



Pawpaw Update: June 21, 2007

Kirk W. Pomper, Ph.D.

Principal Investigator of Horticulture/ Kentucky State University
Adjunct Assistant Professor of Horticulture/ Univ. of Kentucky



Introduction:

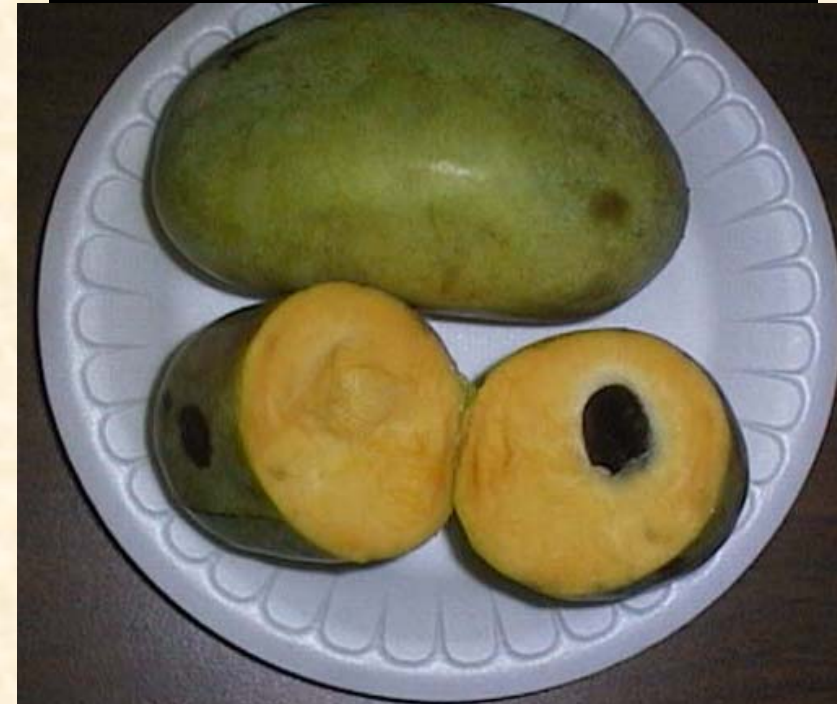
What is Pawpaw?

- *Asimina triloba* (L.)
Dunal.
- Native tree fruit in the southeastern U.S.
- Fruit can weigh up to 2 lbs.
- Organic production possible



The Pawpaw Fruit

- Tropical-like flavor and aroma resembles mixture of banana, mango, and pineapple.
- Custard-like fruits are berries
- The fruit is very nutritious and high in antioxidant activity.
- Could be used in blended fruit drinks, ice creams, yogurt, etc.



Zimmerman

Flowering Time and Harvest

■ The North American Pawpaw, *Asimina triloba*:

- Cross-pollinate
- Pollinated by flies and beetles
- Ripe fruit should yield when squeezed and give way with a gentle tug
- Color change not a reliable indicator of ripeness
- Fruit may be harvested from the same tree over several weeks



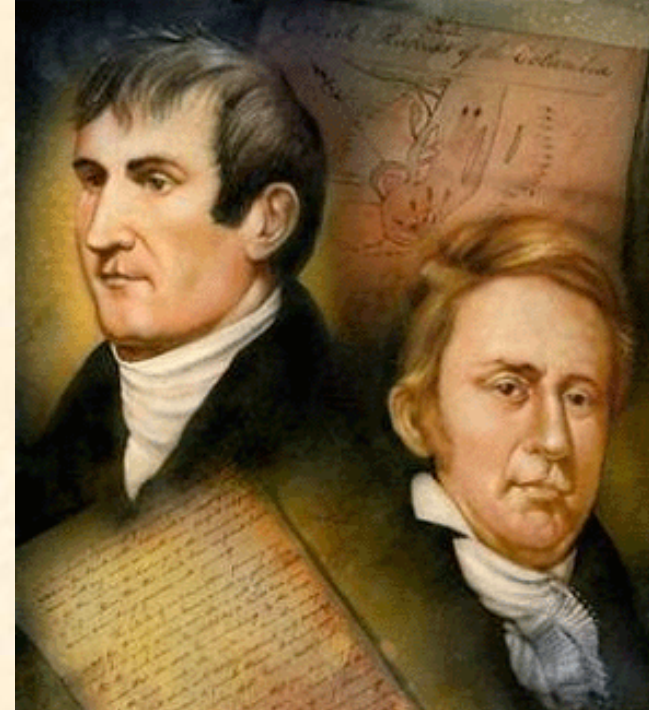
Pawpaws in the Wild



- *A. triloba* is usually found in the forest understory in hardwood forests
- Clonal reproduction by root suckering
- You may not find many fruit (shade, self-incompatibility, lack of pollinators)

History of the Pawpaw

- Lewis and Clark recorded in their journal (18 Sept. 1806) how pawpaws helped save them from starvation.





Hatfield family photo courtesy of McDowell
County Historical Society

Pawpaw Tree Incident

(Marker Number: 2047)

County: Pike

Location: Near Buskirk, KY 1056

Description: This episode is result of August 1882 election-day fight. Tolbert, a son of Randolph McCoy, exchanged heated words with Ellison Hatfield, which started a fight. Tolbert, Pharmer and Randolph McCoy Jr. stabbed Ellison to death. Later the three brothers were captured by Hatfield clan, tied to **pawpaw trees**, and shot in retaliation. Presented by Pikeville-Pike County Tourism.

Where Are We in Terms of Developing a Pawpaw Industry?

- Orchard (cultivars) vs. wild collected fruit
- Private orchards established AL, CA, KY, NC, MD, MI, MO, OH, and WV.
- Ohio Pawpaw Growers Association
 - Ohio Pawpaw Festival



Freeze Damage!



- April 7-9, 2007 freeze destroyed most of the pawpaw crop.

Research Update

- Ornamental Pawpaws
- DNA fingerprinting
- Regional Variety Trial Summary
- Acetogenin Update

KSU Ornamental Pawpaw Project

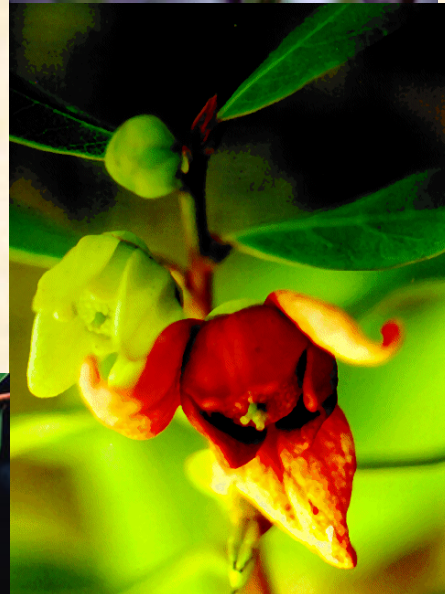
- Started in 1995 with about 200 plants from Mr. Neal Peterson that were the result of a cross between *Asimina triloba* (female) x *Asimina reticulata* (pollen).



The genus *Asimina*

■ Other members of the *Asimina* genus that are native to the extreme southeastern states:

- *A. incarnata* (Bartr.) Exell. (flag pawpaw)
- *A. longifolia* Kral, *A. obovata* (Willd.) Nash
- *A. obovata* Kral
- *A. pygmaea* (Bartr.) Dunal
- *A. reticulata* Shuttlw. ex Chapman
- *A. tetramera* Small (opossum pawpaw)
- *A. parviflora* (Michx.) Dunal (dwarf pawpaw)



KSU Ornamental Pawpaw Project

- Started in 1995 with about 200 plants from Mr. Neal Peterson that were the result of a cross between *Asimina triloba* (female) x *Asimina reticulata* (pollen).



X







Red F1

X



Red F1

F2-Many Flowers Colors





KSUOR001P



KSUOR002Y



KSUOR003Y



KSUOR004R

KSU Ornamental Pawpaw Project

- Propagation a challenge
- We will try a number of clonal propagation approaches

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DNA Fingerprinting

- Dr. Li Lu, Co-Investigator of Biotechnology

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Establishing A Pawpaw Orchard

- “Pawpaw Planting Guide”

- Site

- air drainage (frost)
- deep, fertile, well-drained soil, pH 5.5-7.0
- water source for irrigation



What is a Cultivar?



- Cultivar = refers to a named group of plants within a cultivated species that is distinguishable by a character or group of characters and that maintains its identity when propagated either asexually (e.g. 'Jonathan' apple) or sexually (e.g. 'Tendercrop' snapbean)

Seedlings and Cultivars

- Seedlings produce fruit in 5-8 years
- Grafted cultivars can produce fruit in 3 years; know fruit quality
 - Takes about 5-6 years to reach full production



Pawpaw Propagation and Nursery Sources



- Historically, pawpaws have been a difficult tree species to propagate
 - Seed requires stratification and is desiccation sensitive
- Commercial clonal propagation of cultivars is via chip budding onto seedling rootstock
- Many nurseries grow pawpaw seedlings in containers
- High prices for seedling and grafted trees are limiting the development of an industry
 - Seedlings \$5.00-\$10.00
 - Grafted trees \$15.00-\$25.00



What cultivars should I plant?

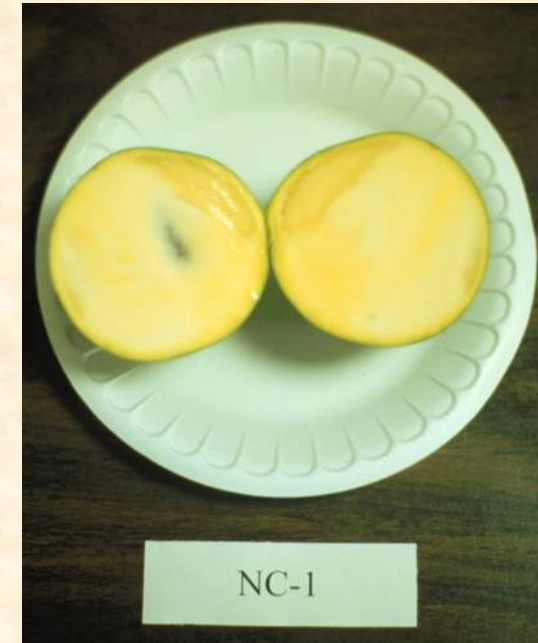
Materials and methods

- 28 selections, 10 named varieties, 224 total grafted trees on PPF seedling rootstock (half-sib seed)
- Established in March 1998 at the KSU Research and Demonstration Farm in Frankfort, Kentucky in a Lowell silt loam soil (pH 6.9)
- Spacing 2 m (6.5 ft) between trees, 5.5 m (18 ft) between rows



Commercially Available Cultivars

Clone	Genetic background
‘Middletown’	Wild seedling from Middletown, Ohio
‘Mitchell’	Wild seedling from Iuka, Ill.
‘NC-1’	‘Davis’ female × ‘Overleese’ male
‘Overleese’	Cultivated (open-pollinated) seedling from Rushville, Ind.
‘PA-Golden’	Second-generation seedling from G.A. Zimmerman collection
‘Sunflower’	Wild seedling from Chanute, Kans.
‘Taylor’	Wild seedling from Eaton Rapids, Mich.
‘Taytwo’	Wild seedling from Eaton Rapids, Mich.
‘Wells’	Cultivated (open-pollinated) seedlings from Salem, Ind.
‘Wilson’	Wild seedling from Cumberland, Ky.



Seedlings of Commercially Available Cultivars



Clone	Genetic background
1-7-1 Shenandoah	Open-pollinated seedling of 'Overleese'
1-23	Open-pollinated seedling of 'Taylor'
1-68	Open-pollinated seedling from 'Overleese'
8-20	Open-pollinated seedlings of 'Sunflower'

Seedlings from Collections

Clone	Open-pollinated seedling of
1-7-2	BEF-30
2-10	BEF-30
2-54	GAZ-VA
3-11	BEF-33
3-21	BEF-43
4-2	BEF-53
5-5	BEF-54
7-90	RS-2
8-58 Rappahannock	BEF-30
9-47	BEF-49
9-58	BEF-50
10-35	BEF-49
11-5 Susquehanna	BEF-53
11-13	BEF-53



BEF = Blandy Experimental Farm Collection, Boyce Va.

GAZ = George A. Zimmerman Collection., Linglestown, Pa.

RS = Ray Schlaanstine Collection, West Chester, Pa.

Fruit Production on Mature Trees 2002-2006

Variety	Fruit weight (g)	Number of fruit per tree
Potomac	240 a	35 fg
Susquehanna	195 b	30 g
5-5	192 bc	30 g
Wabash	188 bc	52 ef
NC-1	177 bcd	35 fg
Overleese	171 cd	44 efg
1-68	167 d	72 bcd
8-20	164 de	50 efg
2-10	162 def	43 efg
Shenandoah	160 def	63 cde
Sunflower	159 def	62 cde
9-58	146 efg	62 cde
10-35	145 fg	86 ab
3-11	137 gh	55 def

Fruit Production on Mature Trees 2002-2006

Variety	Fruit weight (g)	Number of fruit per tree
7-90	136 gh	58 cde
11-13	129 ghi	61 cde
1-23	129 ghi	74 bcd
Taytwo	121 hij	58 cde
2-54	120 hij	57 de
3-21	119 hij	45 efg
Mitchell	115 ij	44 efg
PA-Golden	112 ijk	100 a
Wells	106 jkl	54 def
Taylor	106 jkl	56 de
Rappahannock	93 klm	77 bc
Wilson	86 lm	102 a
Middletown	81 m	65 cde



Pawpaw RVT Overview



- Based on fruit size and quality the pawpaw cultivars: **Potomac, Susquehanna, Wabash, Overleese, Shenandoah, NC-1, and Sunflower** can be recommended.

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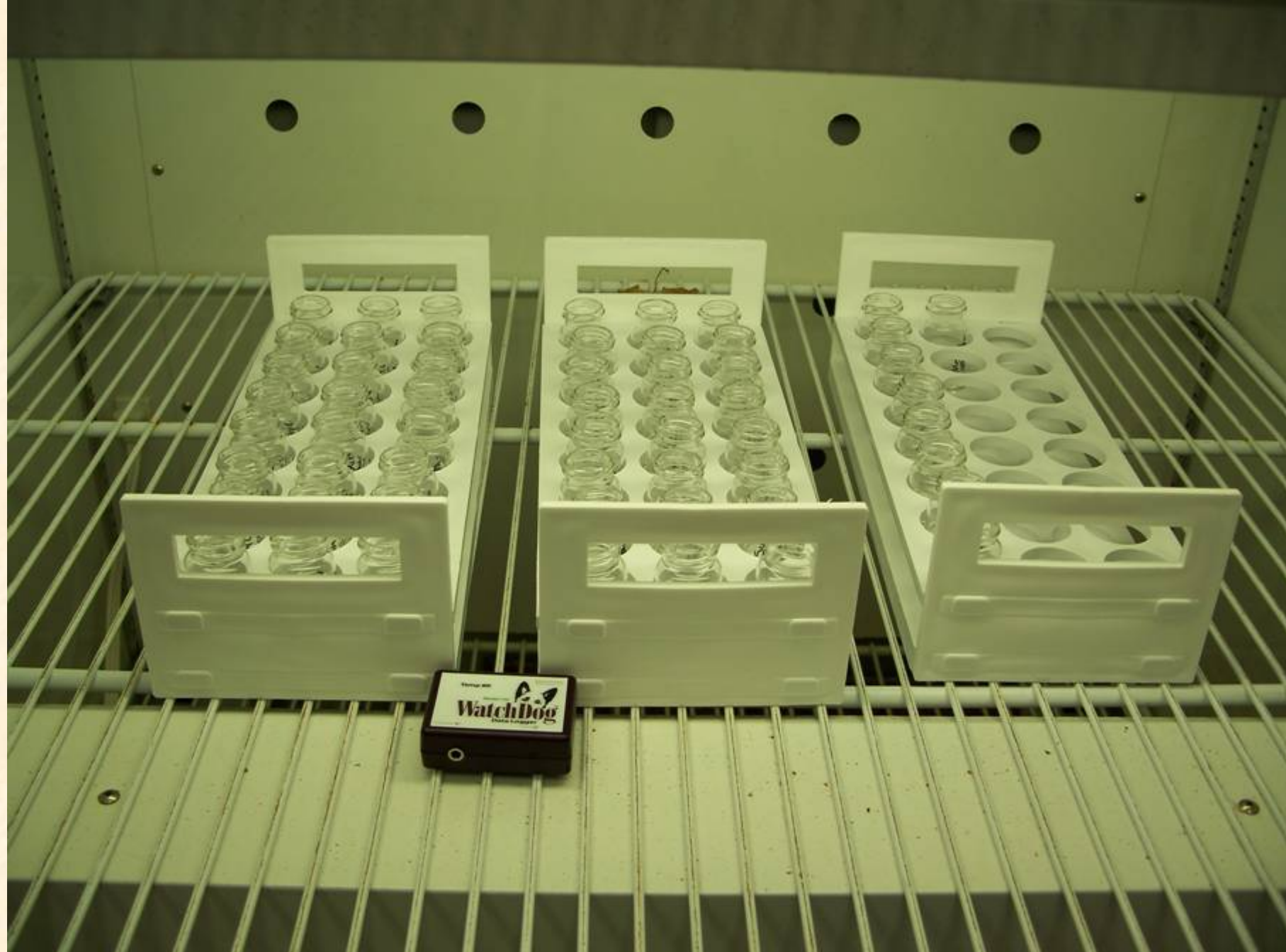
Pawpaw Anticancer Acetogenin Compounds

- Annonaceous acetogenins
 - Long unbranched fatty acid chain
- Present in twig tissues and recently found in fruit tissue
- Anti-cancer activity
- Sometimes suggested as a potential health problem
 - Atypical parkinsonism?

■ Brine Shrimp Test









The BST Results

- High acetogenin cultivars:
 - NC-1, PA-Golden, Potomac, Susquehanna, Wabash, Overleese, Shenandoah, Taytwo, Taylor, Mitchell, Middletown, and Zimmerman
- Low acetogenin cultivars:
 - Sunflower and Wells