



Pitahaya or Dragon Fruit Production in California & A Research Update

**2015 Pitahaya Production Seminar
San Marcos, CA**

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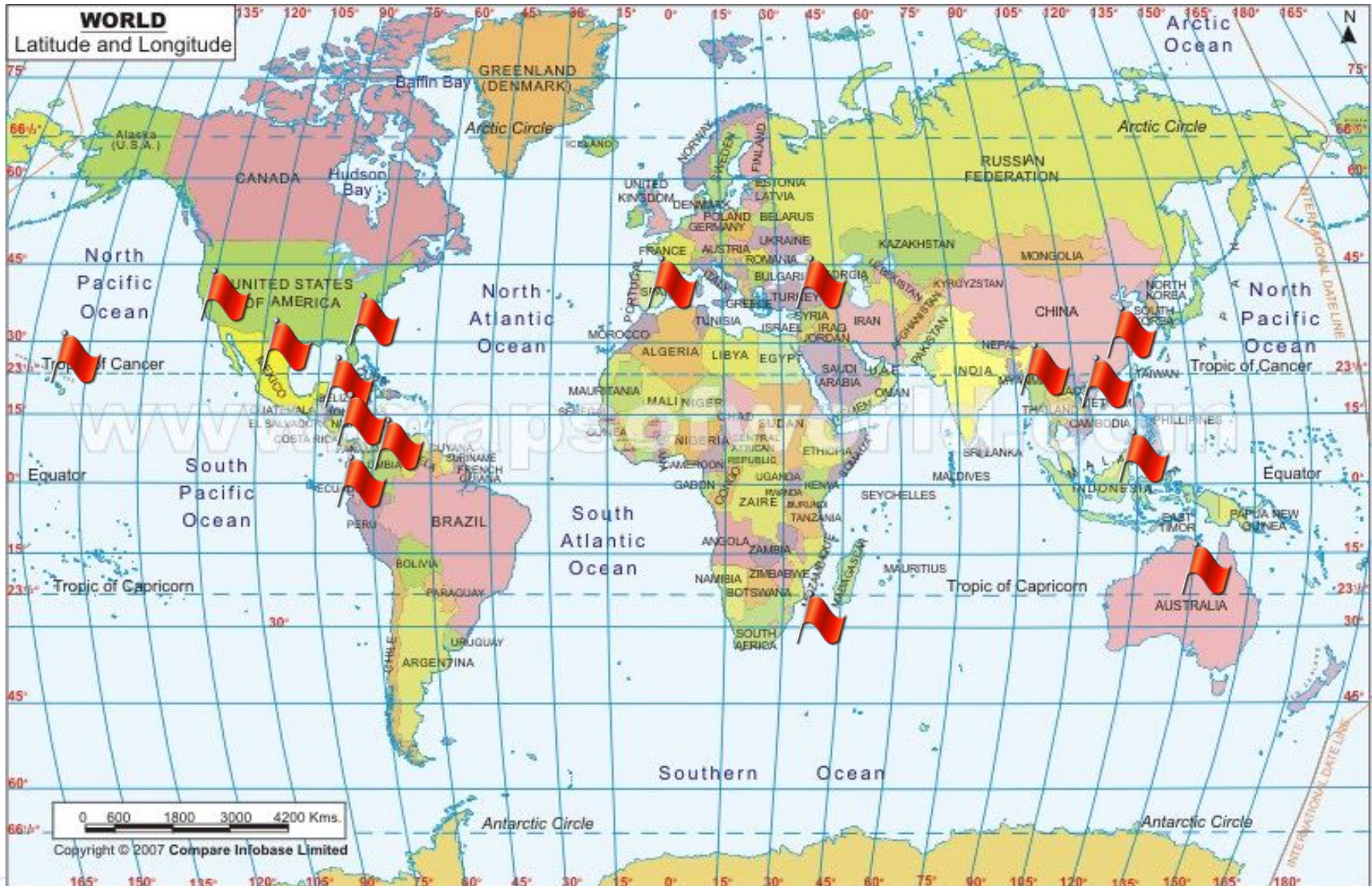
Overview

- Background
- Pitahaya production worldwide
- Why pitahaya research?
- Current research efforts at UC
- Field observations & results to date
- Marketing and Economic Prospects
- What next?

Pitahaya Types

- Several species of *Hylocereus* identified, but there is uncertainty about proper identification
- Differentiated by stem & fruit characteristics (bracts, shape and fruit color - skin and flesh)
- Two commonly available in CA:
 - *Hylocereus undatus* (red skin, white flesh)
 - *Hylocereus* sp. (primarily red skin & red flesh)
- Many *Hylocereus* hybrids (several skin and flesh colors combinations, from yellow to deep magenta or dark red)
- *Selenicereus megalanthus* - Yellow or Colombian, yellow, thorny skin and white, translucent flesh
 - Reclassified as *Hylocereus megalanthus*

Dragonfruit Production



Central & South America

- Nicaragua is main producer of *Hylocereus* sp. (red flesh) in Central America
 - 1000-1200 Hectares planted under various
 - Fresh fruit exported to Canada and Europe (APRONOT) & pulp exported to US and Japan
- Colombia top producer of yellow pitahaya (*S. megalanthus*)
- Ecuador also producing both *Hylocereus* sp. and *S. megalanthus*
- Backyard/small scale production in Guatemala, El Salvador, Honduras, Costa Rica

Nicaraguan Production





Asia, Africa, Australia

- Vietnam main producer of *Hylocereus undatus* in South East Asia (Est. 40,000 Has)
 - Predominantly white flesh fruit, but converting to red flesh
 - Export based industry targeting the US, China & Europe
 - Fruit exported to the US must be irradiated – very costly!
- Thailand (~ 3000 Has.), Malaysia (~500 Has.), Indonesia, Taiwan and the Philippines also becoming important producers
- Israel (~100-200 Has.) has been significant producer/shipper to the European Union
- South Africa and Australia increasing production

U.S. Production

- US production is limited, but acreage increasing rapidly (1000-1200 acres)
 - California (400 - 500 acres.)
 - Florida (500 - 600 Acres)
 - Hawaii (100 - 200 Acres)
- Mostly white fleshed varieties used for fresh consumption or for décor/garnish
- Market is turning red...Pink/Red fleshed varieties becoming more popular





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Commercial Varieties?

- Five clones grown commercially in Nicaragua
 - Orejona, Rosa, Cebra, Lisa, San Ignacio
 - Many other clones available
 - All produce fruit without hand pollination
- Several clones promoted as “superior” but no replicated research data available
- Improved, proprietary varieties available from Israel, Taiwan and private breeders in US
- Big challenge for commercial production and main reason for our research project

Our Research Efforts to Date

- Evaluated varieties for commercial production in California (Bender, Tanizaki)
- Develop post harvest management and information and strategies (Cantwell, Tanizaki)
- Genetic characterization of pitahaya accessions using AFLP markers (Douhan, Vidalakis, Pagliacia)
- Confirm presence of Cactus Virus X (CVX) and screen pitahaya accessions for the virus (Mathews, De Soto, Aguiar, Tanizaki)
- Sensory evaluation of selected varieties of Pitahaya (Cantwell, Arpaia, Ovenland)

Ongoing/Future Research

- Variety evaluation in Ventura and Riverside Counties
- Assess irrigation requirements of Pitahaya (CV. Lisa & Physical Graffiti) under two trellis systems
- Evaluate the response of pitahaya under shade/protected environment
- Assess fertility requirement of pitahaya or dragon fruit in Southern California
- Monitor and catalogue pests and disease incidence

Growing Pitahayas: Tips for New & Existing Growers

[http://ucanr.edu/sites/sdsmallfarms/
Crop_Production_Videos/](http://ucanr.edu/sites/sdsmallfarms/Crop_Production_Videos/)

SITE SELECTION

- In general, pitahayas grow well where Hass avocados grow
 - Frost free tropical/subtropical environment
 - Survive freezing temperatures for short periods
- They should be planted in full sun for optimal fruit production
- They adapt to various types of soils as long as drainage is not an issue
- They like soils high in organic matter

PROPAGATION

Cuttings is most preferred propagation method for commercial plantings



Seeds germinate readily
(80 + % germination rate)
Source: VivaPitaya.com

Direct planting is possible, depending on cutting cost

Grafting works well, but benefits not quite clear yet!

SPACING & DENSITY

- Plant spacing depends on production system and trellis used
 - 6 by 10 feet spacing with single post trellis (@ 726 plant/ac)
 - 4 by 6 observed in California & in Spain on bench-type trellis
 - 2 by 10 and 3 by 8 seen on wire trellis



Spacing & density depends on trellis system and plant structure desired!

IRRIGATION/WATERING

- Pitahayas can survive with minimal water but they require quite a bit of water for successful fruit production
- Great variability in amount of water applied by growers
 - 26 gal/week/plant used in 1st field trial
 - 10 gal/week/plant in Fillmore with 10 * 3 spacing
 - 6 gal/week/plant with newer trials to start

PRUNING

- Depends on trellis/support system, variety, location, goals and desired plant structure
- Three basic strategies or goals:
 - Training: to encourage upright growth during first year
 - Sanitation: removal of dead or diseased stems
 - Thinning: to improve air circulation & exposure to sunlight



**Manage the canopy & keep
a clean, light plant.**

**Maximize # of flowers
(fruits) per plant, not just
biomass**



TRELLISING

- Pitahayas need trellis or support structures
- Type of trellis determined desired plan structure, variety and location
- Different types used in producing areas
 - Anything that can support a plant can be used
 - Live tutors used in Central America, but not an option for SD because of water cost
 - Concrete posts used in Southeast Asia
- Single post, wire or wood trellis systems used by commercial growers in the US

Single Post (wi



SINGLE POST & WIRE TRELLIS



Ladder



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Wire/Hedge/Espalier Trellis



FERTILIZATION

- Fertilizer requirements of pitahaya not well understood yet.
 - 0.25 lbs/plant every 2 months in first year with gradual increases to 0.75 – 1 lb/plant of complete formula in year 4 is recommended in Florida. (Crane and Balerdi)
 - 100 lbs/acre/year active material or 4 oz/plant/quarter of 20-20-20, and 4 ounces of slow release triple 14 plus minor elements in the Spring
- According to local growers pitahayas respond well to foliar fertilizations of micro-nutrients

FERTILIZATION

- Working with AGQ Labs in Oxnard to assess fertilizer extraction & develop fertilizer program for Pitahaya
- Soil & Water analyzed to establish baseline
- Six varieties of DF sampled at full bloom and during harvest, including fruit samples
 - American Beauty, Delight, El Grullo, Lisa, Physical graffiti and Vietnamese Giant
- Samples collected from young, intermediate and mature sections of the plant, including fruits
- Preliminary results presented separately

FLOWERING/FRUITING



Understanding issues related to self-fertility, self-pollination, self-sterility, and self-compatibility are critical for dragon fruit production

FLOWERING/FRUITING



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More about POLLINATION

- Hylocereus pollen can be stored for long periods of time in a household freezer if moisture content reduced to within 5-10 %
- Temperatures below 0 Celsius should be used for long term storage
- Pollen storage can help extend production season and ensure yields in commercial orchards
- Critical for breeding efforts because crossing could be made regardless of the flowering period

Metz, et. al. 2000

Pests: Gophers



Planting in gopher basket is a must if gophers are a problem

BIRDS



OTHER PESTs/DISEASES

- **Squirrels, and rabbits** can feed on and kill plants and be significant problem.
- Cactus **scale** a problem in the greenhouse but not in the field
- **Ants, aphids and snails** can cause problems, damage young shoots and flower buds
- No major diseases/pathogens identified yet (disease like symptoms usually physiological)
- Weeds can be a problem, increase prodn costs
- Cactus Virus X – See separate o

HARVEST/HANDLING

- It takes an average of 40 days for the fruit to develop and mature
- Harvest & handling is critical to preserve fruit internal quality and external appeal
- Must pay attention to variety differences when picking & storing
- Fruit usually harvested too late in SoCal
- Fruit stored at 10-12 C and 85-90 % HR has a shelf life of 2-3 weeks (Cantwell)

PACKING/MARKETING

- Few handlers/packers available in SoCal, may have to pack on your own
- Most buyers want fruit commercially packed in 6, 10, and 20 lb. boxes.
- Market preference for red/colored flesh varieties, over \$ 1.00 more per pound
- Most imports from Vietnam, Nicaragua, Florida and California appear on Reports
- Quality, flavor, local...our selling points!

PACKING/MARKETING



Pitahaya Market & Price Info

- USDA-AMS Market Report calls everything “Red Pitaya” but refers to skin color, no indication about flesh color.
- <https://www.ams.usda.gov>
 - Market News
 - Fruit and Vegetables
 - Fruits
 - Dragon Fruit (Red Pitaya)
 - From here you can refine the report by market, date, etc.

Packaging and Marketing

Date	Market	Origin	Color	Pack	Type	Price US \$
8/18/14	Los Angeles	Nicaragua	Red	10 lbs.	Conventional	32.00 – 33.00
8/18/14	Los Angeles	Vietnam	Red	10 lbs.	Conventional	23.50 – 29.00
8/18/14	Los Angeles	California	Red	10 lbs.	Organic	57.50 – 57.50
8/18/14	Los Angeles	California	Red	6 lbs.	Organic	42.85 – 42.85
8/18/14	San Fran	Nicaragua	Red	10 lbs.	Conventional	38.00 – 38.00
8/18/14	San Fran	Florida	Red	20 lbs.	Conventional	50.00 – 50.00
8/18/14	San Fran	Florida	Red	¾ B.C.	Conventional	60.00 – 65.00

Source: USDA/AMS Website

Packaging and Marketing

Commodity	City Name	Type	Package	Variety	Sub Variety	Grade	Date	Low Price	High Price	Mostly Low	Mostly High	Origin
DRAGON FRUIT (RED PITAYA)	BOSTON		20 lb cartons	WHITE FLESH			8/20/15	45	45			FLORIDA
DRAGON FRUIT (RED PITAYA)	BOSTON		20 lb cartons	RED FLESH			8/20/15	45	45			FLORIDA
DRAGON FRUIT (RED PITAYA)	BOSTON		20 lb cartons	RED FLESH			8/20/15					FLORIDA
DRAGON FRUIT (RED PITAYA)	BOSTON		4.5 kg cartons	RED FLESH			8/20/15	59	60	59	59	VIETNAM
DRAGON FRUIT (RED PITAYA)	DALLAS		10 lb cartons				8/20/15	63	63			VIETNAM
DRAGON FRUIT (RED PITAYA)	LOS ANGELES		10 lb cartons	WHITE FLESH			8/20/15	30	40	35	35	VIETNAM
DRAGON FRUIT (RED PITAYA)	NEW YORK		10 lb cartons	WHITE FLESH			8/20/15					VIETNAM
DRAGON FRUIT (RED PITAYA)	NEW YORK		10 lb cartons	RED FLESH			8/20/15					VIETNAM
DRAGON FRUIT (RED PITAYA)	PHILADELPHIA		20 lb cartons	WHITE FLESH			8/20/15	50	50			FLORIDA



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Marketing Pitahaya or Dragon Fruit: 10 Things a Distributor Wants (from Frieda's Finest)

Understand your customer's business	Labeling and Trace Back
Participate in Marketing	Food Safety and Insurance
Don't be Greedy	Quality Control
Target Dates and Yield Estimates	Pack Size & Pricing
Post-Harvest Control	Variety & Flavor

Success in agriculture depends on marketing what you grow at a profit. Do your homework, develop a business/marketing/food safety plan and spend time talking to prospective buyers or consumers!!

Economic Prospects

- Great potential as a commercial crop alternative
- Establishment costs are high and can range from \$15000-25000/per acre
- Value per acre can be significant if yield and quality are maximized (> 20,000 lbs/acre)
- Downward pressure on price will continue because of increased domestic production and import volume (\$1.50 to \$3.00/lb. farm gate prices; \$6-8 at CFMs)
- Red fleshed varieties usually sell at a higher price than white fleshed varieties (~ \$1.00/lb)
- Risky Business...BE CAUTIOUS!!

The End...Questions??

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