. (1986).

Physiological Disorders: Freezing injury, which results in water-soaked tissue and decay, is the most common physiological disorder. Temperatures slightly below 0 °C (32 °F) can result in freezing (Suslow and Cantwell, 1999).

Postharvest Pathology: Bacterial soft rots, primarily caused by *Erwinia* and *Pseudomonas*, are the most common types of postharvest decay (Suslow and Cantwell, 1999). Other market diseases may be found, but in general these are not of serious concern if appropriate disease control has been implemented during production and if greens are properly handled.

Quarantine Issues: There are no issues. However, anyone exporting any fresh product should check with appropriate authorities in the receiving country to ensure all regulations are met.

Suitability as Fresh-cut Product: All leafy greens have potential for fresh-cut marketing.

Special Considerations: Harvest workers should sanitize cutting tools periodically to avoid the spread of decay-causing microorganisms.

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