PITAHAYA PRODUCTION and MARKETING CONSIDERATIONS

2015 Specialty Crops Production Workshop

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Pitahaya or Dragon Fruit Production
Why Pitahayyas?

• Great potential as a new, water efficient crop for Southern California

• Increasing demand for new, healthy and exotic fruits
  • Current demand exceeds supply, current prices are high (retail @ $ 3-8/pound)
  • Relatively high antioxidant activity when compared to other subtropical fruits

• Makes great landscape plant - fruiting cactus, water efficient, very adaptable
Fruit Uses

• Used in refreshments in Central America
• Red flesh used as colorant in the processed food industry (Snapples, Sobe, Pitaya+)
• Consumed fresh, as a desert item in the US, Canada, and Europe
  • Sliced in salads or cut in half and served chilled, with flesh eaten with spoon
• Used for decoration – Southeast Asia, US
• Great potential for value added products (ice cream, chips, chewy bars, wine, yarn dye, etc.)
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 fleshe varieties used for fresh consumption or for décor/garnish
- Market is turning red...Pink/Red fleshe varieties becoming more popular
- Red fleshe varieties sell at higher price
Varieties Under Study

- Cebra (Nic)
- Rosa (Nic)
- Orejona (Nic)
- Lisa (Nic)
- Sin Espinas (Nic)
- San Ignacio (Nic)
- Mexicana (Mex)²
- Colombiana (SD/Col)³
- Valdivia Roja (Mex)
- Bien Hoa Red (SD)¹

- Bien Hoa White (SD)²
- Delight (SD)
- American Beauty (FL)¹
- Haley’s Comet (FL)
- Physical Graffiti (FL)
- Vietnamese Giant (FL)²
- Yellow Dragon (FL/Col)³
- Seoul Kitchen (FL)
- Armando (Nic)*
- El Grullo (Mex)*
Pitahaya/Dragon Fruit Varieties
### Pitahaya or Dragon Fruit Variety Evaluation Chart

(For Cold Hardiness & Heat Tolerance: 1 = low tolerance & 5 = High Tolerance)

<table>
<thead>
<tr>
<th>Variety/Origin</th>
<th>Color Skin/Flesh</th>
<th>Cold Hardiness</th>
<th>Heat Tolerance</th>
<th>Avg. Wt. (grams)</th>
<th>Brix Score</th>
<th>Mkt Wt/Plant (grams)</th>
<th>Days to Harvest</th>
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<td>1. Cebra (Nic.)</td>
<td>R/R</td>
<td>3.5</td>
<td>3.5</td>
<td>468</td>
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<td>4. Lisa (Nic.)</td>
<td>R/R</td>
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<td>2.75</td>
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<td>16.5</td>
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<td>8. Colombiana (SD-Col.)</td>
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<td>&lt; 200</td>
<td>20.90</td>
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<td>9. Valdivia Roja (Mex.)</td>
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<td>17.9</td>
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<td>10. Bien Hoa Red (SD)</td>
<td>GR/F</td>
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<td>1.75</td>
<td>360</td>
<td>18.9</td>
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<td>11. Bien Hoa White (SD)</td>
<td>P/W</td>
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<td>12. Delight (SD)</td>
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<td>13. American Beauty (FL)</td>
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<td>380</td>
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<td>4.25</td>
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<td>15. Physical Graffitti (FL)</td>
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<td>16. Vietnamese Giant (FL)</td>
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<td>338</td>
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<td>17. Yellow Dragon (FL-Col.)</td>
<td>Y/W</td>
<td>1</td>
<td>1</td>
<td>&lt; 200</td>
<td>21.15</td>
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<td>18. Seoul Kitchen (FL)</td>
<td>PR/W</td>
<td>4</td>
<td>4</td>
<td>518</td>
<td>12.18</td>
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<td>19. Armando (Nic.)</td>
<td>R/R</td>
<td>4</td>
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<td>390.5</td>
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<td>4881</td>
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<td>20. El Grullo (Mex.)*</td>
<td>R/R</td>
<td>4.5*</td>
<td>4.5*</td>
<td>489*</td>
<td>18.11*</td>
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</tbody>
</table>
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

• Spring/early summer planting preferred
• Direct planting may speed up establishment
• 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 if rabbits 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 seen on commercial plantings, 3 by 8 or 3 * 10 used in our new field trials on wire trellis

• Spacing & density depends on trellis system and plant structure desired!
IRRIGATION/WATERING

• Minimal water for survival but they require more water for successful fruit production
• Successful production with 10 gal/plant/week
• Excessive watering in poorly drained soils can be disastrous
• Water stress may induce bloom, so you must cut back in water applied in the Spring
• Irrigation trial under way to fine tune water needs (0.25 to 1.5 avocado reference ET)
PRUNING

• Pruning depends 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 structures
• Type of trellis determined by desired plan structure, variety and location/topography
• 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
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

• Anecdotal information suggests pitahayas respond quite well to foliar fertilization
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 abiotic/physiological)
- Weeds can be a problem, increase prodn costs
- Cactus virus X isolated from samples
Gophers
Other Rodents
CACTUS SCALE
WEEDS & MULCHING
BIRDS

• Most important economic pest of pitahayyas 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!!
Cactus Virus X (CVX)

• Effect on plants not fully known
• No known vector, mechanically transmitted
• 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.)
  – Occassional 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 (Na3PO4; 10 % solution)

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

• 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
• Pollinized 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 orchards

• Critical for breeding efforts because crossing could be made regardless of the flowering period

Metz, et. al. 2000
## Seasonality of Pitahaya Cultivar in Southern California

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<th>Variety</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
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HARVEST/HANDLING

• It takes an average of 40 days for the fruit to develop and mature
• Proper handling is critical to preserve fruit quality and external appeal
• Must pay attention to variety differences when picking & storing
• 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
• 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](http://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

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

Source: USDA/AMS Website
## Packaging and Marketing

<table>
<thead>
<tr>
<th>Date</th>
<th>Market</th>
<th>Origin</th>
<th>Color</th>
<th>Pack</th>
<th>Type</th>
<th>Price US $</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/21/14</td>
<td>Los Angeles</td>
<td>Nicaragua</td>
<td>Red</td>
<td>10 lbs.</td>
<td>Conventional</td>
<td>32.00 – 33.00</td>
</tr>
<tr>
<td>8/21/14</td>
<td>Los Angeles</td>
<td>Vietnam</td>
<td>Red</td>
<td>10 lbs.</td>
<td>Conventional</td>
<td>30.00 – 35.00</td>
</tr>
<tr>
<td>8/21/14</td>
<td>Los Angeles</td>
<td>California</td>
<td>Red</td>
<td>10 lbs.</td>
<td>Organic</td>
<td>57.50 – 57.50</td>
</tr>
<tr>
<td>8/21/14</td>
<td>Los Angeles</td>
<td>California</td>
<td>Red</td>
<td>20 lbs.</td>
<td>Conventional</td>
<td>56.00 – 60.00</td>
</tr>
<tr>
<td>8/21/14</td>
<td>Los Angeles</td>
<td>California</td>
<td>Red</td>
<td>6 lbs.</td>
<td>Conventional</td>
<td>42.00 – 42.00</td>
</tr>
<tr>
<td>8/21/14</td>
<td>Los Angeles</td>
<td>California</td>
<td>Red</td>
<td>6 lbs.</td>
<td>Organic</td>
<td>42.00 – 42.00</td>
</tr>
<tr>
<td>8/21/14</td>
<td>San Fran</td>
<td>Nicaragua</td>
<td>Red</td>
<td>10 lbs.</td>
<td>Conventional</td>
<td>38.00 – 38.00</td>
</tr>
<tr>
<td>8/21/14</td>
<td>San Fran</td>
<td>Florida</td>
<td>Red</td>
<td>20 lbs.</td>
<td>Conventional</td>
<td>50.00 – 50.00</td>
</tr>
<tr>
<td>8/21/14</td>
<td>San Fran</td>
<td>Florida</td>
<td>Red</td>
<td>¾ B.C.</td>
<td>Conventional</td>
<td>60.00 – 60.00</td>
</tr>
</tbody>
</table>

Source: USDA/AMS Website
Economic Prospects

• Great potential as a commercial crop
• Establishment costs can be high, ranging 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 fleshe varieties usually sell at a higher price than white fleshe varieties (~ $1.00/lb)
• Risky Business...BE CAUTIOUS!!
## Marketing Pitahaya or Dragon Fruit: 10 Things a Distributor Wants (Frieda’s Handout)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Preferred Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand your customer’s business</td>
<td>Labeling and Trace Back</td>
</tr>
<tr>
<td>Participate in Marketing</td>
<td>Food Safety and Insurance</td>
</tr>
<tr>
<td>Don’t be Greedy</td>
<td>Quality Control</td>
</tr>
<tr>
<td>Target Dates and Yield Estimates</td>
<td>Pack Size &amp; Pricing</td>
</tr>
<tr>
<td>Post-Harvest Control</td>
<td>Variety &amp; Flavor</td>
</tr>
</tbody>
</table>

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!!

**UCCE University of California**
**Agriculture and Natural Resources | Cooperative Extension**
The End...Questions??

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