History and Horizons of Primocane-Fruiting Blackberries

John R Clark
University Professor of Horticulture
Thank YOU
California Growers,
for USING the Arkansas Blackberries

Royalty support is key to keeping the program going........
Do we have time for a song?
Breeding Blackberries in Arkansas: An Idea Manifested In January 1964 - and In Its 53rd Year!

Dr. James N. Moore, 1967

J.R. Clark, now
Arkansas Location

- 45 in of rain, all months
- 0 to 100F extremes; high chilling
- Most organisms (pathogens and insects) known to man....are common
- Red berry mite screening or management not done; don’t have downy mildew (*Peronospora*) often
Breeding Blackberries?

• Blackberry breeding idea—improve blackberries; why? Dr. Moore...
  – Native crop; to Arkansas and other areas, more adapted than most fruits
  – Little had been done on a large scale in breeding
  – He had been inspired by his mentor Fred Hough, and in working at the USDA Fruit Laboratory, Beltsville, MD, 1961-1964
The Germplasm Base

• Varieties: Darrow, Brazos, Smoothstem, Thornfee, Humble, a few others

• Major objectives:
  – Large fruit
  – Erect canes
  – Thornlessness, eventually
  – Improved quality
  – Machine harvestable
The First Varieties

• ‘Brazos’ x ‘Darrow’
  – Yielded:
    • ‘Comanche’ (a parent of ‘Tupy’ / ‘Tupi’) - 1974
    • ‘Cherokee’ - 1974
    • ‘Cheyenne’ – 1977
The Next Generation

• Later thorny varieties
  – ‘Shawnee’ – 1983
  – ‘Choctaw’ – 1989
  – ‘Kiowa’ – 1996
  – ‘Chickasaw’ – 1999
  – None were intended for storage or shipping, or evaluated for shipping potential
Breeding for Thornlessness

• ‘Navaho’ was released in 1989, 25 years after the breeding effort began
• And, it had much-improved postharvest storage potential!
Improving Postharvest Storage Potential

• After ‘Navaho’ was released, storage potential was evaluated and was found to be very good
• Dr Penny Perkins-Veazie (then with USDA-ARS/Oklahoma) cooperation the key
Postharvest Storage Potential

- Dr Perkins-Veazie developed a storage protocol
- This has been used for all Arkansas releases from 2007 forward
- Evaluates leak, mold, reversion, softness plus other characters
Postharvest Storage Potential

• Great improvements are yet to be made in storage potential
  – Reduced softening
  – Reduced reversion
Primocane Fruiting (PF)

- Source was the wild plant designated “Hillquist” from Virginia
- One cross made of ‘Brazos’ x “Hillquist” in 1967
- One selection made in 1970 – A-593 (no PF) from 40 seedlings; PF breeding not pursued at that time
Miracle/Divine Intervention/Luck

• In the cross made of ‘Brazos’ x “Hillquist”, the paternal parent produced an unreduced gamete to allow a tetraploid plant to be produced

• This is the same genetic event that moved low chilling into highbush blueberries to create the low-chill industry in the world

• This event is what moved PF into the 4X Arkansas germplasm allowing for crossing and improvement
Primocane Fruiting (PF)

• First group of PF selections made Sept. 27, 1997 in Arkansas

• Small, poor shape, double fruits, poor flavor, if there was fruit at all!
Miracle/Divine Intervention/Luck

- Two selections sent in 2000 to Dr Chad Finn in Oregon to test - APF-8 and APF-12
- Genotype x environment miracle revealed
Primocane-Fruiting Varieties

– ‘Prime-Jim®’ and ‘Prime-Jan®’
– ‘Prime-Ark® 45’
– ‘Prime-Ark® Freedom’
– ‘Prime-Ark® Traveler’
Primocane-Fruiting Breeding

– Crossing among the early PF selections (‘Prime-Ark® 45’ came from this activity)
– Crossing with floricane-fruiting genotypes then continuing to cross back to PFs to recover the PF segregants (‘Prime-Ark® Freedom’, ‘Prime-Ark® Traveler’ came from this activity; others will also)
**Prime-Ark® Traveler**

The First PF, Thornless, SHIPPING-
QUALITY Blackberry

- Medium size – 7 g
- 9-11% SS, reduced acidity
- Shipping potential for distant markets
- Target use is shipping, local markets and home gardens
Yield of two primocane-fruiting and two floricane-fruiting blackberry varieties in replicated trials that were established in 2011 and 2012 at the University of Arkansas Fruit Research Station, Clarksville.

<table>
<thead>
<tr>
<th>Variety</th>
<th>2011 Planting (lbs/acre)</th>
<th>2012 Planting (lbs/acre)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Floricane harvest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime-Ark® Traveler</td>
<td>9,827 c²</td>
<td>20,003 c</td>
<td>8,767 b</td>
<td>11,649 cd²</td>
<td>11,851 b</td>
</tr>
<tr>
<td>Natchez</td>
<td>26,047 a</td>
<td>32,514 ab</td>
<td>17,897 a</td>
<td>34,208 a</td>
<td>19,383 a</td>
</tr>
<tr>
<td>Ouachita</td>
<td>16,389 b</td>
<td>27,457 b</td>
<td>13,366 ab</td>
<td>20,567 bc</td>
<td>11,113 b</td>
</tr>
<tr>
<td>Prime-Ark® 45</td>
<td>18,170 b</td>
<td>28,374 b</td>
<td>10,638 b</td>
<td>18,597 bc</td>
<td>9,131 b</td>
</tr>
<tr>
<td><strong>Primocane harvest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prime-Ark® Traveler</td>
<td>0</td>
<td>3,842 b</td>
<td>6,673 a</td>
<td>4,428 a</td>
<td>6,752 a</td>
</tr>
<tr>
<td>Prime-Ark® 45</td>
<td>0</td>
<td>5,821 a</td>
<td>5,793 a</td>
<td>6,957 a</td>
<td>4,441 a</td>
</tr>
</tbody>
</table>

²Means in the same column within cane type followed by the same letter are not significantly different by t-test, \( P \leq 0.05 \).
Summary of temperatures (°F) at the Fruit Research Station, Clarksville, AR for 2012 through 2015 during the months of June through August.

<table>
<thead>
<tr>
<th>Year</th>
<th>Ave. high June, July, Aug.</th>
<th>Days above 90°F</th>
<th>Days above 95°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>90</td>
<td>68</td>
<td>42</td>
</tr>
<tr>
<td>2013</td>
<td>87</td>
<td>36</td>
<td>6</td>
</tr>
<tr>
<td>2014</td>
<td>85</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>2015</td>
<td>87</td>
<td>30</td>
<td>4</td>
</tr>
</tbody>
</table>
### Comparing Prime-Ark 45® and Prime-Ark® Traveler

<table>
<thead>
<tr>
<th>PA 45</th>
<th>PA Traveler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thorny</td>
<td>Thornless</td>
</tr>
<tr>
<td>7-9 g berry; can be jumbo</td>
<td>7-8 g berry; uniform</td>
</tr>
<tr>
<td>Yield often higher</td>
<td>Yield equal to lower</td>
</tr>
<tr>
<td>Nice flavor, some bitterness, SS 10-12%, sub-acid</td>
<td>Nice flavor, no bitterness, SS 10-12%, sub-acid</td>
</tr>
<tr>
<td>Double fruit tendency in heat</td>
<td>Double fruit rare in heat</td>
</tr>
<tr>
<td>Double tipping required</td>
<td>Double tipping required</td>
</tr>
<tr>
<td>Data indicate comparable reversion, leak and soft to PA Traveler</td>
<td>Data indicate comparable reversion, leak and soft to PA 45</td>
</tr>
</tbody>
</table>
## Comparing Prime-Ark 45® and Prime-Ark® Traveler

<table>
<thead>
<tr>
<th>PA 45</th>
<th>PA Traveler</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fruit compression</strong></td>
<td>Fruit compression 12.4 N; better potential storage??</td>
</tr>
<tr>
<td>9.0 N</td>
<td></td>
</tr>
<tr>
<td><strong>Ark FC first ripe date</strong></td>
<td>AR FC first ripe date 9 June</td>
</tr>
<tr>
<td>June 8</td>
<td></td>
</tr>
<tr>
<td><strong>Ark PC first ripe date</strong></td>
<td>AR PC first ripe date July 25- Aug 4</td>
</tr>
<tr>
<td>12 days after PA Traveler</td>
<td></td>
</tr>
<tr>
<td><strong>CA PC first ripe date</strong></td>
<td>CA PC first ripe date 24-30 July</td>
</tr>
<tr>
<td>15-16 July</td>
<td></td>
</tr>
<tr>
<td><strong>AR FC budbreak</strong></td>
<td>AR FC budbreak 8 days after PA 45</td>
</tr>
<tr>
<td>8 days before PA Traveler</td>
<td></td>
</tr>
<tr>
<td><strong>AR 50% FC bloom</strong></td>
<td>AR 50% bloom May 5</td>
</tr>
<tr>
<td>May 1</td>
<td></td>
</tr>
<tr>
<td><strong>No downy mildew seen in CA yesterday</strong></td>
<td>Some downy mildew seen on lower leaves in CA yesterday</td>
</tr>
</tbody>
</table>
Tipping – Make Sure You Do It!!
Prime-Ark® Freedom

- FC crop ripens 7-10 days before Natchez – really early
- Best primocane crop in California – a cooler location than the South...
- Primocane berries up to 16 g in (cool places)
- Intended for home garden or local-market use
So, What’s Coming in New PF Varieties?

• Major areas of focus
  – Fruit firmness and postharvest handling
  – Thornlessness
  – Earlier ripening PCs
  – Healthy plants, varied architecture?
  – Increased yield and precocity; intensification of the PF trait
  – Continuing to move traits from FF genotypes including crispy, low acid, various other traits
Floricane Varieties

• These are the primary varieties in the South and where heat is an issue and PF varieties do not perform well
• Can be grown in most of the US, even now in colder areas using the rotatable crossarm trellis to allow coverage of plants in winter
• Lots to choose from, a few comments follow
Osage—The Newest Arkansas Thornless Floricane-fruiting Blackberry

- Ripens (in Ark.) between Natchez and Ouachita, ave. June 10 beginning harvest—a COMPLEMENT TO OUACHITA
- Yields have been consistent and good, comparable to higher than Ouachita
- Berry size is medium, 5-6 g, slightly smaller than Ouachita
- Flavor is a key attribute of Osage, lower acid flavor with notable flavor components coupled with high soluble solids
- Good even on “bad flavor days” as noted by JRC over the years
- Great postharvest handling potential
Osage—What Are Folks Saying?

- The FLAVOR IS GREAT — BRING THAT ONE HOME!!
- No complaints about size
- Packs really easy particularly in smaller clamshells
- The best plant health!
- About 300,000 plants sold thus far....fourth of the Arkansas varieties (Nat, Oua, PA 45)
- This one is worth trying if you have not considered
Ouachita – The Arkansas Standard

- The most widely planted and adapted
- Consistent production
- Excellent shipping capability
- Over 1 million plants sold last three years
- *If you plant one Arkansas variety, plant this one*
Natchez – Start out BIG

• Earliness is the key, a week before Ouachita
• Very high yield potential, don’t let overcrop
• Can be tart early, can be the BEST also
• Large, fills the clamshell mighty quick
• Over 500,000 plants sold last three years
• Postharvest handling a little trickier, more reversion and soft than others; pick and handle early
• Still one of my favorites of all to pick and tote home – JR Clark
Arkansas Fruit Breeding-Still More Good Things Coming! **For 52 Years!!!!**

AND THANKS FOR YOUR TIME!

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