



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 method for commercial plantings**
 - use mature wood
 - 12 to 18 inch cuttings are ideal if rooting them before planting, longer cuttings preferred if direct planting
 - May fruit after one year post transplant
- **Seed germinates readily**
 - great potential for breeding program
 - Slow grower, may take up to 6 years to fruit
- **Grafting is possible, but benefits not quite clear yet!**

PLANTING

- **Rooted cuttings most commonly used, but direct planting is possible**
 - Rooted cuttings may produce fruit in one year
- **Spring/early summer planting preferred**
- **Must protect plant from rodents if present:**
 - plant in a gopher or chicken wire basket or pots if gophers are a problem
 - Fencing may be needed to keep for rabbits may be needed if they are present
- **Protect young plants from the sun**

SPACING & DENSITY

- Plant spacing depends on production system and trellis used
 - 6 by 10 feet spacing common with single post trellis (@ 726 plant/acre)
 - 4 by 6 observed in California & reported in Spain on bench-type trellis
 - 2 by 10 and 3 by 8 seen on wire trellis in commercial plantings and our field trials
- **Spacing & density depends on trellis system and plant structure desired!**

IRRIGATION/WATERING

- Shallow root system, benefit from short, high frequency irrigation events
- 2-3 g/plant/wk when young; 10+ g/plant/wk when adults depending on soil
- Pitahayas can survive with minimal water but they require more water to produce fruit
- Excessive watering in poorly drained soils can be disastrous
- Dry periods are needed to induce bloom

PRUNING

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

TRELLISING

- Pitahayas need trellis or support structure for support or to grow on
- Type of trellis determined desired plant 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
 - Combination of metal pipes and treated posts used in San Diego

Single Post (with or w/o "T")



Ladder Type Trellis



Wire/Hedge Type Trellis



SINGLE POST & WIRE TRELLIS

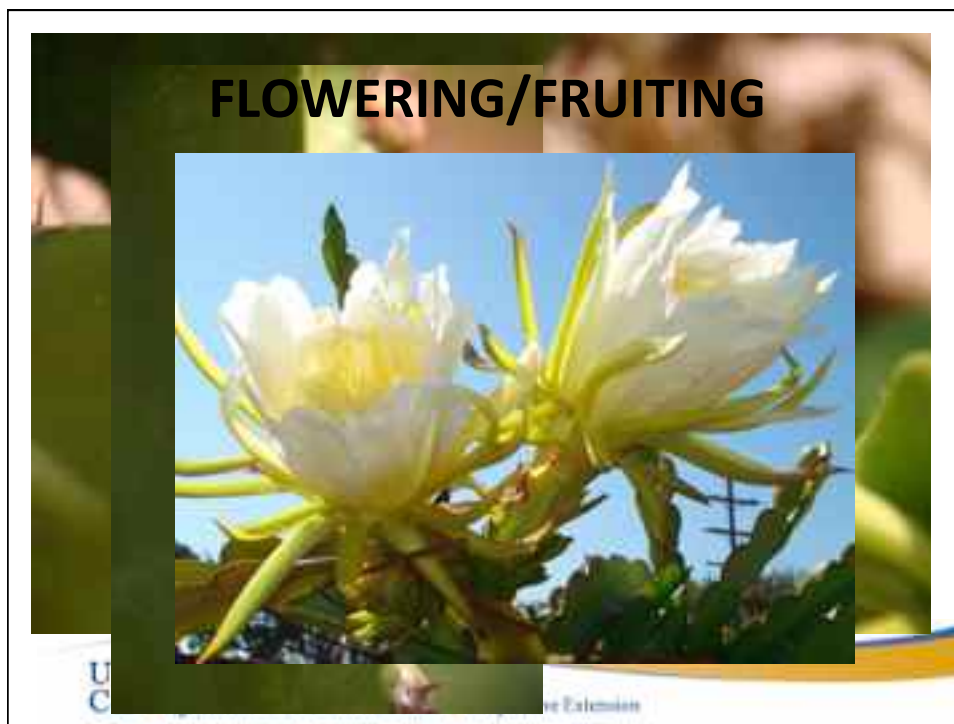


FERTILIZATION

- 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 quite well to foliar fertilization

FLOWERING/FRUITING

- Flowering usually starts in the Spring, in late April and intensifies in June
 - Flowering can be induced with water stress
- It takes an about 20-21 days from bud break to bloom, and about 40 days from bloom to harvest
- Flowers bloom at night and remain viable for one night only



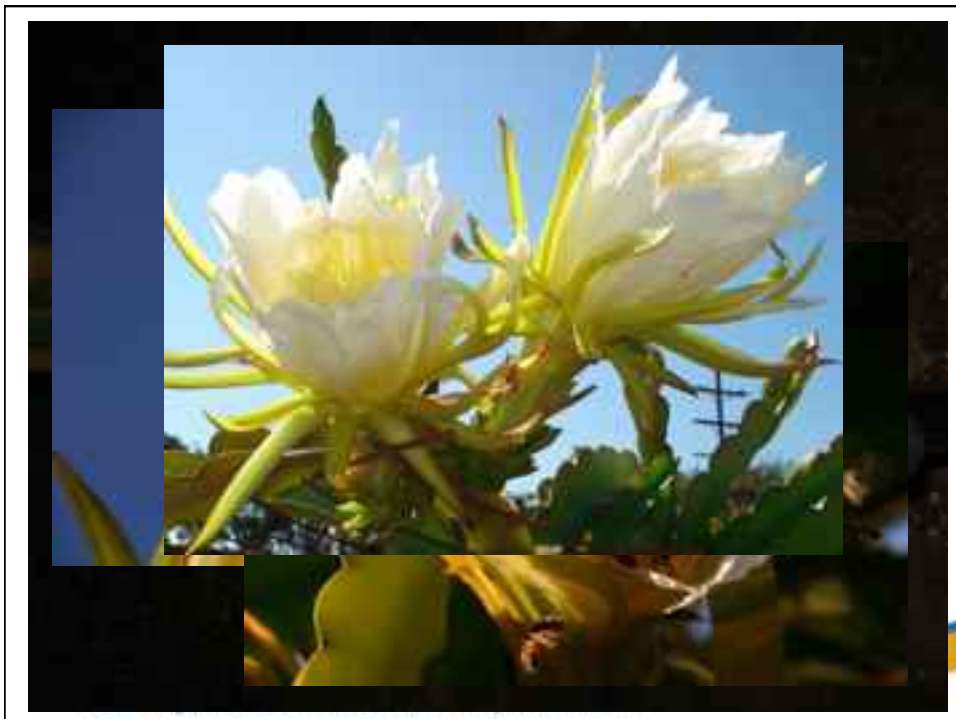
POLLINATION

- Night blooming cactus, large flowers, some with strong scent
- Pollinated by moths and bats in Central America; mostly bees in Southern CA.
- Research emphasis on on self fruitful or self pollinating clones
- Hand and cross pollination improves fruit set and fruit size considerably
- **Most important issue with Dragon Fruit...self-fertility, self-pollination, self-sterility, self-compatibility**

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 ensure yields in commercial commercial orchards
- Critical for breeding efforts because crossing could be made regardless of the flowering period

Metz, et. al. 2000



PESTS AND DISEASES

PEST/DISEASES

- **Gophers, squirrels, and rabbits** can feed on and kill plants and be significant problem.
- **Birds feed on fruits** - reduce marketable yield
- 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 isolated from samples



Cactus Scales

- **Cactus scale** can be a problem in greenhouses
- High populations may kill young plants
- Can be a problem for nursery people because are not visually attractive
- May result in additional restrictions if shipping plants/cuttings out of state
- High pressure water or an insecticidal soap may be effective to control them
- Problem usually goes away when plants are transplanted to the field

RODENTS

(Gophers, Squirrels and Rabbits)

- **Gophers**
 - Feed on roots, but damage not visible until plants begin to decline and eventually die
 - Gopher/chicken wire baskets needed to prevent damage
 - Trapping a successful control, but requires an ongoing effort
- **Rabbits**
 - feed on the plants and may eventually kill young plants
 - Rabbit fencing may be required to exclude them
 - Not usually a problem for mature plants
- **Ground Squirrels**
 - They do not feed on or cause direct damage to the plants
 - They burrow at base of plants and may damage root system or expose roots to the sun

Gophers and Other Rodents

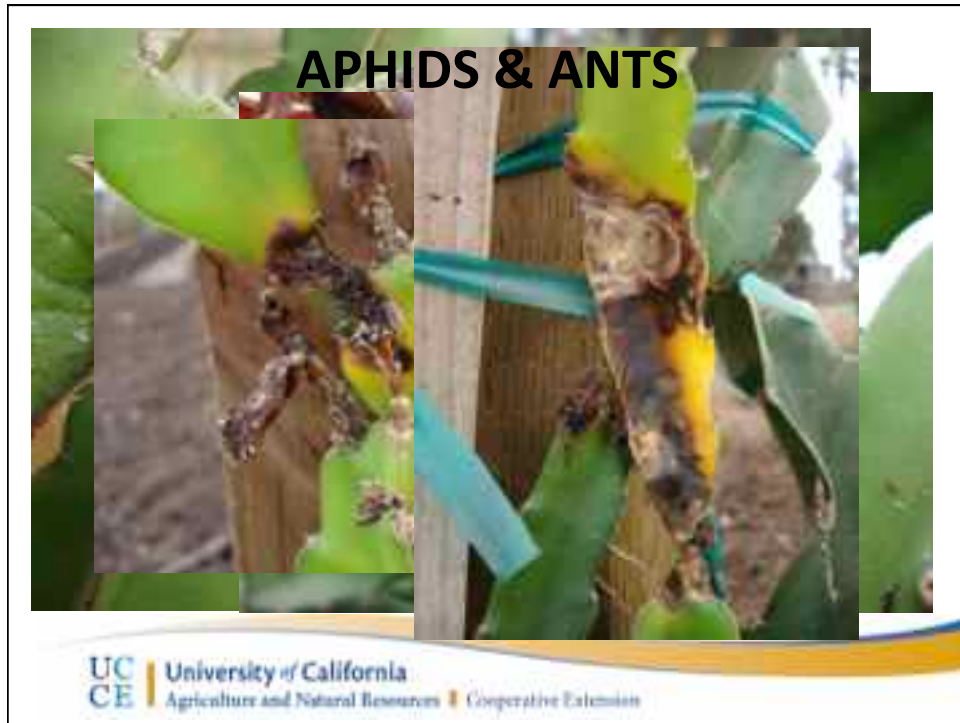


Gophers and Other Rodents



APHIDS & ANTS

- Can cause significant market losses
- Attracted to the flowers and eat the bracts of the flower buds, resulting in scarred, non marketable fruit
- They may feed or burrow in developing fruit, making it non-marketable
- They feed on young shoots and may stunt the plants or lead to rotting of the plants
- They are usually associated with high population of aphids



BIRDS

- Most important economic pest of pitahayas in Southern California
- They cause significant market losses by direct feeding on mature fruits
- They splatter seeds on neighboring fruits while feeding, thus increasing packing and marketing costs
- They perch on plants which may represent a food safety risk
- Netting or other mgt practice is a MUST!!

BIRDS



Cactus Virus X (CVX)

- Belongs to the Potexvirus group
- First reported on H. undates in 2001 (M.R. Liou, et.al.); Confirmed presence @ SCREC in 2012, positive ID in San Diego Co. this year
- Effect on plants not fully known, infected plants may not show macroscopic symptoms
- No known vector, mechanically transmitted
- 54 samples of Physical Graffiti, Delight and Lisa submitted for screening to obtain propagative material for research trials

Cactus Virus X (CVX)

- Potential external symptoms of CVX on various cacti include:
 - Chlorotic circles, mottling on the stems
 - Rings and spots on pads (Opuntia spp.) or on the shoots (Hylocereus spp.)
 - Reddening of fronds on Christmas cactus (Zygocactus sp.)
 - Occasional Extreme symptoms like bending, yellowing and die back of stems may also occur.

M. Chessin. "Symptoms of Virus Infection in Cactus."
ISHS Acta Horticulturae 568: X International Symposium
on Virus Diseases of Ornamental Plants



What to do @ CVX

- Increase phytosanitary measures:
 - Use only clean, virus free plant material
 - Keep your plants and your fields clean
 - Dispose plant litter after pruning
- Sanitize your tools:
 - Alcohol dips (ethanol or isopropyl alcohol)
 - Alcohols dips + flaming (standard for tissue culture)
 - Chlorine treatment (Chlorox, monochloramine)
 - Household cleaners (Listerine, Lysol, Pine-Sol)
 - Trisodium Phosphate (Na_3PO_4 ; 10 % solution)

Chalker-Scott, L. "Sterilized Pruning Tools: Nuisance or Necessity?"
WSU Puyallup Research and Extension Center

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!



Pitahaya Market & Price Info

- USDA-AMS Market Report calls everything “Red Pitaya” but refers to skin color, no indication about flesh color.
- www.usda.ams
 - Market News
 - Fruit Vegetables and Specialty Crops
 - Market News Portal – Fruits 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	¼ B.C.	Conventional	60.00 – 65.00

Source: USDA/AMS Website

Packaging and Marketing

Date	Market	Origin	Color	Pack	Type	Price US \$
8/21/14	Los Angeles	Nicaragua	Red	10 lbs.	Conventional	32.00 – 33.00
8/21/14	Los Angeles	Vietnam	Red	10 lbs.	Conventional	30.00 – 35.00
8/21/14	Los Angeles	California	Red	10 lbs.	Organic	57.50 – 57.50
8/21/14	Los Angeles	California	Red	20 lbs.	Conventional	56.00 – 60.00
8/21/14	Los Angeles	California	Red	6 lbs.	Conventional	42.00 – 42.00
8/21/14	Los Angeles	California	Red	6 lbs.	Organic	42.00 – 42.00
8/21/14	San Fran	Nicaragua	Red	10 lbs.	Conventional	38.00 – 38.00
8/21/14	San Fran	Florida	Red	20 lbs.	Conventional	50.00 – 50.00
8/21/14	San Fran	Florida	Red	¼ B.C.	Conventional	60.00 – 60.00

Source: USDA/AMS Website

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

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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!!

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The End...Questions??

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