Cauliflower

Charles Forney[1] and Peter M. A. Toivonen[2]
Agriculture and Agri-Food Canada
[1]Atlantic Food and Horticultural Research Center, Kentville NS, Canada
[2] Pacific Agri-Food Research Center Summerland BC, Canada

Scientific Name and Introduction: *Brassica oleracea* L., *Botrytis* group, also known as cauliflower, is derived from the wild cabbage that is native to southern Europe. Cauliflower produces an edible head of malformed and condensed flowers (the curd) whose stalks are short, fleshy, and closely crowded. Cauliflower is sensitive to its growing environment and requires cool temperatures, plenty of moisture and good fertility to produce quality heads. Therefore, much of commercial production is in coastal areas having moderate temperatures, or the crop is grown to take advantage of the cooler times of the growing season.

Quality Characteristics and Criteria: Heads of high quality cauliflower are white to cream in color, firm and compact. The curds should be free of mechanical damage, decay, browning, or yellowing, which can be caused by sun exposure. Heads should be surrounded by a whorl of trimmed green turgid leaves.

Horticultural Maturity Indices: Harvest maturity is based on head diameter and compactness. Mature heads are > 15 cm (6 in) in diameter. Signs of over maturity include "riciness" that is caused by protruding immature floral parts, and browning or spreading of the curds.

Grades, Sizes and Packaging: There are two grades, U.S. No. 1 and U.S. Commercial. The grades are based on size, external appearance, decay, damage, and trimming (USDA/AMS, 1968). Heads are normally well-trimmed and packed in a single layer with 12 to 24 heads in a carton weighing 11.4 to 13.6 kg (25 to 30 lb). Cauliflower may also be packed in 27 kg (60 lb) wire-bound crates or 23 kg (50 lb) cartons/crates (Boyette et al., 1996). Cauliflower is commonly packed in the field, where leaves are trimmed closely to the head and heads are over-wrapped with a perforated plastic film. The over-wrap should have four to six 6-mm (0.25 in) holes to provide adequate ventilation but minimize dehydration. Individual florets are also cut and packed in 2.3 and 4.6 kg (5 and 10 lb) film bags for institutional use, or smaller units for consumer packs.

Pre-Cooling Conditions: Cauliflower is mostly vacuum- or hydro-cooled prior to storage or marketing. Vacuum-cooling works well for field packed heads and is more effective if cauliflower is wetted before cooling (Stewart and Barger, 1961). Forced-air cooling can also be used.

Optimum Storage Conditions: Commercial storage at 0 °C (32 °F) with 95 to 98% RH can maintain good quality for up to 3 weeks, or more depending on initial quality. Increasing RH to 98 to 100% can further reduce weight loss and maintain turgidity of the heads (van der Berg and Lentz, 1977), but free water accumulation on the curd must be avoided. Storage-life is about 7 to 10 days at 5 °C (41 °F), 5 days at 10 °C (50 °F), and 3 days at 15 °C (59 °F) (Herregods, 1964). Loss of quality during prolonged storage includes wilting, browning and spreading of curds, yellowing of leaves and decay.

Controlled Atmosphere (CA) Considerations: The benefits from CA and modified atmosphere are modest (Saltveit, 1997). Low O_2 (< 2%) in combination with 3 to 5% CO_2 may delay leaf yellowing and the onset of curd browning (Romo-Parada et al., 1989). However, injury may occur at < 2% O_2 and/or > 5% CO_2 (Lipton and Harris, 1976; Lipton et al., 1967). Injury may not be apparent until curds are cooked, when they become soft, grayish, and develop off-flavors. Storage in > 10% CO_2 can induce injury within 2 days.

Unlike broccoli, fresh cauliflower does not produce strong off-odors when held in low O_2 atmospheres (Forney and Jordan, 1999).

Retail Outlet Display Considerations: Bottom-icing of refrigerated displays enhance shelf-life of cauliflower. Plastic over-wraps are also important to minimize wilting during marketing.

Chilling Sensitivity: Cauliflower is not chilling sensitive.

Ethylene Production and Sensitivity: Cauliflower has a very low ethylene production rate of < 1 μL kg^{-1} h^{-1} at 20 ºC (68 °F). It is extremely sensitive to ethylene, with the most prevalent symptoms being curd discoloration and leaf yellowing and abscission.

Respiration Rates:

Temperature	mg CO_2 kg^{-1} h^{-1}
0 °C	16 to 18
5 °C	20 to 22
10 °C	32 to 36
15 °C	42 to 50
20 °C	74 to 84
25 °C	86 to 98

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 Suslow and Cantwell (1999).

Physiological Disorders: Black speck is a disorder where 0.5 to 4 mm (0.02 to 0.16 in) diameter necrotic lesions appear on the surface of branches or flower stalks in the interior of the curds. This disorder is more prevalent on certain cultivars and is most severe in cauliflower produced under periods of warm weather and rapid growth (Loughton and Riekels, 1988). Boron deficiency can result in brownish discoloration of the curd and pith of the stems and may result in hollow stems. In addition, blisters and cracks may form on the midribs of leaves and curds may taste bitter (Dearborn and Raleigh, 1935). Riciness has been described as loose curds with floral parts protruding and can be induced when plants are exposed to > 20 °C (68 °F) prior to curd initiation and to 7 °C (45 °F) thereafter (Wiebe and Krug, 1974). Over-maturity and storage at elevated temperatures encourages its development, while it can be reduced by timely harvest and storage at 0 °C (32 °F). Heads are susceptible to freezing injury, which appears as water-soaked and grayish curds, if held < 0.8 °C (30.6 °F).

Postharvest Pathology: The major causes of postharvest decay are bacterial soft rot caused by *Erwinia* and *Pseudomonas* spp., and brown rot caused by *Alternaria* spp. (Ceponis et al., 1987). Storing only good quality, disease-free heads and maintaining good temperature control can best control these decay organisms.

Quarantine Issues: None.

Suitability as Fresh-cut Product: Commonly converted to fresh-cut floret products.

Special Considerations: Growing conditions can strongly influence quality of fresh cauliflower. Heads must be protected from the sun, normally by tying the leaves, during development to prevent yellowing and strong flavor development in the curd. Only high quality heads should be stored or shipped long distances. Heads must be handled gently to avoid bruising which results in rapid browning and decay (Suslow and

Cantwell, 1999).

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