

# Nopalitos

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**Scientific Name and Introduction:** Cactus stems or “nopalitos” in Spanish are the rapidly growing succulent stems (cladodes) of the Prickly Pear Cactus (*Opuntia* spp). They are a warm season vegetable and available year-round, being grown in California as a specialty vegetable or imported from Mexico, where they are a traditional vegetable. Although the young stems of many *Opuntia* species can be eaten, most commercial plantings of nopalitos are from *O. ficus-indica* and *O. inermis*. Nopalitos are mostly water (92%) and carbohydrates, including fiber (4 to 6%) and a little protein (1 to 2%). They also contain some minerals, principally calcium (1%), and moderate amounts of vitamin C and vitamin A. Their composition is similar to dark green leaf lettuces (Rodríguez-Felix and Cantwell, 1988).

**Quality Characteristics and Criteria:** Good quality nopalitos are fresh, turgid and a brilliant green color. In the early stages of growth, vestigial true leaves, usually subtended by spines, are present on the stems, but the leaves often abscise by the time nopalitos reach commercial size. However, if the true leaves remain on the stem and are green, this is an additional indication of freshness. Nopalitos should be harvested when young and tender and not early in the morning to avoid a high acid content (see “Special Considerations”).

**Horticultural Maturity Indices:** Nopalitos are harvested based on size and can be Small, < 10 cm (4 in) long; or Medium, < 20 cm (8 in) long. Medium are about 100 g (0.2 lb) in size. Over-mature nopalitos are thick with lots of spongy white tissue and are acidic in flavor.

**Grades, Sizes and Packaging:** There are no Grades. They are packed according to size and quality. The fruit are typically loose packed in 4.5 to 9.0 kg (10 or 20 lb) cartons or boxes.

**Pre-cooling conditions:** Nopalitos should be cooled to about 5 °C (41 °F) to reduce loss of visual appearance (shiny surface) due to water loss. They are usually room-cooled, but also may be forced-air cooled. Hydro-cooling should be avoided as it favors discoloration in damaged areas (especially where spines have penetrated the surface) and decay.

**Optimum Storage Conditions:** Good quality can be maintained for 3 weeks at 5 °C (41 °F) and 2 weeks at 10 °C (50 °F) with 95 to 99% RH (Cantwell et al., 1992). Major factors limiting storage-life of nopalitos are decay and dehydration. Nopalitos stored under ambient conditions rapidly lose their brilliant shiny appearance, become dull-green and may begin to yellow and curve inward due to water loss. Some discoloration (chilling injury) occurs if stored longer than 3 weeks at 5 °C (41 °F) (Cantwell et al., 1992).

**Controlled Atmosphere (CA) Considerations:** No information is available on the potential benefits of CA or MAP of nopalitos. For diced product, 5 to 10% CO<sub>2</sub> may be beneficial (Cantwell, unpublished).

**Retail Outlet Display Considerations:** Nopalitos should be kept in a refrigerated display case to reduce water loss and curvature. They should not be sprinkled or top iced.

**Chilling Sensitivity:** Nopalitos are chilling sensitive when stored below 10 °C (50 °F). Chilling damage may be manifested as a superficial bronzing or discoloration and increased susceptibility to decay. Symptoms may appear after 3 weeks at 5 °C (41 °F) (Cantwell et al., 1992) or sooner (Ramayo-Ramirez et al., 1978).

**Ethylene Production and Sensitivity:** Ethylene production rates are very low at 0.05, 0.1 and 0.22 nL kg<sup>-1</sup> h<sup>-1</sup> at 5, 10 and 20 °C (41, 50, and 68 °F), respectively (Cantwell et al., 1992). Nopalitos are not sensitive to ethylene exposure, but exposure at warm temperatures will enhance yellowing.

**Respiration Rates:**

Temperature	mg CO <sub>2</sub> kg <sup>-1</sup> h <sup>-1</sup>
5 °C	16 to 19
10 °C	38 to 42
15 °C	52 to 59
20 °C	68 to 79

These are average rates for 10 cm (4 in) nopalitos over a 7-day period at the indicated temperatures. Initial rates are about 50% higher. Respiration rates of 20 cm (8 in) stems are about 50% lower than rates of 10 cm (4 in) stems. To get mL kg<sup>-1</sup> h<sup>-1</sup>, divide the mg kg<sup>-1</sup> h<sup>-1</sup> 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<sup>-1</sup> h<sup>-1</sup> by 220 to get BTU per ton per day or by 61 to get kcal per metric ton per day.

**Physiological Disorders:** See section on “Chilling Sensitivity.”

**Postharvest Pathology:** Decay at the cut stem end may be a problem if nopalitos are stored > 2 weeks. Decay can be avoided by insuring that nopalitos are not damaged when cut from the plant. Fungicide dips reduce postharvest decay of nopalitos, but are not used commercially (Ramayo-Ramírez et al., 1978).

**Quarantine Issues:** None.

**Suitability as Fresh-cut Product:** Some types of nopalitos are spiny, and therefore a cleaned and diced product is an attractive option. Reducing brown discoloration at cut surfaces and preventing fluid (mucilage) loss are the main problems in handling diced cactus stems. Cut nopalitos cannot be washed before marketing, because it will cause mucilage to exude and enhance discoloration of cut surfaces. Notwithstanding the chilling sensitivity of intact nopalitos, they should be stored between 0 and 5 °C (32 and 41 °F) (Cantwell, unpublished). Shelf-life of diced nopalitos was 1 day at 20 °C (68 °F) and 6 days at 5 °C (41 °F) (Rodríguez-Felix and Soto-Valdez, 1992). Moderate CO<sub>2</sub> (5 to 10%) CA may be useful to reduce discoloration and other visual defects of cut nopalitos (Cantwell, unpublished).

**Special Considerations:** Cactus stems should be harvested and handled with care to avoid mechanical damage, especially due to spines from one stem penetrating the neighboring stem. Spine damage leads to a rusty-brown discoloration and pathological problems

Because the prickly pear plant is a CAM plant (Crassulacean Acid Metabolism) and fixes CO<sub>2</sub> at night as malic acid before converting it to sugars during the day, the acid content of nopalitos may fluctuate greatly and affect their flavor (Rodríguez-Felix and Cantwell, 1988). Therefore, it is recommended that stems be harvested 2 to 3 h after sunrise. Small nopalitos, however, are not CAM-active. Also, low temperature storage at 5 °C (41 °F) maintains acid levels, while warmer storage conditions of 15 to 20 °C (59 to 68 °F) result in decreased acid (Cantwell et al., 1992).

**References:**

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