Pomegranates at the University of Georgia Ponder Farm (Tifton)

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Fruit quality and nutritional value

- Fruit quality affected by:
  - Cultivar
  - growing region
  - Climate
  - Maturity
  - Cultural practice
  - Storage

- Pomegranate is rich source of organic acids, phenolic compounds, sugars, water-soluble vitamins and minerals.
Medical Use

• Long history of use in folk medicine.
• Fruit contains:
  – Anticarcinogenic
  – Antimicrobial
  – Antiviral compounds
  – Strong antioxidant activity of polyphenols

http://clinicaltrials.gov/ct2/show/NCT00617318
Medical Use

- Animal and human clinical studies show pomegranate health benefits:
  - Improve blood lipid profile
  - Reduce blood pressure
  - Improve endothelial function
  - Anti-tumor activity
  - Anti-atherosclerotic activity

http://clinicaltrials.gov/ct2/show/NCT00617318
Variation in Fruit Types

- Considerable variation exists in:
  - Seediness
  - Color
  - Tartness
  - Sweetness
  - Size
Production in South Georgia

- Research plantings available at:
  - **Byron Farm**, USDA-ARS-SE Fruit & Tree Nut Research Lab (Byron)
    - 20 varieties
    - Planted in 1976.
  - **Ponder Farm**, Univ. of Georgia (Ty Ty)
    - 24 varieties
  - **Tifton Campus**, Univ. of Georgia (Tifton)
    - 24 varieties
    - Planted in 2010.
# Pomegranate varieties at UGA

<table>
<thead>
<tr>
<th>Variety</th>
<th>Ponder Farm</th>
<th>Tifton Campus</th>
<th>Variety</th>
<th>Ponder Farm</th>
<th>Tifton Campus</th>
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<tbody>
<tr>
<td>A7:23</td>
<td></td>
<td>x</td>
<td>Molla Nepes</td>
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<tr>
<td>AKA</td>
<td>x</td>
<td></td>
<td>Old Harmon</td>
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<tr>
<td>Azadi</td>
<td>x</td>
<td></td>
<td>Parfyanka</td>
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<tr>
<td>Cloud</td>
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<td>x</td>
<td>Pink</td>
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<td>x</td>
</tr>
<tr>
<td>Comb Sweet</td>
<td>x</td>
<td></td>
<td>R-19</td>
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<td>x</td>
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<tr>
<td>Crab</td>
<td></td>
<td>x</td>
<td>R-2</td>
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<td>x</td>
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<tr>
<td>Cranberry</td>
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<td>x</td>
<td>R-25</td>
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<td>x</td>
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<td>Desertnyi</td>
<td></td>
<td>x</td>
<td>R-26</td>
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<td>x</td>
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<tr>
<td>Don Sumner North</td>
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<td>R-30</td>
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<td>R-33</td>
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<td>R-6</td>
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<td>Eve</td>
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<td>R-8</td>
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<td>R-9</td>
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<td>I-8</td>
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<td>Thomson</td>
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<td>Wonderful (Tifton)</td>
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<tr>
<td>Medovyi Vahsha</td>
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<td>x</td>
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</table>
Methodology

• 20 cultivars at Ponder Farm (Ty Ty)
• Harvest: Manually, early in the morning.
  – Early harvest: 24 Sept. 2010
  – Late harvest: 8 Oct. 2010
• Design: RCBD with factorial arrangement (20 cultivars x 2 maturity stages x 2 shelf life = 80 treatments) and 4 replications.
Physical Analysis

- Every fruit from each cultivar, maturity stage, shelf life and replication was assessed for:
  - **Fruit weight** (balance having an accuracy of 0.001 g)
  - **Size** (equator and pole) using digital micrometer
  - **Skin color** ($L^*$, $a^*$, $b^*$) using colorimeter
  - **Smoothness** (rating 1-5) and surface defects like crack, sunscald and bruise using rating scale 1-3
  - **Decay**: fruit surface (Cercospora) and internal rotting rated using 1-3 rating scale
Chemical Analysis

- **Arils weight** (50 arils). Arils squeezed using a cheese cloth to produce the aril juice.
- **Total Soluble Solids** (TSS) - Digital refractometer.
- **Titratable Acidity** (TA) - Metrohm titration system.
- **Total phenol content** in arils juice - Spectrophotometer
- **Antioxidant activity** in arils juice - two methods:
  - DPPH assay - Spectrophotometer
  - TOSC assay - GC
- **Total anthocyanins content** in arils juice - HPLC
Sensory Analysis

- 20 pomegranate cultivars.
- Panelists (UGA horticulture staff and others)
- Questionnaire on consumer attitudes
- Panelists were asked to evaluate and score separately fruit using a panel score sheet.
- Scoring based on a scale of 1-5 (sweetness and seed hardiness) or 1-3 (taste).
Yield per tree

kg/tree* (2010)

- R-26
- Comb Sweet
- Crab
- Cranberry
- Don Sumner South
- Don Sumner North
- Eve
- Freischman's
- R-9
- R-19
- Old Harmon
- R-8
- Thompson

* Note: 1 kg = 2.2 lbs
Fruit weight

g/fruit* (2010)

R-26, Comb Sweet, Crab, Cranberry, Don Sumner South, Don Sumner North, Eve, Freischman's, R-9, R-19, Old Harmon, R-8, Thompson

*Note: 230 g = 0.5 lb
Fruit weight, g

Pomegranate cultivars

- Early harvest
- Late harvest
L* [a measure of color]

The graph shows the L* value (a measure of color) for various pomegranate cultivars. The cultivars are categorized by early and late harvest samples, with early harvest represented by dark gray bars and late harvest by light gray bars. The cultivars include:

- King
- Thomson
- Pink
- Don summer North
- Kaj akikanor (R9)
- Don summer South
- Sweet
- Cloud
- Fleshman
- Salavski (R8)
- Comb's sweet
- Mejhos (R2)
- Nikitski rami (R19)
- Cranberry
- Utah sweet
- Crab
- Avganski (R26)
**a* (redness)**

- **Pomegranate cultivars**
  - Crab
  - Afganski (R19)
  - Cranberry
  - Comb's sweet
  - Fleshman
  - Thomson
  - Don summer North
  - King
  - Cloud
  - Mejhos (R2)
  - Salavatiski (R8)
  - Entek-Habi saveh (I8)
  - Kaj aqikanor (R9)
  - Pink
  - Utah sweet
  - Sweet
  - Don summer Sourth

- **Legend:**
  - Early harvest
  - Late harvest
b* (yellowness)

Pomegranate cultivars

- Early harvest
- Late harvest
Taste (1 = poor, 3 = excellent)

Pomegranate cultivars

- Early harvest
- Late harvest
Fruit diameter, mm

Pomegranate cultivars

- Early harvest
- Late harvest
Degree of Sunscald (1-3)

Pomegranate cultivars

- Early harvest
- Late harvest
Amount of Cercospora (1-3)

The graph illustrates the amount of Cercospora (1-3) in pomegranate cultivars, comparing early and late harvests. The x-axis represents the pomegranate cultivars, and the y-axis represents the amount of Cercospora. The bars indicate the amount for early and late harvests, with error bars showing variability.
Weight of 50 arils, g

Pomegranate cultivars

- Early harvest
- Late harvest
Amount of Juice in 50 arils, ml

![Graph showing the amount of juice in 50 arils for different pomegranate cultivars, with early and late harvest data indicated.](image)
Juice pH

Pomegranate cultivars

Early harvest  Late harvest
Juice Total Soluble Solids(%)
Titratable Acidity (% citric acid)

<table>
<thead>
<tr>
<th></th>
<th>Early harvest</th>
<th>Late harvest</th>
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</thead>
<tbody>
<tr>
<td>Early harvest</td>
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<tr>
<td>Late harvest</td>
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</table>

Pomegranate cultivars

- Utah sweet
- Kaj akkanor (R9)
- Salavatski (R8)
- Entek Habi savheh (R8)
- Mejnos (R2)
- Afanksi (R26)
- Nikitski ranni (R19)
- Cranberry
- Don summer North
- Don summer South
- Sweet
- Pink
- Cloud
- Thomson
- Fleshman
- King
TSS:acid ratio

Sweet

Sour

Pomegranate cultivars

- Early harvest
- Late harvest
Total phenol content

Pomegranate cultivars

- Early harvest
- Late harvest
Antioxidant activity, DPPH assay

Pomegranate cultivars

- Early harvest
- Late harvest
Sweetness rating (1-5)

Pomegranate cultivars

- Early harvest
- Late harvest
Seed hardness (1-5)

Pomegranate cultivars:
- Don summer South
- Fleshman
- Sweet
- Thomson
- King
- Comb's sweet
- Don summer North
- Pink
- Salavatski (R8)
- Cranberry
- Afganski (R26)
- Crab
- Entek Habi saveh (18)
- Mejhos (R2)
- Nikitski ramii (R19)
- Kaj acikanor (R9)
- Cloud
- Utah sweet

Early harvest, Late harvest
Taste (1 = poor, 3 = excellent)

Taste (1-3) vs. Pomegranate cultivars

- Early harvest
- Late harvest
## Fruit attributes (2012)

<table>
<thead>
<tr>
<th></th>
<th>Fruit Wt (g)</th>
<th>TSS (%)</th>
<th>pH</th>
<th>TA (%)</th>
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<td>17.6 a</td>
<td>1.0 c</td>
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<tr>
<td>Thompson</td>
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<td>14.9 a</td>
<td>5.5 a</td>
<td>2.1 c</td>
<td>7.3 a</td>
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<td>1</td>
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<td>NS</td>
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<td>C x W</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>*</td>
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</table>
R9 (Kaj acik anor)
CONCLUSIONS

• Large variation in fruit yield, fruit color, taste and juice potential among cultivars.

• Cranberry and R19 had among the highest fruit yield and best postharvest attributes and nutraceutical content.