Persimmon: From Phenotypes to Preservation

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Project
Enhancing Marketability

California Dept. of Food and Agriculture Specialty Crop Block Grant Program Project #14-003: “Enhancing the marketability of California persimmons”

Project Director
Dr. Andrew Breksa

Co-Investigator
Dr. John Preece

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Dr. Rebecca Milczarek
Enhancing Marketability

California Dept. of Food and Agriculture Specialty Crop Block Grant Program Project #14-003:

“Enhancing the marketability of California persimmons”

- goal = increase the profitability of California persimmons in three ways
  - evaluating the vitamin/nutrient content and flavor of 55 persimmon cultivars
  - developing protocols to rapidly dry persimmons
  - recommending which cultivars consumers prefer
Project Timeline: Sensory

Sample Harvests and Drying
10 September 2015
15 December 2015
16 February 2016
5 April 2016
20 September 2016
6 December 2016
14 February 2017
6 April 2017

Trained Panel Evaluation: Fresh & Frozen/Thawed
2015
2016

Trained Panel Evaluation: Dried
2016
2017

Dried Product Consumer Test 1: 7 November 2015
Dried Product Consumer Test 2: 5 November 2016
Dried Product Consumer Test 3: 29 March 2017

Trained Panel Evaluation: Dried
16 February 2016
5 April 2016

## Project Timeline: Chemical & Instrumental Texture Analyses

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Year</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Harvests and Drying</td>
<td>2015</td>
<td>10 September</td>
</tr>
<tr>
<td>Processing, Extraction, &amp; Cryopreservation</td>
<td>Fresh</td>
<td>15 December</td>
</tr>
<tr>
<td>Instrumental Texture Evaluation:</td>
<td>2016</td>
<td>16 February</td>
</tr>
<tr>
<td>Dried</td>
<td></td>
<td>5 April</td>
</tr>
<tr>
<td>Processing, Extraction, &amp; Cryopreservation</td>
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<td>20 September</td>
</tr>
<tr>
<td>Dried</td>
<td></td>
<td>6 December</td>
</tr>
<tr>
<td>Instrumental Texture Evaluation:</td>
<td>2017</td>
<td>14 February</td>
</tr>
<tr>
<td>Dried</td>
<td></td>
<td>6 April</td>
</tr>
</tbody>
</table>

**Chemical Analyses**

- **Brix, TTA, pH, Sugars**
  - Fresh
- **Anti-Oxidant, Tannin Content**
  - Fresh
- **Extraction, Sugars**
  - Dried
- **Anti-Oxidant, Tannin Content**
  - Dried
- **Vitamin C, Organic Acids**
  - Fresh & Dried
- **Brix, TTA, pH, Sugars**
  - Fresh
- **Anti-Oxidant, Tannin Content**, **Vitamin C, Organic Acids**
  - Fresh & Dried
Project Timeline: Preparing for Harvests

- **Sample Harvests and Drying**
  - 10 September 2015
  - 15 December 2015

- **Pruning Trees in Research Collection**
  - 20 September 2016

- **Thinning Fruit in Research Collection**
  - 6 December 2016

- **Sample Harvests and Drying**
  - 20 September 2016
  - 6 December 2016

- **Arranging Logistics with Commercial Growers**
  - March to September 2015
  - 6 April 2017
The 119 Samples

• “sample” = fruit from one persimmon cultivar, harvested at one source, on one particular date
Sidebar: What is a “cultivar”?

persimmon scientific name:

*Diospyros kaki var. xyz*
The 119 Samples

• “sample” = fruit from one persimmon cultivar, harvested at one source, on one particular date
• 55 cultivars (40 in Fall 2015, 46 in Fall 2016)

9 31 15
black font = tested both years
blue font = unique in Fall 2015
green font = unique in Fall 2016
# The 119 Samples

<table>
<thead>
<tr>
<th>[unnamed]</th>
<th>Fuji</th>
<th>Hachiya</th>
<th>Lycopersicon</th>
<th>Nui Nai</th>
<th>Thiene</th>
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<tbody>
<tr>
<td>Akoumanzaki</td>
<td>Fujiwaragosho</td>
<td>Hanagosho</td>
<td>Maekawa Jiro</td>
<td>Okugosho</td>
<td>Tishihtzu</td>
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<tr>
<td>Brazzale</td>
<td>Fuyu</td>
<td>Hazegosho</td>
<td>Mandarino</td>
<td>Rispoli</td>
<td>Vainiglia</td>
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<td>Chienting</td>
<td>Fuyu Imoto</td>
<td>Ichidagaki</td>
<td>Maru</td>
<td>Rose Yanka</td>
<td>Yeddo</td>
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<td>Chocolate</td>
<td>Fuyu Jiro</td>
<td>Ichikeijiko</td>
<td>Matsumoto Wase Fuyu</td>
<td>Saijo</td>
<td>Yotsumizo</td>
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<td>Costata</td>
<td>Giant Fuyu</td>
<td>Izu</td>
<td>Mikatani Gosho</td>
<td>Sangokuichi</td>
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<tr>
<td>Emon</td>
<td>Giombo</td>
<td>Jiro</td>
<td>Mishirasu</td>
<td>Suruga</td>
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<td>F-444</td>
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<td>Kakiyamagaki</td>
<td>Moro</td>
<td>Syouro</td>
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<td>Farmacista Honorati</td>
<td>Great Wall</td>
<td>Korean</td>
<td>Muraya</td>
<td>Tamkam</td>
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<tr>
<td>Fennio</td>
<td>Guang Yang</td>
<td>Lampadina</td>
<td>Nishimura Wase</td>
<td>Tanenashi</td>
<td></td>
</tr>
</tbody>
</table>

- **black font** = tested both years
- **blue font** = unique in Fall 2015
- **green font** = unique in Fall 2016
The 119 Samples

• “sample” = fruit from one persimmon cultivar, harvested at one source, on one particular date

• 4 sources
  – National Clonal Germplasm Repository (NCGR) – Davis, CA - 96
  – L.E. Cooke Co. – Visalia, CA - 19
  – Oak Acre Farms – Live Oak, CA - 3
  – O. Bertolero – Santa Rosa, CA - 1
The 119 Samples

• “sample” = fruit from one persimmon cultivar, harvested at one source, on one particular date

• fruit stored for average of 7 days before drying
“But wait…”

“…what’s this ‘Freeze-Thaw’ business?”
Phenotypes
The 3 Types of Persimmon

NonastrinGetnt

• harvested when commercially ripe (at least some orange blush on skin)
• flesh is always orange, regardless of whether or not the fruit has seeds
• nonastrinGetnt (palatable) when firm and ripe 😊
• ‘Fuyu’ is most common nonastrinGetnt cultivar
The 3 Types of Persimmon

Astringent

- harvested when commercially ripe (at least some orange blush on skin)
- flesh is always orange, regardless of whether or not the fruit has seeds
- astringent (not palatable) when firm and ripe 😞
  - need to “mellow” and lose astringency in order to be palatable
- ‘Hachiya’ is most common astringent cultivar
The 3 Types of Persimmon

Pollination-Variant (a.k.a. Variant)

• harvested when commercially ripe (at least some orange blush on skin)

flowers **pollinated** in the spring → seeds upon harvest → brown speckled flesh color & tastes and acts like nonastringent cultivars

flowers *not pollinated* in the spring → no seeds upon harvest → flesh color stays orange & tastes and acts like astringent cultivars
The 3 Types of Persimmon

Pollination- Variant (a.k.a. Variant)

• “Chocolate” and “Coffee Cake” are common names for some variant cultivars
The 3 Types of Persimmon

Pollination-Variant (a.k.a. Variant)
How to Remove Astringency from Astringent and Unpollinated Variant Persimmon Cultivars

1. Let fruit sit at room temperature until flesh is jelly-soft. (common method that consumers use with Hachiyas)
2. Expose to ethylene gas.
3. Expose to carbon dioxide gas.
4. Expose to ethanol.
5. Freeze and thaw.
Preservation
Hoshigaki

~4 weeks

top-left photo: Neal P., taken at Benu Restaurant (San Francisco)
https://www.instagram.com/p/-VDJLTAbrf/
other photos: Russell Yip, The San Francisco Chronicle
Preserved Pulp

- frozen pulp
- jam
- pie filling
Frozen Slices

- freezing reduces astringency for some (but not all) Astringent and unpollinated Variant cultivars
- luckily, ‘Hachiya’ is a good responder to freeze-thaw treatment
- did not test blanching
- did not test sugar addition
- did not test acid addition
Line Attribute Results for Frozen-Thawed

Sweetness: Fresh vs. Frozen-Thawed

Sourness: Fresh vs. Frozen-Thawed

Astringency: Fresh vs. Frozen-Thawed

no significant difference from Fresh to Frozen-Thawed

significant decrease from Fresh to Frozen-Thawed, but small in absolute value

significant decrease from Fresh to Frozen-Thawed, and large in absolute value

Error bars represent +/- 1 standard deviation

[this slide from Sedej et al. “Reducing astringency in persimmons through processing, an approach for increasing marketability”, presented at the American Chemical Society Nat’l Meeting & Expo - Philadelphia, PA - 22 Aug 2016]
Sensory Freeze-Thaw Summary

[Best Responders to Freeze-Thaw Treatment]

[This slide from Sedej et al. “Reducing astringency in persimmons through processing, an approach for increasing marketability”, presented at the American Chemical Society Nat’l Meeting & Expo - Philadelphia, PA - 22 Aug 2016]
Hot Air Drying

- water rinse > 200 ppm chlorine > water rinse
- slice to 5 mm on commercial meat slicer
- 125°F (52°C) for 18 hours → safe but over-dried
- did not test blanching
- did not test sugar addition
- did not test acid addition
What **Not** to Do With Hot Air Drying

**Do Not…**

- remove the seeds ahead of time (easier to pick them out after drying)
  - active debate on kitchen knife vs. mandolin
Seeds
What **Not** to Do With Hot Air Drying

**Do Not…**

- remove the seeds ahead of time (easier to pick them out after drying)
  - active debate on kitchen knife vs. mandolin
- wait til astringent/unpollinated-variant fruits are mellowed
  - too soft to safely slice
Squishy Fruit Are Difficult to Slice
What **Not** to Do With Hot Air Drying

**Do Not…**

• remove the seeds ahead of time (easier to pick them out after drying)
  – active debate on kitchen knife vs. mandolin

• wait til astringent/unpollinated-variant fruits are mellowed
  – too soft to safely slice

• dry pollinated (brown) variants
Dried Variants

These taste good but have awful appearance and texture.
Thank you for your attention!

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For additional information…
Persimmon Project Website:
https://www.ars.usda.gov/PersimmonCDFA2014Project.html