

The Pitaya or Dragon Fruit

(Hylocereus undatus)

L. Luders* and G. McMahon, Senior Technical Officer, Crops, Forestry and Horticulture, Darwin
* Formerly DPIFM

INTRODUCTION

Plants in the cactus family, Cactaceae, originated in North, Central, and South America. They are widely distributed, from coastal areas, to high mountains, and in tropical rainforests. Their appearance is just as variable, from thimble-size species, to enormous column species, and the epiphytic (climbing) species.

The cactus family are highly adaptable to a new environment. The plants are able to tolerate drought, heat, poor soil, and cold. The modification of the stem for water storage, the reduction or absence of leaves, the waxy surfaces, and night-time opening of the tissues for carbon dioxide uptake (the CAM process), enable the plants to tolerate harsh conditions. Terms used to describe plants with such adaptations include xerophyte and succulent.

These adaptations to survive dry, hot conditions, apply to the above-ground plant. The roots are non-succulent and require small amounts of water and cooler temperatures. Cacti will not tolerate saline or water-logged conditions, nor will they grow where there is an absence of plant life.

In their native lands, the plants were used for many purposes, but one of major importance is the fruit as a food source. Fruit was collected from naturally established stands. Later, cuttings were taken from highly productive plants and grown around houses. A similar process is now in place in several countries around the world to establish plantations of cacti with edible fruit, from column, shrubby and climbing types.

Epiphytic or climbing cacti use their adventitious roots from the stems to cling to rocks and trees for support. These roots do not feed from the host plant. The aerial roots collect water and nutrients from their surroundings, enabling the plant to survive if the base is severed. This feature also allows the plants to be successfully grown from cuttings.

Hylocereus undatus (Haworth) Britt and Rose, a climbing cactus thought to be from the tropical rainforests of Central and northern South America, is one species that has been used as a food source. It has already received worldwide recognition as an ornamental plant for the large, scented, night-blooming flowers. Its fame is now spreading throughout the world for its fruit, especially in Israel, Vietnam and Australia.

Other climbing cactus species grown for the edible fruit include *Hylocereus polyrhizus* and *Selenicereus megalanthus*. *H. polyrhizus* has red skin and red flesh dotted with edible black seeds, while *S. megalanthus*,



the pitaya amarillo or yellow pitaya, has yellow skin and clear to white flesh containing edible black seeds. Columnar cacti, such as *Cereus peruvianus* - the apple cactus, and the shrubby *Opuntia* species - the cactus (prickly) pears, are also grown for their edible fruit.

The *Opuntia* species are also well known due to their noxious weed status. Plants spread and establish rapidly from seeds and vegetative pieces. The potential for *Hylocereus* to become a weed is unknown at this stage.

GROWING AREAS

In Mexico, Guatemala, and northern South America, the cactus fruits are known as pitaya, pitahaya, pitajaya, pitaya roja, and pitahaya de Cardón. In Israel, the name pitaya has been adopted. In Vietnam, the fruit is called Dragon fruit or Thanh Long.

The plants grow naturally in Mexico, Central and South America and are also planted in backyards. Orchards are now established to provide fruit for the local and export markets in North America and Europe.

Hylocereus undatus is not able to tolerate the intense sunlight in Israel. Plantations are established in shade houses on metal trellis systems to provide fruit to the local and export markets in Europe.

About 100 years ago, the French brought *H. undatus* into Vietnam, where it was grown exclusively for the king. Later, it became popular with the wealthy families throughout the country. More recently, it has been established as a backyard and orchard plant, providing fruit to the local and export markets in South East Asia and Europe.

FRUIT APPEAL

So successful is the fruit in Vietnam, that at times it is the major export item, and can fetch higher prices than durian - the 'King of Fruits' in South East Asia. Formerly uncultivated, marginal lands are used to establish *H. undatus* orchards. The plants are grown on concrete or wooden posts, trees and fences, for support. The branches are encouraged to hang down to promote flowering and fruit set. Water and fertiliser requirements may be lower when compared to other tropical fruit species grown in these areas.

The attractive colours in the fruit encourage people to buy. The bright red or pink skin glows, the green scales enhance the red skin colour, and the brilliant white flesh looks even more enticing dotted with the tiny, edible, black seeds. The fruit is considered gourmets' delight, creating a spectacular centrepiece on any table.

USES FOR THE FRUIT

H. undatus fruit is highly appreciated when served chilled and cut in half to reveal the attractive colours. The flesh and seeds are scooped out with a spoon, much like a kiwi fruit. The flesh is firm and crisp, with a delicately sweet and lingering flavour. The juicy flesh can also be mixed with milk or sugar, used in marmalades, jellies, ices and soft drinks.

FLOWERING AND FRUITING

In warm climates, the dry season is when active growth slows or stops. *H. undatus* flowers are self-compatible, producing fruit with one species, but cross-pollination with other *Hylocereus* species can occur. *H. undatus* is a long-day plant, requiring longer day lengths to induce flowering. In the Northern Hemisphere, the main fruiting season occurs between May to October. Recent observations indicate the season in Darwin extends from October to April. *H. polyrhizus* is not so reliant on day length and will produce some fruit most of the year.

Buds are contained in aerioles along the three-ribbed stem and emerge in the summer months. Once emerged, the buds then form into branches or flowers. The scented, white, night-blooming flowers attract bats and moths. Bees and other insects visit the flowers before dusk as the petals open and after dawn as the flowers begin to close. Flowers only open for two days, after which, fruit set and development is rapid. Fruit can be harvested approximately 28 days after the flower closes. The fruit must be fully expanded and have 85% pink colour in the skin. Fruit can be left on the stem from 10 to 15 days at this stage, albeit at the risk of attack by birds.



The average fruit weight is 350 g. The flowers and fruit can be thinned to one to two fruit per branch, to produce fruit of an even size and quality for the export market.

An unripe fruit contains mucilage, a sticky substance, which makes the fruit unappealing. Fruit is cut from the stem at the full-colour stage and packed for the market. At the full-colour stage, the skin becomes pink-red and the scales remain green. The fruit is non-climacteric, having the best flavour, soluble sugar level and acidity when harvested at the full colour stage. Fruit will colour up at the green-pink stage, but full flavour does not develop.

Pitaya can be stored for two to three months at 7-10°C with a relative humidity of 90-98%. The yellow pitaya (*S. megalanthus*) can be stored for four weeks at 10°C, and a week or more at 20°C. The relative humidity for both temperatures is 60-70%.

In Vietnam, a second fruiting season is possible using lights to extend the day length or potassium nitrate to induce flowering. Induction commences 70 days before the expected harvest although less fruit is produced from flower induction.

ORCHARD MANAGEMENT

Seedlings are slow growing, and unreliable for fruit production making them unfavourable for propagation. Healthy, green cuttings are preferred for rapid propagation. Cuttings should be obtained from proven fruiting plants, and should be about 30 cm in length for successful establishment. The cutting is cured by storing in a dry place for a week before potting into a free-draining mix. Cuttings need to be shaded and require minimal water and fertiliser before the roots develop. Once the roots have developed, the plants can be sun-hardened and planted into a mounded area.

Plants should be established on well-drained beds, up to 300 mm high, 2.5-3 m apart within a row and 3-4 m between rows, depending on the size of orchard equipment. Concrete or wooden posts (treated timber should be avoided) can be used as support, with a frame on top to train the branches. A suggested post size is 300 mm diameter and 2 m high, with 600 mm buried in the ground. One to four plants can be used for each post depending on post size. A single leader stem is grown up the post, with side branches removed, until the top of the post is reached.



Branches then need to hang down to flower and fruit, and training is easier at midday when the branches are soft.

Red flesh pitaya is different in its growth habit and prefers to sprawl along a trellis or on a fence line. Plants are grown along the row at 1-2 m spacings and the lateral branches tied to the fence for support.

The majority of roots are found in the top 15-30 cm of soil and irrigation is required to ensure the soil does not dry out completely. Wet and dry periods during fruit development may lead to splits in the fruit. Irrigation is used to maintain water levels in the soil during fruit development to prevent splits. Thick mulch placed on the mound, but away from the stem, will also slow water loss.

Many of the fruiting cacti grow naturally in areas with high minerals, lime and decaying organic matter. A balanced NPK fertiliser, organic fertiliser, lime, and foliar fertiliser during fruit growth are required by *H. undatus*. Fertiliser is included in the planting hole and then applied after the first month. Fertiliser can be applied as granules or through the irrigation. Nitrogen is required during vegetative growth, but is normally reduced during the resting and pre-flowering stages. A suggested fertiliser program of NPK, dolomite, and dynamic lifter can be applied on alternate months at a rate of 100 g/plant (see table below).

	J	F	M	A	M	J	J	A	S	O	N	D
NPK												
Dolomite												
Dynamic Lifter												
Mulch												

Pruning the tips allows easy access through the orchard and is used for flower and fruit thinning. An open, manageable, and productive canopy is maintained by thinning the branches. A plant in the first year should have 30 branches, increasing to 130 branches in the fourth year. After harvest, the plant is pruned to a maximum number of 50 main branches, with one to two secondary branches on a main branch. (Refer to the Pitaya Pruning Information Sheet - IO11)

Cacti may be attacked by a range of pests that should be monitored and controlled with appropriate measures. Pests can include ants, scale insects, mealy bugs, beetles, slugs, borers, caterpillars, nematodes, fruit flies, mice, rats and birds. Some, or all of these, may be present on *H. undatus*. A soft watery rot can occur from injury, such as sunburn, or wet conditions. For information on insect control, please refer to the DPIFM Entomology website at <http://pestinfo.nt.gov.au/>

THE FUTURE

H. undatus has a niche market in Australia at present. Prices are dependent on the demand for the fruit. The ease of establishment and rapid growth may quickly lead to an over supply in the market. The export potential for *H. undatus* from Australia is unknown at this stage.

Please visit us at our website:

www.nt.gov.au/dpifm

Department of Primary Industry, Fisheries and Mines

© Northern Territory Government, 2006

ISSN 0157-8243

Serial No. 778

Agdex No. 238/10

Disclaimer: While all care has been taken to ensure that information contained in this Agnote is true and correct at the time of publication, the Northern Territory of Australia gives no warranty or assurance, and makes no representation as to the accuracy of any information or advice contained in this publication, or that it is suitable for your intended use. No serious, business or investment decisions should be made in reliance on this information without obtaining independent/or professional advice in relation to your particular situation.