Dragon Fruit

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Scientific Name and Introduction

Dragon fruit (*Hylocereus* spp.), also known as strawberry pear or thang loy (Vietnamese), pitaya roja (Spanish), and la pitahaya rouge (French), grows on a tropical climbing cactus. There is some confusion as to what species is being grown as they are all referred to as "pitahaya" in Spanish. The normally white-fleshed *Hylocereus undatus* is grown commercially, as are the red- or purple-fleshed *H. costaricensis* (grown in Nicaragua and possibly Guatemala) and *H. polyhizus* (grown in Israel). 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). Dragon fruit is a self-compatible cultivar in Vietnam (Mizrahi et al. 1997, Nerd and Mizrahi 1997).

Quality Characteristics and Criteria

Dragon fruit is a large, oblong fruit with a red peel and large, green scales. The scales turn yellow on ripening. The skin begins to change color 25 to 30 days after flowering in both *H. undatus* and *H. polyhizus*. At about the same time flesh firmness approaches a minimum, and eating quality approaches a maximum 33 to 37 days after flowering (Nerd et al. 1999). Fruit can be harvested 25 to 45 days after 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 to 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. 2000). At this stage, soluble solids content (SSC) increases to about 14% (Nerd et al. 1999, Le et al. 2000).

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, total acidity (TA), and days from flowering (minimum 32 days). An 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 suggested for Vietnam are extra large (over 1.1 lb or 500 g), large (0.84 lb-1.1 lb or 380-500 g), regular (0.66-0.84 lb or 300-380 g), medium (0.57-0.66 lb or 260-300 g), and small (under 0.57 lb or 260 g) (Le et al. 2000). Fruit exported from Israel to Europe are graded by number of fruit per 8.8-lb (4-kg) cardboard box: 6, 8, 10, 12, 14, and 16.

Precooling 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 (43 °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 (45 °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% RH, a storage life of 17 days can be achieved (Le et al. 2000) if fruit are harvested 30 to 35 days after flowering. However, 5 °C (41 °F) may lead to chilling injury on return to 20 °C (68 °F), as indicated by peel and flesh deterioration and inferior taste (Nerd et al. 1999). Thus, 10 °C (50 °F) for a maximum of 14 days may be a better recommended storage temperature.

Controlled Atmosphere (CA) Considerations

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 4,000 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 after flowering) in the same MA bag had 50% of the shelf-life.

Retail Outlet Display Considerations

Display dragon fruit at 10 ºC (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 the 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 after flowering are more sensitive to chilling (6 °C, 7 days). Sensitivity is significantly reduced when fruit are harvested 30 to 35 days after flowering (6 °C, 17 days).

Ethylene Production and Sensitivity

Dragon fruit are nonclimacteric, 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. 2002).

Respiration Rates

The maximum respiration rate of these nonclimacteric fruit *(H. undatus* and *H. polyhizus)* occurs during early fruit growth (Nerd et al. 1999, Le et al. 2000). The following respiration rates are for mature fruit:

Temperature	mg CO_2 kg^{-1} h^{-1}
20 °C	95 to 144
23 °C	75 to 100

Data from Nerd et al. (1999) and Le et al. (2000), respectively.

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

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

Postharvest Pathology

Bacterial *(Xanthomonas campestris)* and *Dothiorella* spp. diseases have been reported (Barbeau 1990). Postharvest disease has been associated with *Fusarium lateritium*, *Aspergillus riger*, and *Aspergillus flavus* (Le et al. 2000). 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 has 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 reevaluated.

Suitability as Fresh-Cut Product

Dragon fruit are often available as a fresh-cut product in Southeast Asian markets in trays with overwrap. There is some potential, as fresh-cut fruit can be stored at 4 °C (39 °F) for 8 days (Le et al. 2002).

Special Considerations

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

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