

# The Pawpaw: Its Past, Present, and Future

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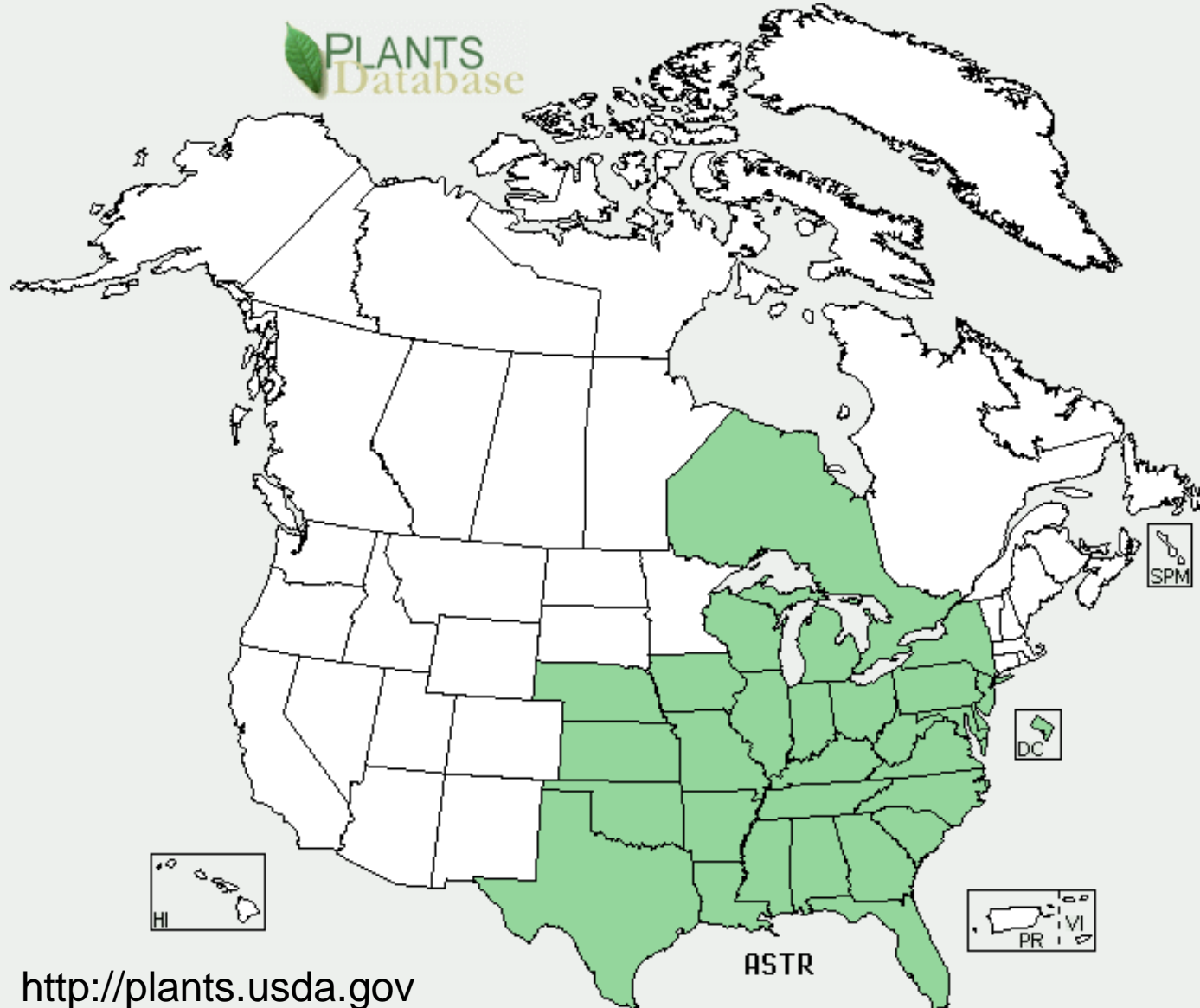
# The North American Pawpaw

- *Asimina triloba* (L.)  
Dunal.
- Slow growing,  
moderate sized tree;  
pyramidal in full sun
- Fruit:
  - Clusters of 1-13 fruit
  - Fruit up to 2 lbs.



K. Pomper

# Native Range (*Asimina triloba*)



<http://plants.usda.gov>

# 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)

# The Pawpaw Fruit

- Tropical-like flavor and aroma
  - banana, mango, and pineapple
- Nutritious and high in antioxidant activity
- blended fruit drinks, ice creams, yogurt, etc.



Zimmerman

S. Jones

# Pawpaw Market Potential

- Farmers Markets
  - Fruit: \$1 each
  - \$2 to \$3/pound
- Gourmet Market
  - Frozen pulp
  - Ice cream
- Restaurants



# History of the Pawpaw

- In 1541 Spanish explorer Hernando de Soto found Native Americans growing and eating pawpaws in the valley of the Mississippi.
- Lewis and Clark recorded in their journal (18 Sept. 1806) how pawpaws helped save them from starvation.
- Daniel Boone and Mark Twain were pawpaw fans.





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.

# Domesticating Pawpaw

- In 1916, best pawpaw contest sponsored by the American Genetics Association
  - “intelligent breeding” would result in commercial quality varieties and an industry would begin (Popenoe 1916, 1917).
- An industry did not develop
- One reason for the failure of pawpaw to become popular could be rapid perishability of fruit



# New Interest in Pawpaw

- From 1950 and 1985, interest grew nurtured by individuals in the Northern Nut Growers Association
- The PawPaw Foundation was founded in 1988, by R. Neal Peterson
- Ohio Pawpaw Festival (1999-present), Ohio Pawpaw Growers Association (2000), and Appalachian Pawpaw Growers Association (2008)

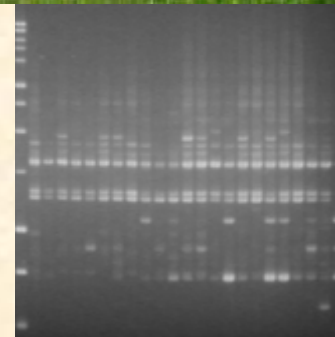
# The Kentucky State University Pawpaw Research Program

## ■ Program Leaders:

- Brett Callaway (1990-1993)
- Desmond Layne (1994-1997)
- Kirk Pomper (1998-Present)

## ■ USDA National Clonal Germplasm Repository for Pawpaw; satellite of Corvallis, OR (1994)

## ■ 2000 accessions from 17 different States; over 45 cultivars



# Establishing A Pawpaw Orchard

- “Pawpaw Planting Guide”
- Site
  - air drainage (frost)
  - deep, fertile, well-drained soil, pH 5.5-7.0
  - Weed control
    - Johnson grass
  - water source for irrigation



# Pawpaw Propagation and the Nursery Industry

- High tree prices are limiting development of an industry
  - Seedlings \$5-\$10
  - Grafted trees \$15-\$30
- Grafted trees (named cultivars) produce fruit sooner after planting and have a known fruit quality.



# Pawpaw Propagation

- If you do produce trees from seed:  
Historically, pawpaws have been a difficult tree species to propagate:
  - Seed requires stratification (3 months of refrigeration)
  - Desiccation sensitive (do not dry out)
  - Seed is killed by freezing
- Commercial clonal propagation of cultivars is via chip budding onto seedling rootstock
- Many nurseries grow pawpaw seedlings in containers
- Top working existing trees



**What cultivars should I plant?**

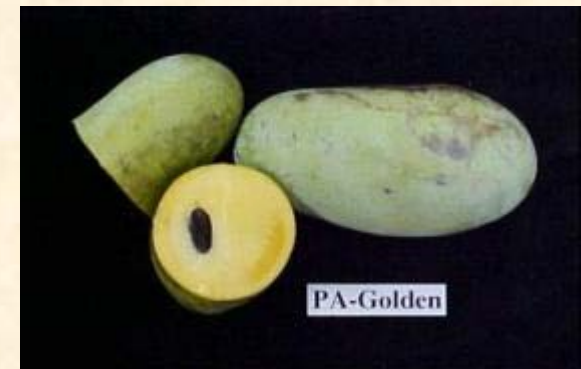
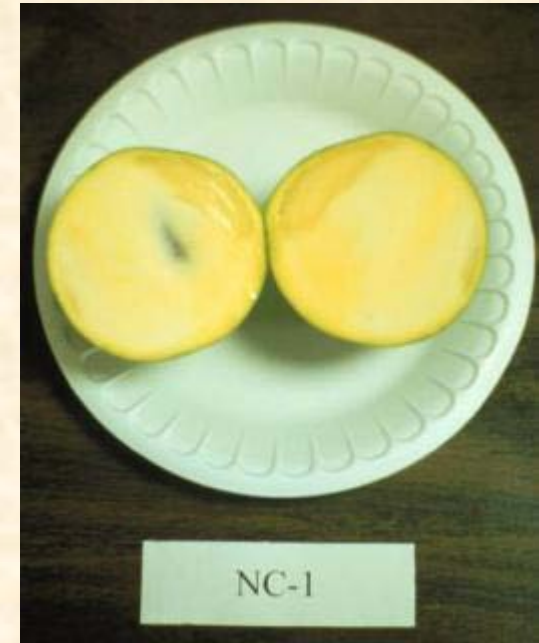
# Variety Trial at KSU

- 28 selections, 10 named varieties, 224 total grafted trees on PPF seedling rootstock (half-sib seed)
- Spacing 2 m (6.5 ft) between trees, 5.5 m (18 ft) between rows
- Princeton, KY (1995) and Frankfort, KY (1998)



# 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 <a href="#">Shenandoah</a>	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 <b>Wabash</b>	BEF-30
2-10	BEF-30
2-54	GAZ-VA
3-11	BEF-33
3-21	BEF-43
4-2 <b>Potomac</b>	BEF-53
5-5	BEF-54
7-90	RS-2
8-58 <b>Rappahannock</b>	BEF-30
9-47	BEF-49
9-58	BEF-50
10-35	BEF-49
11-5 <b>Susquehanna</b>	BEF-53
11-13	BEF-53

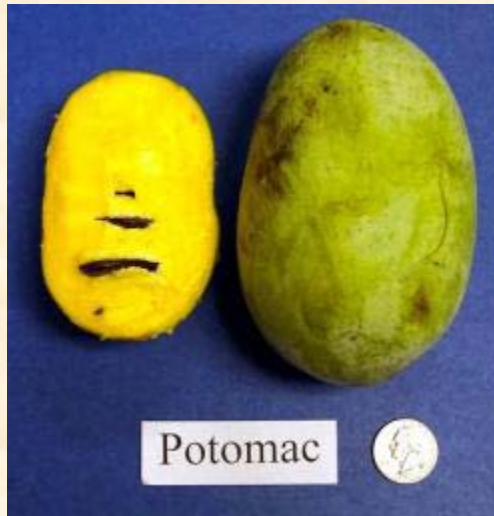


BEF = Blandy Experimental Farm Collection, Boyce Va.

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

RS = Ray Schlaanstine Collection, West Chester, Pa.

# Fruit Production on Mature Trees 2004-2006 in Frankfort



Clone	Average fruit weight (g)	Average number of fruit per tree
Potomac	235 a	44 ghi
5-5	188 b	39 hi
Wabash	185 b	65 fg
Susquehanna	184 b	39 i
NC-1	179 bc	44 ghi
Overleese	170 bcd	54 fghi
8-20	170 bcd	59 fghi
1-68	167 bcd	90 cde
2-10	160 cde	52 fghi
Shenandoah	156 def	78 def
Sunflower	155 def	74 def
9-58	146 efg	79 def
10-35	145 efg	105 abc

# Fruit Production on Mature Trees 2004-2006 in Frankfort




Clone	Average fruit weight (g)	Average number of fruit per tree
3-11	137 efgh	68 ef
7-90	135 fghi	74 def
1-23	126 ghij	90 cde
11-13	124 hij	75 def
Taytwo	121 hijk	73 def
2-54	121 hijk	73 def
3-21	115 ijkl	60 fghi
Mitchell	112 jkl	58 fghi
PA-Golden	108 jklm	118 ab
Taylor	106 jklm	68 efg
Wells	104 klm	64 fgh
9-47	100 lm	74 def
Rappahannock	96 lm	96 bcd
Wilson	89 mn	128 a
Middletown	75 n	74 def

# NC-1

- Fruit weight: 179 g
- Number of fruit/tree: 44
- Good flavor
- Available from many commercial nurseries




NC-1 

# Overleese

- Fruit weight: 170 g
- Number of fruit/tree: 54
- Good flavor
  - (melon)
- Available from many commercial nurseries



Overleese 

# Sunflower

- Fruit weight: 155 g
- Number of fruit/tree: 74
- Mild flavor
- Available from many commercial nurseries



Sunflower



# Potomac

- Fruit weight: 235 g
- Number of fruit/tree: 44
- Good flavor
- Fruit cracking?
- Available:
  - Nolin River Nut Tree Nursery
  - Forest Keeling



Potomac 

# Shenandoah

- Fruit weight:  
156 g
- Number of  
fruit/tree: 78
- Mild flavor
- Available:
  - Nolin River  
Nut Tree  
Nursery
  - Forest Keeling



Shenandoah



# Wabash

- Fruit weight:  
185 g
- Number of  
fruit/tree: 65
- Dark flesh
- Cracking  
issues
- Available:
  - Nolin River Nut  
Tree Nursery
  - Forest Keeling



Wabash



# Establishing a Pawpaw Orchard

- Pawpaw will fruit in the shade, optimum yields are obtained in open exposure
- Grass and weed control!
- Shading recommended the first year
- Irrigation should be provided at least the first two years



# Pawpaw Pruning



# Field Planting Pawpaw



- 8' between trees, 18' between rows
- 295 trees/ac
- Tree seldom grow taller than 25 feet

# Fertilization and Irrigation of Pawpaw



- Trickle Irrigation:
  - emitters (1 gal/hr) with 2 emitters/tree
  - about 240 gal/tree/yr.
- Fertigation: Peters 20-20-20 (3 times each yr.)
  - 0.6 oz N/tree/yr.
- Granular (10-10-10)
  - 1 oz N/tree/yr., 2 oz N/tree/yr. after two years

# Pawpaw Pests and Diseases

- Leaf and fruit spot (*Phyllosticta*)
- Japanese beetles
- Leaf rollers
- Zebra swallowtail butterfly-not necessarily a pest
- *Talponia plummeriana* - pawpaw peduncle borer



# Pawpaw Flowering and Harvest

- Flowers: male and female parts in a flower
- Cross-pollinate (self-fruitful?)
- Pollinated by flies and beetles
- Ripe fruit-soft
- Color change not a reliable indicator of ripeness
- Harvest from the same tree over several weeks



# The Potential of Pawpaw

- Fresh market-unique flavor
- Appearance-not unappealing
- Post harvest handling issues
  - Bruising
  - Short shelf-life of about 7 days at room temp
  - Storage for 2-3 wks under refrigeration



# The Potential of Pawpaw

- Processing pulp
  - Hand processing
  - Labor intensive



# Roma Food Processor with Grape Spiral with Pumpkin Screen



# Research Update from KSU

- New Cultivar development
- Fruit thinning
- Roostock and Training trial

# Further Germplasm Improvement

## ■ Evaluation of:

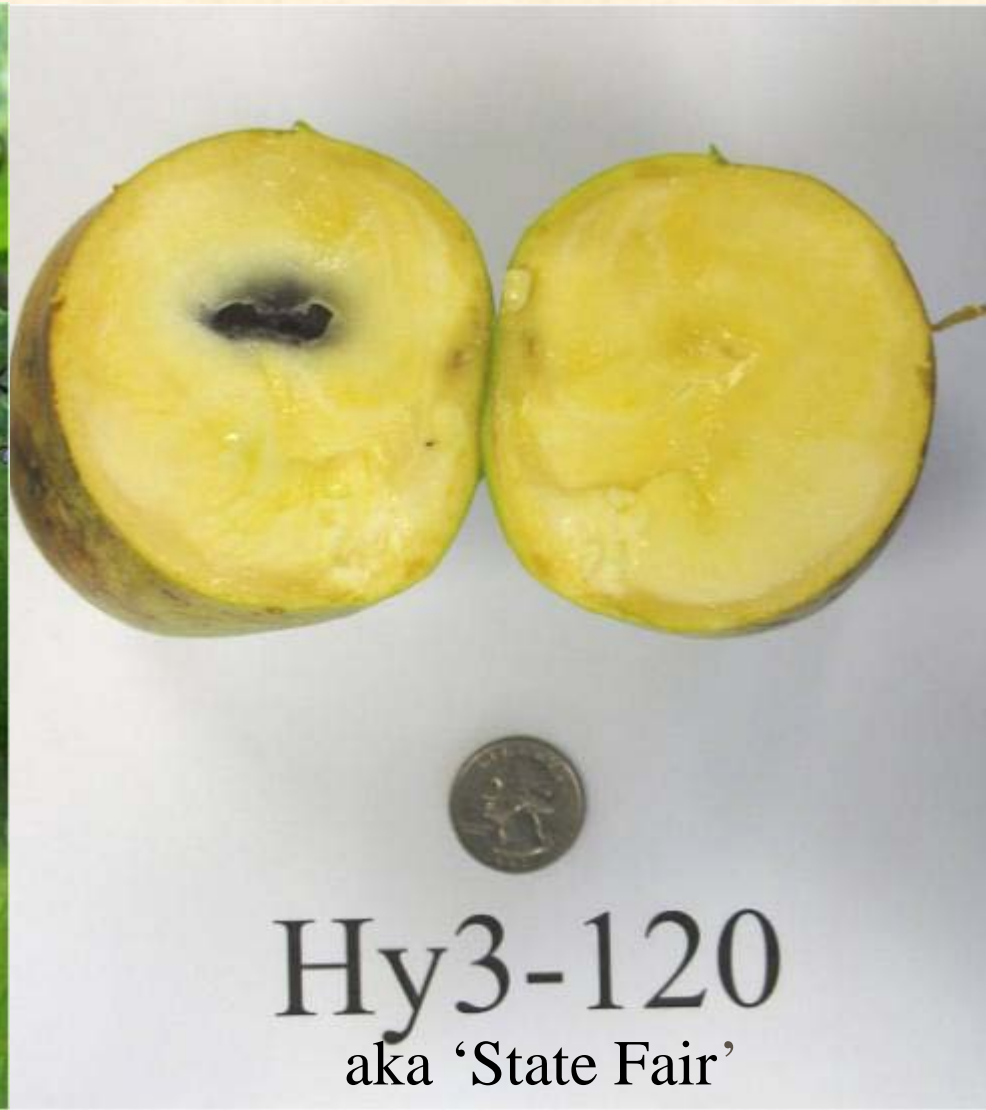
- Seedling populations from throughout the native range
- Crosses from Neal Peterson
- Hybrid material from *Asimina triloba* x *A. reticulata*



# KSU-Atwood™



# 2011 Pawpaw Variety Trial



Hy3-120  
aka 'State Fair'

# 2011 Pawpaw Regional Variety Trial

row	tree	Name & comments	Total # fruit	avg frt wt oz	yield lbs/tree	% frt >3.5 oz
4	20	Salem, IN (late flowering)	272	3.1	52.6	28%
4	25	Ithaca, NY (coconut flavor)	92	6.0	34.8	89%
9	109	11-13 x 1-23 (large fruit)	254	7.2	114.8	93%
9	111	11-13 x 1-23 (high yield)	500	5.4	168.0	79%
3	25	2-9 x 10-35 (firm?)	148	4.2	39.0	65%
5	23	Ithaca, NY (early ripening)	139	5.7	49.8	82%



# Fruit Thinning to Increase Fruit Size



# Average fruit weights of hand-thinned and unthinned pawpaw fruit in 2006 and 2008

Treatment	Fruit weight (g)	
	2006	2008
Hand-Thinned	129	145
Control	88	118
significance	* *	*



Central leader



Planted spring 2004  
Photo taken 1/28/08

Minimal pruning



Planted spring 2004  
Photo taken 4/21/10

# 2009 Growing Season

Scion	Survival	TCA	# of clusters	# of Flower Buds	# of fruit	fruit per cluster	fruit wt (oz)	Yield (lb)
Susquehanna	61%	23.3	7.0	65	21	2.7	9.4	11.7
Sunflower	76%	22.1	17.0	136	36	2.1	6.7	15.2
P-value	NS	NS	***	***	*	***	(l)	NS

Rootstock	Survival	TCA	number of fruit	fruit weight (g)	Yield (kg)	fruit set
RVT	73 ab	21.7	32	218 ab	6.3	15%
Sunflower	87 a	23.2	22	226 a	5.1	8%
PA-Golden	75 ab	25.3	33	235 a	7.2	17%
K8-2	57 bc	20.8	22	176 b	4	33%
Susquehanna	48 c	20.8	40	220 ab	8.2	13%
P-value	**	NS	NS	*	NS	NS

# 2009 Growing Season

Scion	Survival	TCA	# of fruit	fruit weight (g)	Yield (kg)	fruit set
Minimal Pruning	60%	28.5	35	7.4	7.3	25%
Central Leader	76%	17.8	25	7.9	5.3	10%
P-value	*	***	NS	(I)	NS	*



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Photograph of pawpaw flower taken on May 5, 2009. Photo by Jeremy Lowe.

*pawpaw.kysu* provides information on how to grow and use fruit from the North American pawpaw tree.



## Pawpaw News

[Pawpaws Gain Standing as Kentucky Crop \(6/28/09\)](#)

[Pomper and Crabtree win Shepard Award for Pawpaw Research \(6/18/09\)](#)

[From Novel Fruits \(pawpaw\), a Lush Landscape in NY Times \(5/20/09\)](#)

[Pawpaw article in Northern Nut Growers Association Nutshell Newsletter \(5/13/09\)](#)

[Summaries of recent KSU pawpaw research projects \(5/06/09\)](#)

[KSU Student wins award for pawpaw research project \(see page 7\) \(5/06/09\)](#)

■ Over 280,000 visitors since 2003!



Questions?