Cauliflower

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Scientific Name and Introduction

Brassica oleracea L., Botrytis group of the Brassicaceae (Cruciferae) family, is also known as cauliflower. It 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 are white to cream in color, firm, and compact. The curds should be free of mechanical damage, decay, browning, or yellowing, which can result from 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 larger than 15 cm (6 in) in diameter. Signs of overmaturity include “riciness” 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. Grading is based on size, external appearance, decay, damage, and trimming (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 overwrapped with a perforated plastic film. The overwrap should have four to six 6-mm (0.25-in) holes to allow 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.

Precooling Conditions

Cauliflower is mostly vacuum-cooled or hydrocooled 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 (below 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 below 2% O_2 and/or above 5% CO_2 (Lipton et al. 1967, Lipton and Harris 1976). Injury may not be apparent until curds are cooked, when they become soft, grayish, and develop off flavors. Storage at CO_2 levels above 10% 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 overwraps 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, <1 μL kg^{-1} h^{-1} at 20 °C (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

Data from Suslow and Cantwell (2008).

To get mL CO_2 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 tonne per day.

Physiological Disorders

Black speck is a disorder in which necrotic lesions 0.5 to 4 mm (0.02 to 0.16 in) in diameter 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 during 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 is a developmental disorder in which elongation of flower stems causes flower clusters to separate, making the head appear granular. Overmaturity and storage at elevated temperatures encourages development of riciness, which 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 below 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

Cauliflower is commonly converted to fresh-cut floret products.

Special Considerations

Growing conditions can strongly influence the quality of fresh cauliflower. Heads must be protected from the sun, normally by tying leaves subtending the head together, 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 2008).

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Acknowledgments

Some of the information included was obtained from the Oregon State University website on "Commercial Vegetable Production Guides" *At* http://horticulture.oregonstate.edu/content/vegetable-production-guides.

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