2013 Pitahaya Production Seminar & Field Day

August 23, 2013
San Marcos, CA
Pitahaya or Dragon Fruit Production in California: A Research Update

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Overview

• Background
• Pitahaya production worldwide
• Why pitahaya research?
• Current research efforts at UC
• Results to Date
• What next?
The Pitahaya

• Also known as Strawberry Pear, Dragon Fruit in South East Asia, Pitahaya in Mexico and Pitaya in Central America

• Native to tropical America, range from Southern Mexico to Northern South America

• Taken by the french to South East Asia at the turn of the 19th century
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 white to deep magenta or dark red)

• Selenecereus megalanthus - Yellow or Colombian, yellow, thorny skin and white, translucent flesh
Why Pitahayasy?

• 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 dessert 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 (chips, chewy bars, wine, yarn dye, etc.)
Dragonfruit Production
Pitahayas in California
U.S. Production

• US production is limited, but acreage increasing rapidly (300 - 600 Has.)
  • California (100 - 200 acres.)
  • Florida (~ 400+ Acres)
  • Hawaii (~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
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
Colombian Pitahaya

(*Selenicereus megalanthus*)
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
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
Ongoing Research Efforts

• Evaluate varieties for commercial production under field conditions in California
  • Concentrate on self-fruitful varieties with good yield, fruit & flavor characteristics

• Determine irrigation requirements (MVP Farms in Fillmore & UC-SCREC in Irvine)

• Evaluate promising varieties in controlled environment MVP Farms in Fillmore & UC-SCREC

• Develop Pest and Post harvest management information and strategies
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)
Results to Date

• Most varieties in trial adapted well to growing conditions at SCREC
• Most selections set fruit **WITHOUT** hand pollination (Pollinated by bees & other insects)
• Most varieties in trial produce well **WITHOUT** shade, some would benefit from it.
• Fruit size & quality good, good marketable yields but results **NOT FINAL** yet!
Results to Date

• Sin Espinas, Lisa, Physical Graffiti, Delight, American Beauty and Bien Hoa Red rated highest in external appearance
• American Beauty, Bien Hoa Red, Physical Graffiti, Delight, Sin Espinas and Lisa rated highest in flavor when panelists could see flesh color
• Bien Hoa Red, American Beauty, Physical Graffiti, Sin Espinas and Lisa rated highest in flavor in a blind test
• Post-harvest work ongoing
Pitahaya Guide
Ave Wt. (grams): 468
Brix Score: 15.75
Mkt. Wt./Plant (grams): 8746
Days to Harvest: 46
Origin/Source: Nicaragua
Rosa

Ave. Wt. (grams): 384
Brix Score: 16.05
Mkt. Wt./Plant (grams): 7217
Days to Harvest: 45
Origin/Source: Nicaragua
Orejona

Ave. Wt. (grams): 438
Brix Score: 15.78
Mkt. Wt./Plant (grams): 4598
Days to Harvest: 45
Origin/Source: Nicaragua
Lisa

Ave. Wt. (grams): 465
Brix Score: 17.02
Mkt. Wt./Plant (grams): 13319
Days to Harvest: 44
Origin/Source: Nicaragua
Sin Espinas

Ave. Wt. (grams): 393
Brix Score: 16.5
Mkt. Wt./Plant (grams): 3527
Days to Harvest: 43
Origin/Source: Nicaragua
San Ignacio

Ave. Wt. (grams): 552
Brix Score: 15.6
Mkt. Wt./Plant (grams): 12712
Days to Harvest: 48
Origin/Source: Nicaragua
Mexicana

Ave. Wt. (grams): 495
Brix Score: 14.04
Mkt. Wt./Plant (grams): 9165
Days to Harvest: 40
Origin/Source: Nicaragua
Colombiana

Ave. Wt. (grams): <200
Brix Score: 20.90
Mkt. Wt./Plant (grams): 0
Days to Harvest: 150-180
Origin/Source: SD/Col.

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Valdivia Roja

Ave. Wt. (grams): 250
Brix Score: 17.9
Mkt. Wt./Plant (grams): 8588
Days to Harvest: 40
Origin/Source: Mexico
Bien Hoa Red

Ave. Wt. (grams): 360
Brix Score: 18.9
Mkt. Wt./Plant (grams): 1477
Days to Harvest: 41
Origin/Source: San Diego
Bien Hoa White

Ave. Wt. (grams): 388
Brix Score: 11.85
Mkt. Wt./Plant (grams): 7394
Days to Harvest: 37
Origin/Source: San Diego

University of California
Agriculture and Natural Resources  Cooperative Extension
Delight

Ave. Wt. (grams): 371
Brix Score: 18.08
Mkt. Wt./Plant (grams): 14931
Days to Harvest: 41
Origin/Source: San Diego
American Beauty

Ave. Wt. (grams): 380
Brix Score: 18.51
Mkt. Wt./Plant (grams): 5566
Days to Harvest: 43
Origin/Source: Florida
Haley’s Comet

Ave. Wt. (grams): 482
Brix Score: 16.7
Mkt. Wt./Plant (grams): 5979
Days to Harvest: 38
Origin/Source: Florida
Physical Graffiti

- Ave. Wt. (grams): 374
- Brix Score: 17.93
- Mkt. Wt/Plant (grams): 23429
- Days to Harvest: 40
- Origin: Florida
Vietnamese Giant

Ave. Wt. (grams): 338
Brix Score: 15.6
Mkt. Wt./Plant (grams): 6511
Days to Harvest: 41
Origin/Source: Florida
Yellow Dragon

Ave. Wt. (grams): <200
Brix Score: 21.15
Mkt. Wt./Plant (grams): 0
Days to Harvest: 150-180
Origin: Florida/Colombia
Ave. Wt. (grams): 518
Brix Score: 12.18
Mkt. Wt./Plant (grams): 15379
Days to Harvest: 41
Origin/Source: Florida

Seoul Kitchen
Armando

Ave. Wt. (grams): 390.5
Brix Score: 16.11
Mkt. Wt./Plant (grams): 4881
Days to Harvest: 41
Origin/Source: Nicaragua
Ave. Wt. (grams):
Brix Score:
Mkt. Wt./Plant (grams):
Days to Harvest:
Origin/Source: Mexico
Results to Date

• Recently completed DNA work confirmed suspicions about various cultivars:
  – Bien Hoa Red and American Beauty considered the same
  – Delight, Haley’s Comet and Physical Graffiti are very closely related
  – Seoul Kitchen, Vietnamese Giant, Bien Hoa White and Mexicana very closely related
  – Yellow Dragon and Colombiana considered the same
  – Lisa, Rosa, Cebra could considered the same
  – Armando and San Ignacio related but not same as other Nicaraguan varieties
  – Sin Espinas unique & different from other Nicaraguans
  – Valdivia Roja unique, closely related to El Grullo (new entry)

• Variety selection determined by your personal preferences and intended use
Several Others Cultivars Under Observation
## 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>
</tr>
</thead>
<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>
</tr>
<tr>
<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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<tr>
<td>3. Orejona (Nic.)</td>
<td>R/R</td>
<td>3.25</td>
<td>3.75</td>
<td>438</td>
<td>15.78</td>
<td>4598</td>
<td>45</td>
</tr>
<tr>
<td>4. Lisa (Nic.)</td>
<td>R/R</td>
<td>3.75</td>
<td>4.0</td>
<td>465</td>
<td>17.02</td>
<td>13319</td>
<td>44</td>
</tr>
<tr>
<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>
</tr>
<tr>
<td>6. San Ignacio (Nic.)</td>
<td>R/R</td>
<td>3.75</td>
<td>4.0</td>
<td>552</td>
<td>15.6</td>
<td>12712</td>
<td>48</td>
</tr>
<tr>
<td>7. Mexicana (Mex.)</td>
<td>P/W</td>
<td>3.25</td>
<td>3.0</td>
<td>495</td>
<td>14.04</td>
<td>9165</td>
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<tr>
<td>8. Colombiana (SD-Col.)</td>
<td>Y/W</td>
<td>1.0</td>
<td>1.0</td>
<td>&lt; 200</td>
<td>20.90</td>
<td>0</td>
<td>150-180</td>
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<tr>
<td>9. Valdivia Roja (Mex.)</td>
<td>R/R</td>
<td>5.0</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>
<td>41</td>
</tr>
<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>
<td>7394</td>
<td>37</td>
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<tr>
<td>12. Delight (SD)</td>
<td>R/PW</td>
<td>3.0</td>
<td>3.5</td>
<td>371</td>
<td>18.08</td>
<td>14931</td>
<td>41</td>
</tr>
<tr>
<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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<tr>
<td>14. Haley’s Comet (FL)</td>
<td>R/F</td>
<td>4.5</td>
<td>4.25</td>
<td>482</td>
<td>16.7</td>
<td>5979</td>
<td>38</td>
</tr>
<tr>
<td>15. Physical Graffiti (FL)</td>
<td>R/P</td>
<td>4.5</td>
<td>4.5</td>
<td>374</td>
<td>17.93</td>
<td>23429</td>
<td>40</td>
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<tr>
<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>
</tr>
<tr>
<td>17. Yellow Dragon (FL-Col.)</td>
<td>Y/W</td>
<td>1.0</td>
<td>1.0</td>
<td>&lt; 200</td>
<td>21.15</td>
<td>0</td>
<td>150-180</td>
</tr>
<tr>
<td>18. Seoul Kitchen (FL)</td>
<td>PR/W</td>
<td>4.0</td>
<td>4.0</td>
<td>518</td>
<td>12.18</td>
<td>15379</td>
<td>41</td>
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<tr>
<td>19. Armando (Nic.)</td>
<td>R/R</td>
<td>4.0</td>
<td>4.0</td>
<td>390.5</td>
<td>16.11</td>
<td>4881</td>
<td>41</td>
</tr>
</tbody>
</table>
Several Others Cultivars Under Observation
UC	
  Small Farm Program
  UCCE San Diego County

Results to Date
The End...Questions??

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