Parsley

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Scientific Name and Introduction: *Petroselinum crispum* (Mill.) Nyman ex A.W. Hill, parsley, is a member of the Apiaceae family. The edible foliage is grown as an annual and used as a garnish and food ingredient. Both curly-leaved (eg., Deep Green, Forest Green, Moss Curled) and flat-leaved (eg., Plain, Plain Italian Dark Green, Deep Green Italian) varieties are available. There is a subspecies, *P. crispum* subsp. *tuberosum*, Hamburg parsley, with an edible root. Parsley has very high vitamin and nutrient content. It is highest in calcium, iron and folate of all vegetables (Athar et al., 1999) studied, and among the highest contents of β-carotene, thiamin, riboflavin and vitamins C and E. A high proportion of the carotene is 9-cis β-carotene, possibly active against cancer and cardiovascular disease (Benamotz and Fishler, 1998).

Quality Characteristics and Criteria: The quality standards for parsley refer to freshness, green color, freedom from defects or seed stems and freedom from decay (USDA, 2002).

Horticultural Maturity Indices: Parsley can be harvested progressively or cut all at one time. Long petioles are desirable for bunching. Most of the U.S. crop is harvested by hand; gloves should be worn in the field.

Grades, Sizes and Packaging: Only one grade is available (U.S. No. 1), which consists of parsley of similar varietal characteristics, ie., not mixing curly- and flat-leaved varieties, that meet quality criteria. Parsley is usually packaged in cartons or jumbo crates of 60 bunches, 9 to 11 kg (20 to 25 lb).

Pre-cooling Conditions: Rapid removal of field heat without excessive drying is advantageous for retaining green color and freshness of parsley. Parsley can be pre-cooled with ice (package icing or liquid-icing (Cantwell and Reid, 1992) or by vacuum-cooling (Aharoni et al., 1989). Forced-air or hydro-cooling are commonly practised (Joyce et al., 1986).

Optimum Storage Conditions: The recommended conditions for commercial storage of parsley are 0 °C (32 °F) with 95 to 100% RH (UC-Davis, 2002). Parsley can be stored for 1 to 2 mo under these conditions, compared to only 3 days at 18 to 20 °C (64 to 68 °F) with 85 to 90% RH (Lisiewska et al., 1997). The endpoint of storage at 0 °C (32 °F) occurs when parsley wilts, at around 20% weight loss (Hruschka and Wang, 1979). MAP is effective in extending storage-life, but temperature changes and condensation must be avoided. Aharoni et al. (1989) showed that non-perforated polyethylene liners delayed yellowing and decay at low temperature. Park et al. (1999) achieved 77 days of storage at 0 °C (32 °F) or 35 days at 5 °C (41 °F), with good retention of firmness and vitamin C content, using a 40 µm-thick ceramic film. A pre-harvest spray with gibberellic acid may extend storage-life (Lers et al., 1998). Hamburg parsley roots (without leaves) can be stored at 0 °C (32 °F) for several mo (Bakowski et al., 1994; Elkner et al., 1998).

Controlled Atmosphere (CA) Considerations: Parsley can tolerate 8 to 10% O_2 + 8 to 10% CO_2 (Saltveit, 1997), but this may be of little benefit at 0 °C (32 °F). 10% O_2 + 11% CO_2 was optimal for delaying yellowing in parsley stored at 5 °C (41 °F) (Apeland 1971). Storage in 10% O_2 + 10% CO_2 (Yamauchi and Watada, 1993) or 10% CO_2 (Lers et al., 1998) delayed yellowing at room temperature.

Retail Outlet Display Considerations: Parsley is often sold in unsealed bunches. Light reduces yellowing, but levels in retail shelves are too low to have a significant effect. Use of ice or water sprays is

acceptable. If MAP is used during storage, care must be taken to prevent condensation during the retail period.

Chilling Sensitivity: Parsley is not chilling sensitive. It should be stored as cold as possible without freezing which occurs at -1.1 °C (30 °F).

Ethylene Production and Sensitivity: Parsley leaves produce very little ethylene but are very sensitive to ethylene (Joyce et al., 1986; Tsumura et al., 1993). Cantwell and Reid (1993) observed that parsley leaves produced 0.08, 0.44 and 0.80 μL kg^{-1} h^{-1} at 0, 10 and 20 °C (32, 50, 68 °F). As little as 0.4 μL L^{-1} is enough to accelerate yellowing if parsley is stored above 0 °C (32 °F) (Cantwell and Reid, 1993). Ethylene application does not stimulate respiration in parsley (Inaba et al., 1989).

Respiration Rates:

Temperature	mg CO_2 kg^{-1} h^{-1}
0 °C	22 to 38
5 °C	49 to 70
10 °C	78 to 150
15 °C	131 to 168
20 °C	176 to 221
25 °C	259 to 289

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 Apeland (1971), Hruschka and Wang (1979) and Cantwell and Reid (1986). Rates were measured 3 days after harvest.

Physiological Disorders: Wilting and yellowing signal the end of shelf-life. No particular disorders are described for parsley.

Postharvest Pathology: Both *Erwinia* and *Botrytis* can cause postharvest damage from rots and mold (Ryall and Lipton, 1979).

Quarantine Issues: None.

Suitability as Fresh-cut Product: Parsley flavor and aroma were retained better in perforated film packages than in sealed film packs (Manzano et al., 1995). Food safety is a major concern. Although chlorinated water is somewhat beneficial in reducing contamination (Park and Sanders, 1992) but personal hygiene of staff is paramount. Parsley has been implicated as a source of the following infectious agents: *Shigella* (Crowe et al., 1999), *Citrobacter freundii* (causing gastroenteritis and hemolytic uraemic syndrome; Tschape et al., 1995) and thermotolerant campylobacters (Park and Sanders, 1992).

Special Considerations: Parsley has an extremely high respiration rate. Young leaves respire at a higher rate than old leaves at harvest, but the respiration rate does not decrease as much after harvest in older leaves as in younger leaves, so younger leaves store better (Apeland, 1971).

Parsley contains furocoumarins, including psoralen (Manderfeld et al., 1997), which are effective antimicrobial agents, but can act as phototoxins inducing dermatitis (Lagey et al., 1995). Parsley is used as a medicinal plant to treat hypertension in Morocco (Ziyyat et al., 1997) and diabetes in Turkey (Tunali et al., 1999).

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