Pitahaya Establishment
Costs and Economic Prospects

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San Marcos, CA

Ramiro Lobo, Gary Bender & Gary Tanizaki
UCCE San Diego
OVERVIEW

• Background
• Pitahaya Culture & Production Practices
• Marketing and Economic Prospects
• Estimated establishment costs
• What next?
WHY PITAHAYAS?

• 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
• Used for decoration – Southeast Asia, US
• Great potential for value added products (chips, chewy bars, wine, yarn dye, etc.)
• Emphasis should be on Fresh Market!!
COMMERCIAL VARIETIES?

• Several species & up to 70 different clones available in Southern California – No performance data
• Five clones grown commercially in Nicaragua (Orejona, Rosa, Cebra, Lisa, San Ignacio)
• Several clones promoted as “superior” but no replicated research data available
• Improved, proprietary varieties available from Israel, Taiwan and private breeders in US
• Lack of reliable information about varieties a major challenge for commercial production and main reason for our research project
VARIETIES UNDER STUDY

- Cebra (Nic)
- Rosa (Nic)
- Orejona (Nic)
- Lisa (Nic)
- Sin Espinas (Nic)
- San Ignacio (Nic)
- Mexicana (Mex)
- Colombiana (SD/Col)
- Valdivia Roja (Mex)
- Bien Hoa Red (SD)
- Bien Hoa White (SD)
- Delight (SD)
- American Beauty (FL)
- Haley’s Comet (FL)
- Physical Graffiti (FL)
- Vietnamese Giant (FL)
- Yellow Dragon (FL/Col)
- Seoul Kitchen (FL)
- Armando (Nic)
- El Grullo (Mex)
## Pitahaya / Dragon Fruit Research - Results to Date

<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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<tbody>
<tr>
<td>1. Cebra (Nic.)</td>
<td>R/R</td>
<td>3.5</td>
<td>3.5</td>
<td>468</td>
<td>15.75</td>
<td>8746</td>
<td>46</td>
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<td>2. Rosa (Nic.)</td>
<td>R/R</td>
<td>3.5</td>
<td>3.5</td>
<td>384</td>
<td>16.05</td>
<td>7217</td>
<td>45</td>
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<td>3. Orejona (Nic.)</td>
<td>R/R</td>
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<td>3.75</td>
<td>438</td>
<td>15.78</td>
<td>4598</td>
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<td>4. Lisa (Nic.)</td>
<td>R/R</td>
<td>3.75</td>
<td>4</td>
<td>465</td>
<td>17.02</td>
<td>13319</td>
<td>44</td>
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<td>5. Sin Espinas (Nic.)</td>
<td>P/R</td>
<td>2.25</td>
<td>2.75</td>
<td>393</td>
<td>16.5</td>
<td>3527</td>
<td>43</td>
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<td>6. San Ignacio (Nic.)</td>
<td>R/R</td>
<td>3.75</td>
<td>4</td>
<td>552</td>
<td>15.6</td>
<td>12712</td>
<td>48</td>
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<td>7. Mexicana (Mex.)</td>
<td>P/W</td>
<td>3.25</td>
<td>3</td>
<td>495</td>
<td>14.04</td>
<td>9165</td>
<td>40</td>
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<tr>
<td>8. Colombiana (SD-Col.)</td>
<td>Y/W</td>
<td>1</td>
<td>1</td>
<td>&lt; 200</td>
<td>20.90</td>
<td>0</td>
<td>150-180</td>
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<td>9. Valdivia Roja (Mex.)</td>
<td>R/R</td>
<td>5</td>
<td>4.5</td>
<td>250</td>
<td>17.9</td>
<td>8588</td>
<td>40</td>
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<tr>
<td>10. Bien Hoa Red (SD)</td>
<td>GR/F</td>
<td>1.75</td>
<td>1.75</td>
<td>360</td>
<td>18.9</td>
<td>1477</td>
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<tr>
<td>11. Bien Hoa White (SD)</td>
<td>P/W</td>
<td>2.5</td>
<td>2.5</td>
<td>388</td>
<td>11.85</td>
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<td>12. Delight (SD)</td>
<td>R/PW</td>
<td>3</td>
<td>3.5</td>
<td>371</td>
<td>18.08</td>
<td>14931</td>
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<td>13. American Beauty (FL)</td>
<td>GR/F</td>
<td>2.75</td>
<td>2.5</td>
<td>380</td>
<td>18.51</td>
<td>5566</td>
<td>43</td>
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<td>14. Haley’s Comet (FL)</td>
<td>R/F</td>
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<td>4.25</td>
<td>482</td>
<td>16.7</td>
<td>5979</td>
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<td>15. Physical Graffiti (FL)</td>
<td>R/P</td>
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<td>4.5</td>
<td>374</td>
<td>17.93</td>
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<td>16. Vietnamese Giant (FL)</td>
<td>PR/W</td>
<td>3.25</td>
<td>3.25</td>
<td>338</td>
<td>15.6</td>
<td>6511</td>
<td>41</td>
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<tr>
<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>
<td>0</td>
<td>150-180</td>
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<tr>
<td>18. Seoul Kitchen (FL)</td>
<td>PR/W</td>
<td>4</td>
<td>4</td>
<td>518</td>
<td>12.18</td>
<td>15379</td>
<td>41</td>
</tr>
<tr>
<td>19. Armando (Nic.)</td>
<td>R/R</td>
<td>4</td>
<td>4</td>
<td>390.5</td>
<td>16.11</td>
<td>4881</td>
<td>41</td>
</tr>
</tbody>
</table>
SITE SELECTION

- In general, pitahayas grow well in frost free areas where Hass avocados grow
- 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
- An economic rent is used for the price of land instead of land values ($25-50 K/Acre)
PROPAGATION

• Cuttings most preferred propagation method for commercial plantings
  – Avoid soft, tender shoots, use mature wood
  – 12 to 18 inch cuttings are ideal if rooting them before planting, longer cuttings preferred if direct planting

• Seeds germinates readily
  – great potential for breeding program
  – Slow grower, may take up to 6 years to fruit

• Depending on variety, quality & quantity, cuttings cost anywhere from $3-10/cutting

• 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 protect plants from rabbits

• Protect young plants from the sun with white wash (latex paint or kaolin clay)
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

• Plant material/planting can cost $8,000/Acre

• 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 to maximize fruit production
• Excessive watering in poorly drained soils can be disastrous
• Dry periods are needed to induce bloom, reduce amount water applied in the Spring
• Irrigation system estimated at $1,200/Acre plus cost of water ($1,200/Ac. Ft.)
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**: Helps improve air circulation, exposure to sunlight, and fruit size

• Pruning costs an estimated $2,200/Acre/Year
TRELLISING

• Pitahayas need trellis or support structure for support or to grow on

• 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 in California
  – Concrete posts used in Southeast Asia
  – Combination of metal pipes and treated posts used in San Diego

• Trellis system can cost over $10,000/Acre
Single Post (with or w/o “T”)

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[Image of a single post system in a field with dragon fruit plants]
Ladder Type Trellis
Wire/Hedge Type Trellis
SINGLE POST & WIRE TRELLIS
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
• 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
• Self-fertility important but not a limiting factor for successful pitahaya production
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
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)
  – We apply 4 ounces/plant/quarter of a complete formula (triple 20), and 4 ounces of slow release triple 14 plus minor elements in the Spring

• Based on growers’ accounts, pitahayas respond 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, bird netting may be needed
• Scale, 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 production costs - Mulch helps with suppression
• Cactus virus X isolated from samples
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 10 pound boxes (6-8 fruit/box)
• Market preference for red/colored flesh varieties, over $1.00 more per pound
• Most imports from Vietnam, but questionable quality a problem
• Quality, flavor, local...our selling points!
PACKING/MARKETING
(Vietnamese fruit at LA Terminal Market)
### Marketing Pitahaya or Dragon Fruit:
10 Things a Distributor Wants (Frieda’s Handout)

<table>
<thead>
<tr>
<th>Understand your customer’s business</th>
<th>Labeling and Trace Back</th>
</tr>
</thead>
<tbody>
<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!!**
Economic Prospects

• Great potential as a commercial crop despite increasing imports
• Establishment costs are high and can range from $15000-25000/per acre
• Downward pressure on price will continue because of increased domestic production and import volume (~ $3.00/lb. farm gate price)
• Red fleshed varieties usually sell at a higher price than white fleshed varieties (~ $1-2/lb. difference)
• Value per acre can be significant if yield and quality are sustained (>20,000 lbs./acre)
• Risky Business...BE CAUTIOUS!!
Questions??

Ramiro Lobo
Small Farms and Agricultural Economics Advisor
UCCE San Diego County
151 E. Carmel Street
San Marcos, CA 92078

(760)745-4716
relobo@ucdavis.edu
http://cesandiego.ucdavis.edu