College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Fruit, Nut, and Beverage Crops
May 2014
F_N-28

Dragon Fruit: Postharvest Quality-Maintenance Guidelines

Robert E. Paull
Department of Tropical Plant and Soil Sciences University of Hawaii at Manoa, Honolulu, HI

The dragon fruit, known as strawberry pear, thang loy (Vietnamese), pitaya roja (Spanish), and la pitahaya rouge (French), grows on a tropical climbing cacti. The normally white-fleshed *Hylocereus undatus* is grown commercially, as is the red- or purple-fleshed *H. costaricensis* (grown in Nicaragua and possibly Guatemala) and *H. polyhizus* (grown in Israel). There is often some confusion as to the precise species being grown (Paull and Duarte 2012). There are yellow clones of *H. undatus* named pitaya amarilla (yellow pitaya) in Mexico and other Latin American countries. Pitaya amarilla is a different species from the other yellow pitaya, *Selenicereus megalanthus* (Mizrahi et al. 1997). One type of dragon fruit grown in Vietnam is a self-compatible cultivar (Mizrahi et al. 1997, Nerd and Mizrahi 1997).

Dragon fruit, *Hylocereus spp.*

Quality Characteristics and Criteria

The dragon fruit is a large, oblong fruit with a red peel and large green scales. The scales turn yellow upon ripening. Skin color begins to change 25 to 30 days from flowering in both *H. undatus* and *H. polyhizus*. At about the same time, 33 to 37 days after flowering, flesh firmness approaches a minimum and eating quality approaches a maximum (Nerd et al. 1999). Fruit can be harvested from 25 to 45 days from flowering; 32 to 35 days was recommended by Nerd et al. (1999).

Fruit size depends on seed number (Weiss et al. 1994). The flesh of different species can vary from white through various hues of red to very dark red. As the fruit matures, acidity reaches a peak just as the skin color change occurs, then declines 25 to 30 days after flowering (Nerd et al. 1999, Le et al. 2000a). At this stage, SSC increases to about 14% (Nerd et al. 1999, Le et al. 2000a).

Horticultural Maturity Indices

A common index of maturity is skin color change to almost full red (Nerd et al. 1999). Harvesting indices include color, SSC, TA, and days-from-flowering (minimum 32 days). A SSC:TA of 40 has been suggested as a harvest index.

Grades, Sizes and Packaging

There are no U.S. or international standards. Fruit are generally graded by size and color. Size grades sug-

Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, under the Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i 96822.
Copyright 2011, University of Hawai'i. For reproduction and use permission, contact the CTAHR Office of Communication Services, ocs@ctahr.hawaii.edu, 808-956-7036. The university is an equal opportunity/affirmative action institution providing programs and services to the people of Hawai'i without regard to race, sex, gender identity and expression, age, religion, color, national origin, ancestry, disability, marital status, arrest and court record, sexual orientation, or status as a covered veteran. Find CTAHR publications at www.ctahr.hawaii.edu/freepubs.

Dragon fruit on display.

gested for Vietnam are the following: Extra large fruit greater than 500 g (1.1 lb), large 380 to 500 g (0.84 to 1.1 lb), regular 300 to 380 g (0.66 to 0.84 lb), medium 260 to 300 g (0.57 to 0.66 lb), small less than 260 g (Le et al. 2000a). Fruit exported from Israel to Europe are graded by number of fruits: 6, 8, 10, 12, 14, or 16 per 4-kg (8.8-lb) cardboard box.

Pre-Cooling Conditions

There are no reported data. Room-cooling and hydrocooling are possible.

Optimum Storage Conditions

The recommended storage temperature for dragon fruit is 10°C (50°F), since 6°C (42.8°F) can induce chilling injury (Nerd et al. 1999). The lower temperature (6°C) has been recommended for the yellow pitaya *Selenicereus megalanthus* (Nerd and Mizrahi 1999), and this agrees with minimum growth temperature of 7°C (44.6°F) for this species (Nerd and Mizrahi 1998). Dragon fruit has a storage-life of about 14 days at 10°C (50°F), while at 5°C (41°F) and 90% relative humidity a storage-life of 17 days can be achieved (Le et al. 2000a) if the fruit is harvested 30 to 35 days from flowering. However, 5°C (41°F) may lead to chilling injury upon return to 20°C (68°F), indicated by deterioration of peel and flesh, and inferior taste (Nerd et al. 1999). Hence, 10°C (50°F) for a maximum of 14 days may be a better recommended storage temperature.

Controlled Atmospheres (CA) Consideration

No reported CA data are available. Fruit harvested 28 to 30 days after flowering and stored in a modified-atmosphere (MA) bag (O_2 transmission rate 4000 mL m^{-2} day^{-1}) can be held for 35 days at 10°C (50°F), versus 14 days for air controls (Le et al. 2000b). More mature fruit (40 days from flowering) in the same MA bag had 50% of the shelf-life.

Retail Outlet Display Considerations

Display at 10°C (50°F). Do not mist.

Chilling Sensitivity

Flesh translucency is a symptom of chilling injury. Other symptoms include softening, wilting, darkening of scales, browning of outer flesh, and poor flavor. These symptoms rapidly develop on *H. undatus* and *H. polyhizus* fruit held at 6°C (42.8°F) for 2 weeks then transferred to 20°C (68°F) (Nerd et al. 1999). Fruit harvested 25 days from flowering are more sensitive to chilling (6°C, 7 days); sensitivity is significantly reduced when fruit are harvested 30 to 35 days from flowering (6°C, 17 days).

Ethylene Production and Sensitivity

Non-climacteric, with ethylene production rates of 0.025 to 0.091 µL kg^{-1} h^{-1} (Nerd et al. 1999). Ethylene treatment does not initiate color development (Le et al. 2000b).

Respiration Rates

The maximum respiration rate of these non-climacteric fruit (*H. undatus* and *H. polyhizus*) occurs during early fruit growth (Nerd et al. 1999, Le et al. 2000a). See Table 1 for the respiration rate for mature fruit.

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.

Table 1. Respiration Rates

Temperature	mg CO_2 kg^{-1} h^{-1}
20°C	95 to 144 (Nerd et al. 1999)
23°C	75 to 100 (Le et al. 2000a)

Physiological Disorders

Chilling injury, mechanical injury, and water loss are the three major disorders of dragon fruit. Mechanical injury leads to development of sunken areas. More mature fruit are more susceptible to mechanical injury (Le et al. 2000a). Splitting is a problem in fruit more than 35 days from flowering that have received rainfall or excessive irrigation during ripening (Le et al. 2000a).

Postharvest Pathology

Bacterial (*Xanthomonas campestris*) and fungal (*Dothiorella* spp.) diseases have been reported (Barbeau 1990). Postharvest disease has been associated with *Fusarium lateritium*, *Aspergillus riger*, and *Aspergillus flavus* (Le et al. 2000a). No commercially significant bacterial or fungal diseases have been experienced in Israel.

Quarantine Issues

Dragon fruit are a fruit fly host. Irradiation at 300 Grays may have potential for disinfestation. In Israel, no insect problems have been observed in commercial production, and the fruit's status as a fruit fly host may need to be re-evaluated.

Suitability as Fresh-Cut Product

Dragon fruit are often available as a fresh-cut product in South East Asian markets in trays with over-wrap. There is some potential, as fresh-cut fruit can be stored at 4°C (39.2°F) for 8 days (Le et al. 2000b).

Special Considerations

Fruit are very low in vitamin C but rich in potassium (Le et al. 2000a).

An earlier version of this article was originally published at the USDA's website: www.ba.ars.usda.gov/hb66/contents.html

References

Barbeau, G. 1990. La pitahaya rouge, an nouveau fruit exotique. *Fruits* 45:141–147.

Le, V.T., N. Nguyen, D.D. Nguyen, K.T. Dang, T.N.C. Nguyen, M.V.H. Dang, N.H. Chau, and N.L. Trink. 2000a. Quality assurance system for dragon fruit. *ACIAR Proceedings* 100:101–114.

Le V.T., D. Nguyen, N. Nguyen, K.T. Dang, T.N.C. Nguyen, M.V.H. Dang, N.H. Chau, and N.L. Trink. 2000b. The effects of harvesting time, use of plant growth regulators and modified atmosphere packages on storage-life and the quality of dragon fruit grown in Vietnam. *Intl. Symp. Trop. Subtrop. Fruits,* Cairns, Australia.

Mizrahi, Y., A. Nerd, and P.S. Nobel. 1997. Cacti as crops. *Hort. Rev.* 18:291–319.

Nerd, A. and Y. Mizrahi. 1997. Reproductive biology of cactus fruit crops. *Hort. Rev.* 18:321–346.

Nerd, A. and Y. Mizrahi. 1998. Fruit development and ripening in yellow pitaya. *J. Amer. Soc. Hort. Sci.* 123:560–562.

Nerd, A. and Y. Mizrahi. 1999. The effect of ripening stage of fruit quality after storage of yellow pitaya. *Postharv. Biol. Technol.* 15:99–105.

Nerd, A., F. Gutman, and Y. Mizrahi. 1999. Ripening and postharvest behaviour of fruits of two Hylocereus species (Cactaceae). *Postharv. Biol. Technol.* 17:39–45.

Paull, R.E. and O. Duarte. 2012. Tropical Fruit - Volume II. Chapter 12. pp. 303–361. CAB International, Wallingford, UK.

Weiss, J., A. Nerd, and Y. Mizrahi. 1994. Flowering behavior and pollination requirements in climbing cactus with fruit crop potential. *HortScience* 29:1487–1492.