## Update on the UGA Pecan Breeding Program – Dr. Patrick Conner



# Pecan scab #1 biological production constraint in this region.



#### **Desirable + Stuart = 60% Trees in Georgia**





#### Desirable

Stuart

Nuts from a sprayed orchard in 2005.

### Goals of the pecan breeding program

- Increase pest resistance
- Stabilize production
- Increase quality
- Change harvest date
- Increase productivity





### Scab Resistance

#### • Several cultivars have high levels of resistance.



Unsprayed 'Faircloth' nuts.



Unsprayed 'Excel' nuts.

• But, nut quality does not match susceptible cultivars like 'Desirable'.

# **Breeding Strategy**

#### **Recurrent Mass Selection**

- 1. Select superior seedlings from chance populations.
- 2. Hybridize among best selections.
- 3. Selection superior offspring for use as parents in the next cycle or as cultivars.

**Cross 2 parents which in combination have the desired traits and select seedlings which have desired traits.** 

X

#### Cultivar #1

- 1. Large nuts
- 2. Early harvest
- 3. Disease susceptible

#### Cultivar #2

- 1. Small nuts
- 2. Late harvest
- 3. Disease Resistant

#### New cultivar

- 1. Large nuts
- 2. Early harvest
- 3. Disease resistant

Most seedlings

- 1. Small nuts
- 2. Late harvest
- 3. Disease Susceptible

"Quantity makes Quality" — The breeder must find clever ways of selecting from as many seedlings as possible.



# Pecan Breeding Methods

### **Pollen Collection**



# **Pollination Technique**







# Seedling Evaluation Phase I

- Initial Screen
  - 10 year selection cycle
  - Evaluate for:
    - nut size and quality
    - tree vigor
    - earliness
    - disease resistance
    - insect resistance



### **Seedling Nursery – Year 1**



#### **Seedling Nursery – Year 2**

Remove all scab susceptible seedlings. 20-90% eliminated



### **Transplanting selected seedlings.**



### **Seedling Orchard – Year 3**



### **Seedling Orchard – Year 6**



### **Seedling Evaluation Phase II**

- Propagate best selections for replicated trials
- Compare to elite cultivars

   tree productivity
   alternate bearing intensity
- Use best new selections as cultivars or parents in breeding program.



### Where are we now?

- Program started in 1999.
- New crosses made each year.
- 106 controlled crosses.
- 10,000 seedlings screened.
- First nuts produced from the 1999 crosses in 2006.
- 300-400 seedlings fruiting in 2007.
- Will begin testing new selections in replicated trials in 2 years.

## Ponder Farm Variety Trial

- Planted in 2002
- 5-6 trees per cultivar
- 2-week fungicide spray schedule
- Commercial level care.
- Microjet irrigation
- Desirable and Stuart as check cultivars



## Data collection

- Yield for each tree
- 50-nut sample
  - nut weight
  - nut volume
  - % kernel
  - % fuzz
- Pest resistance
  - leaf scab
  - nut scab
  - black aphid damage
  - sooty mold buildup
- Bloom times



# Cherryle

#### Quality for years 1-5.

	Yield	Nuts/lb	% Kernel
Cherryle	0.3	40	55
Desirable	0.4	52	51
Stuart	0.1	52	45



- Alabama grower selection
- Good size and quality
- Precocity similar to Desirable



# Cherryle

- Moderate scab resistance
   Needs fungicide
- Scabs badly in original orchard
- Reports of suture split



#### Pest resistance years 2003-2006.

	Leaf Scab	Nut Scab	Black Aphid
Cherryle	1.6	1.4	1.3
Desirable	3.0	2.8	1.5
Stuart	1.9	2.0	2.0

# Nacono

#### Quality for years 1-5.

	Yield	Nuts/lb	% Kernel
Nacono	1.1	44	51
Desirable	0.4	52	51
Stuart	0.1	52	45



- USDA release
- Good size and quality
- Precocious
- Excellent sheller
- Large cluster size





#### • Very scab susceptible



#### Pest resistance years 2003-2006.

	Leaf Scab	Nut Scab	Black Aphid
Nacono	2.4	2.6	1.5
Desirable	3.0	2.8	1.5
Stuart	1.9	2.0	2.0

# McMillan

#### Quality for years 1-5.

	Yield	Nuts/lb	% Kernel
McMillan	0.7	51	47
Desirable	0.4	52	51
Stuart	0.1	52	45



- Alabama seedling
- Low percent kernel
- Somewhat unattractive
- Medium size on mature trees

# McMillan

- No scab so far
- Clean tree



#### Pest resistance years 2003-2006.

	Leaf Scab	Nut Scab	Black Aphid
McMillan	1.0	1.0	1.5
Desirable	3.0	2.8	1.5
Stuart	1.9	2.0	2.0

## Zinner

#### Quality for years 1-5.

	Yield	Nuts/lb	% Kernel
Zinner	0.2	51	55
Desirable	0.4	52	51
Stuart	0.1	52	45



- Auburn selection
- Good size and quality
- Bright kernel
- Not precocious
- Vigorous tree



### Zinner

- Needs full-season spray schedule
- Resistance similar to Stuart



#### Pest resistance years 2003-2006.

	Leaf Scab	Nut Scab	Black Aphid
Zinner	1.9	1.5	1.9
Desirable	3.0	2.8	1.5
Stuart	1.9	2.0	2.0

# Jenkins

#### Quality for years 1-5.

	Yield	Nuts/lb	% Kernel
Jenkins	0.5	47	52
Desirable	0.4	52	51
Stuart	0.1	52	45



- Large cluster size
- Kernel fuzz is common
- Low % kernel on older trees





### Jenkins

• No scab so far.



#### Pest resistance years 2003-2006.

	Leaf Scab	Nut Scab	Black Aphid
Jenkins	1.0	1.0	1.9
Desirable	3.0	2.8	1.5
Stuart	1.9	2.0	2.0

### Excel

#### Quality for years 1-5.

	Yield	Nuts/lb	% Kernel
Excel	0.3	44	48
Desirable	0.4	52	51
Stuart	0.1	52	45

- Georgia seedling
- Large size
- Low % kernel
- Hard to shell



### Excel

- No scab so far.
- Clean tree.



#### Pest resistance years 2003-2006.

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	Leaf Scab	Nut Scab	Black Aphid
Excel	1.0	1.0	1.3
Desirable	3.0	2.8	1.5
Stuart	1.9	2.0	2.0



Thanks to The Georgia Agricultural Commodity Commission For Pecan for its support of our breeding program!