Sustainable Grape Growing for the Southeastern United States

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Muscadines are a Low Maintenance Crop With An Established Market

- Large Fruited, High Quality Varieties
- Disease Resistant
- Insect Resistant
- Adapted to Southeastern Soils & Climate
There is a Distinct Demand for Bunch Grapes for Both Wine & Fresh Market
But.... There Are Serious Limitations
Geographic Reality
Hurricane Ike

10 PM CDT Fri Sep 12 2008
Position 28.6 N 94.4 W
Maximum Winds 110 mph
Gusts 130 mph
Movement NW at 11 mph
Minimum Pressure 952 mb (28.10 inches)
① Pierce’s Disease
Xylella fastidiosa Biology

- Xylem-limited Bacterium
- Native to SE United States
- Directly Occludes Vascular Tissue (Xylem)
- Obligately Vectored by Insects
- Intolerant to Cold Climates
- Enlargement of Tyloses Adds Additional Blockage
Where is Pierce’s Disease & Why?
Where is Pierce’s Disease & Why?

Pierce's Disease of Grape in United States

Purcell & Hopkins, 2003
And Today......

Legend:
- Red: Traditional Pierce's Disease Range
- Blue: Expanded Pierce's Disease Range
Traditional Vectors of Pierce’s Disease in California

Red-headed sharpshooter

Green Sharpshooter

Blue-green sharpshooter
The Game Changer in California

- Introduced From Texas on Nursery Stock
- Distant Flyer
- Feeds on Woody Tissue
- Vine to Vine Disease Spread

All Sharpshooters are Voracious Feeders and Need to Change Feeding Hosts Frequently
Texas Sharpshooters - Proconiiini

Cuerna costalis

Oncometopia orbona

Homalodisca vitripennis

Homalodisca insolita

Oncometopia sp. (undescribed)

Paraulacizes irrorata

Photos I. Lauziere & F. Mitchell
Texas Sharpshooters - Cicadellini

Sibovia occatoria

Ciminius harti

Draeculacephala navicula

Draeculacephala robinsoni

Graphocephala versuta

Graphocephala hieroglyphica

Graphocephala coccinea

Xyphon sagittifera

Xyphon flaviceps

Ciminius harti

Draeculacephala navicula

Draeculacephala robinsoni

Graphocephala versuta

Graphocephala hieroglyphica

Graphocephala coccinea

Photos I. Lauziere & F. Mitchell
Other Texas Xylem Feeders - Clastopterini

Clastoptera lineatocollis
Clastoptera lawsoni
Clastoptera xanthocephala

Lepyroniiini
Lepyronia quadrangularis

Fidicinini
Pacarina puella

Photos I. Lauziere & F. Mitchell
These Two Subfamilies have Very Different Flight Patterns

Cicadellini

Proconiini
Xylella fastidiosa

Concepts in Host Responses

- **Susceptibility** – the lack of resistance mechanisms.
  - *V. labrusca*, *V. vinifera*, Fr./Am. Hybrids. Great differences in field longevity

- **Resistance** – the ability of the host to limit colonization by the pathogen.
  - *V. smallii* derived hybrids and others?

- **Tolerance** - the ability of host to sustain infection by the pathogen with no reduction in yield.
  - ‘Black Spanish’, ‘Blanc du Bois’, ‘MisBlanc’, most wild *Vitis* species native to Gulf Coast and S.E. United States
Maps of Disease Progress in a Viognier Vineyard Over a Three Year Period
Integrated Management of Pierce’s Disease

- Site Selection
- Vineyard Floor & Adjacent Vegetation Management
- Monitor Vector Movement
- Diagnostic Testing of Grapevines Suspected of Being Infected With X.f.
- Rouging of Infected Vines
- Use of Systemic Nicotinoid Insecticides Through Drip System

Under Moderate Disease Pressure, These Tactics Work, But In the Hot Zone....
Fungal Pathogens of Fruit & Foliage

Axioms to Live By:

• Great Wine is Only Made From Sound, Ripe Fruit
• Optimal Maturity Depends on Disease Free Clusters & Canopy
• Vine Health is Dependent on Effective Crop Control and a Healthy Canopy
Phomopsis Cane & Leaf Spot  
(*Phomopsis viticoli*)

- Cool, Wet Season Disease
- Overwintering Structures
- Latent Rachis Infections
- Infections Become Systemic
Powdery Mildew

• Problematic in All Grape Growing Regions
• 0.1” Rain & 50°F Needed for Primary Infection
• No Rainfall Needed for Secondary Infection
• Key Period of Susceptibility is 2 Weeks Pre-bloom to 30 Days Post-bloom
Black Rot

• Overwinters as Mummified Fruit or Cane Lesions

• Infection Periods are Temperature and Leaf Wetness Driven

• Key Periods of Susceptibility 2 Weeks Pre-bloom to 30 Days Post-bloom

• Achilles Heel of Organic Grape Production
Downy Mildew

- Overwinters in Leaf Litter on Vineyard Floor
- Spores Disseminated by Splashing Rain
- Primary Infection Takes Place During Wet Nights
- Fruit/Rachis Infections Become Systemic
Bunch Rot Organisms
Periods of Greatest Fruit/ Rachis Infection Potential

- **Blackrot**
- **Powdery**
- **Downy**
- **Phomopsis**
- **Leaf Blight**
- **Bunch Rots**

Budbreak-1” 3-5” 10-12” Pre-bl Bl.-Shatter Pea Berry Véraison Harvest
Management of the Primary 4 Fungal Pathogens

Focus the Use of Systemic, Highly Effective Materials During Periods of High Susceptibility

- Phomopsis
- Blackrot
- Powdery
- Downy

Stage:
- Budbreak-1"
- 3-5"
- 10-12"
- Prebloom
- Bloom-Shatter
- Pea Berry
- Veraison
- Harvest
<table>
<thead>
<tr>
<th>Fungicide/ common name, trade name</th>
<th>Phomopsis cane and leaf spot</th>
<th>Anthracnose</th>
<th>Black rot</th>
<th>Downy mildew</th>
<th>Powdery mildew</th>
<th>Leaf Blight</th>
<th>Summer Rot Complex</th>
<th>Botrytis bunch rot</th>
<th>Fungicide Group</th>
<th>REI (hours)</th>
<th>PHI (days)</th>
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<td>azoxystrobin (Abound)</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>11</td>
<td>4</td>
<td>14</td>
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<tr>
<td>azoxystrobin + difenoconazole (Quadris Top)</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>11, 3</td>
<td>12</td>
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<td>0</td>
<td>?</td>
<td>0</td>
<td>0</td>
<td>+++</td>
<td>0</td>
<td>0</td>
<td>++/++++</td>
<td>7</td>
<td>12</td>
<td>14</td>
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<td>+++</td>
<td>+++</td>
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<td>+++</td>
<td>++</td>
<td>++</td>
<td>++/++++</td>
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<td>+</td>
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<td>+</td>
<td>+++</td>
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<td>++</td>
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<td>0</td>
<td>21</td>
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<td>0</td>
<td>0</td>
<td>+?</td>
<td>?</td>
<td>0</td>
<td>+++</td>
<td>9</td>
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<td>7</td>
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<td>+</td>
<td>+++</td>
<td>0</td>
<td>?</td>
<td>0</td>
<td>0</td>
<td>+++</td>
<td>9, 3</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>+++</td>
<td>19, 12</td>
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<td>7</td>
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<td>dihydrogen potassium phosphate (Nutrol)</td>
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<td>0</td>
<td>0</td>
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<td>N/A</td>
<td></td>
<td>0</td>
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<tr>
<td>fenamidone (Reason)</td>
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<td>+++</td>
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<td>0</td>
<td>?</td>
<td>11</td>
<td>12</td>
<td>30</td>
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<td>21</td>
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<td>0</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>+++</td>
<td>17</td>
<td>12</td>
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<td>fixed copper (several formulations) and lime</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>+++</td>
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<td>TVSL</td>
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<td>+++</td>
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<td>0</td>
<td>43</td>
<td>12</td>
<td>21</td>
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<td>fluopyram + tebuconazole (Luna Experience)</td>
<td>+</td>
<td>?</td>
<td>+++</td>
<td>0</td>
<td>+++</td>
<td>?</td>
<td>?</td>
<td>+++</td>
<td>7, 3</td>
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<td>+++</td>
<td>7</td>
<td>48</td>
<td>7</td>
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<td>kresoxim-methyl (Sovran)</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>2</td>
<td>48</td>
<td>7</td>
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<tr>
<td>mancozeb (Dithane, Manzate, Penncozeb)</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+++</td>
<td>N/A</td>
<td>24</td>
<td>66</td>
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<tr>
<td>mandipropamid (Revu)</td>
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<td>0</td>
<td>+++</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40</td>
<td>4</td>
<td>14</td>
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<td>mandipropamid + difenoconazole (Revue Top)</td>
<td>0/+?</td>
<td>0</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
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<td>0</td>
<td>0</td>
<td>40, 3</td>
<td>12</td>
<td>14</td>
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<tr>
<td>mefanoxam + mancozeb (Ridomil Gold MZ)</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>+++</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>48</td>
<td>66</td>
</tr>
<tr>
<td>mefanoxam + copper hydroxide (Ridomil Gold Copper)</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>+++</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>M1</td>
<td>48</td>
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</table>
Three to Five Inch Shoot Growth

Phomopsis cane and leaf spot
This is a critical spray for control of rachis infections on susceptible varieties in wet springs. On highly susceptible varieties, this can also be an important time to prevent the establishment of infections on young berry stems, which can move into the fruit and rot them later in the season. The maximum rates of the listed products should not be necessary at this growth stage if sprays are thoroughly applied.

<table>
<thead>
<tr>
<th>Product</th>
<th>Rate</th>
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<tbody>
<tr>
<td>Captain 50W</td>
<td>2-4 lb</td>
</tr>
<tr>
<td>OR Captain 80WDG</td>
<td>1.25-2.5 lb</td>
</tr>
<tr>
<td>OR Captec 4L</td>
<td>1-2 qt</td>
</tr>
<tr>
<td>OR Dithane DF,</td>
<td>2-4 lb</td>
</tr>
<tr>
<td>or Dithane M45,</td>
<td></td>
</tr>
<tr>
<td>or Manzate 75DF,</td>
<td></td>
</tr>
<tr>
<td>or Penncozeb 75DF</td>
<td></td>
</tr>
<tr>
<td>OR Dithane F-45</td>
<td>1.6-3.2 qt</td>
</tr>
</tbody>
</table>

Black rot
Black rot sprays are rarely needed this early in the season unless serious disease occurred the previous year and warm, wet conditions are anticipated well before the next spray.

<table>
<thead>
<tr>
<th>Product</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dithane DF,</td>
<td>2-4 lb</td>
</tr>
<tr>
<td>or Dithane M45,</td>
<td></td>
</tr>
<tr>
<td>or Manzate 75DF,</td>
<td></td>
</tr>
<tr>
<td>or Penncozeb 75DF</td>
<td></td>
</tr>
<tr>
<td>OR Dithane F-45</td>
<td>1.6-3.2 qt</td>
</tr>
<tr>
<td>OR Rally 40WSP</td>
<td>3-4 oz</td>
</tr>
<tr>
<td>OR Orius 45DF</td>
<td>3-4 oz</td>
</tr>
<tr>
<td>or Tebuzol 45DF</td>
<td></td>
</tr>
<tr>
<td>OR Revus Top 4SC</td>
<td>7 fl oz</td>
</tr>
</tbody>
</table>

Inspire Super, Orius, Revus Top, Tebuzol, and Rally have some protective activity but are most effective when applied after the start of an infection period. The duration of post-infection activity is incompletely characterized, but sprays applied up to 3-7 days after the start of an infection period
3. Grapevine Trunk Diseases
Trunk Disease Complex Includes:

- Bot Dieback (*Botrospheria* spp., *Diplodia* spp., *Lasiodiplodia* spp.)
- Esca, Black Measles (*Phaeomoniiella* spp., *Phaeoacremonium* spp.)
- Eutypa (*Eutypa lata*)
- Others (Aspergillus)
Management of GTDs

• Don’t Prune in the Rain
• Double Pruning
• Spray Pruning Cuts with Mycobutanyln (Rally)
• Painting of Pruning Cuts
• Remove and Destroy Infected Tissue
**Grape Options for PD Hot Zone**

- **‘Herbemont’**
  Grown Commercially in Texas & Mexico Since 1830

- **‘Black Spanish’**
  Grown Commercially in Texas Since 1889

- **‘Blanc du Bois’**-
  John Mortensen’s 1988 Release
  Complex lineage: *V. vinifera, smalliana, simpsoni*, and perhaps *lincecumi*
Evaluation of T.V. Munson’s Most Promising Varieties

‘Carmen’
‘Lomanto’
‘Delicatessen’
‘Bailey’
‘Wine King’
‘M.H. White’
‘Ben Hur’
‘Wapanuka’
‘Nitodal’

T. Volney Munson
1843-1913
PD\textit{X. index} Resistance of Olmo’s Mexico Collections

Slide- A. Walker, 2010
Andy Walker’s 88% V. vinifera Selections

<table>
<thead>
<tr>
<th>Genotype</th>
<th>% Vinifera</th>
<th>Berry Color</th>
<th>° Brix</th>
<th>pH</th>
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<td>U0501-12</td>
<td>87.5</td>
<td>Black</td>
<td>29.4</td>
<td>3.87</td>
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<td>U0502-01</td>
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<tr>
<td>U0502-10</td>
<td>87.5</td>
<td>Black</td>
<td>23.7</td>
<td>3.48</td>
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</table>

Selected Progeny with the PdR1 Resistance Source
Jiang Lu- Florida A&M Breeding Program

A14-8-1   A24-6-6
D16-13-1   D16-16-4
C30-7-1    O44-6-5
C30-5-1    D6-12-4
Other Varieties Under Evaluation

• Ark 1475 (Victoria Red)
• Miss Blanc
• Miss Blue
• Mortensen Hardy
• Edsal
• Phoenix (‘Bacchus’ x ‘Villard Blanc’)
• Orion (‘Optima’ x Villard Blanc’)
• Sirius (‘Bacchus x Villard Blanc’)

The Institute for Grapevine Breeding Geilweilerhof
Texas grapevine evaluations
Focus on traditional breeding
<table>
<thead>
<tr>
<th>Variety</th>
<th>Harvest Date</th>
<th>Brix</th>
<th>pH</th>
<th>TA (g/L)</th>
<th>Berry weight (g)</th>
<th>Cluster weight (kg)</th>
<th>Berries / Cluster</th>
<th>Tons / Acre</th>
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<td>U0505-35</td>
<td>6/27</td>
<td>21.2</td>
<td>3.62</td>
<td>7.83</td>
<td>*</td>
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<td>Phoenix</td>
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<tr>
<td>Orion</td>
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<td>19.0</td>
<td>3.5</td>
<td>5.80</td>
<td>*</td>
<td>0.11</td>
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<tr>
<td>Blanc du Bois</td>
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<td>6.35</td>
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<td>4.05</td>
<td>1.55</td>
<td>0.09</td>
<td>57.69</td>
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U0505-35

- Breeder: Dr. Andy Walker (UC Davis)
- Parentage: A81-138 x Cabernet Sauvignon
U0502-38

- Breeder: Dr. Andy Walker (UC Davis)
- Parentage: A81-138 x ‘Chardonnay’

7/12/2013
• Breeder: Dr. Andy Walker (UC Davis)
• Parentage: A81-138 x Chardonnay
U0502-20
June 3, 2012
Industry, Texas
## Variety Trial Harvest 2014

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2014 Harvest – Hill Country

Merlot

Sangiovese

U0502-38  U0505-35  U0502-10  U0502-01  U0502-26
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First Releases from Andy Walker

50% Petite Sirah, 25% Cab Sauv P

Caymus, Sonoma,

Early bloom, early ripening

Relatively large berries, medium large clusters

Medium productivity

Thanks to ETS Labs
First Releases from Andy Walker

50% Zinf, 25% Petite Sirah, 12.5% Cab Sauv P

Caymus, Temecula, Silverado

Late bloom, mid-season ripening

Relatively large berries, large clusters

Moderate-low productivity

09331-047
First Releases from Andy Walker

50% Sylvaner, 12.5% Cabernet Sauvignon, Carignane, Chardonnay N

Davis only

Mid-season bloom and ripening

Large berries, loose medium clusters

High productivity

09356-235
First Releases from Andy Walker

62.5% Cab Sauv, 12.5% Carig, 12.5% Chard N

Temecula, Sonoma, Silverado

Early bloom, early ripening

Small - medium berries, medium large clusters

High productivity
First Releases from Andy Walker

62.5% Cab Sauv, 12.5% Carig, 12.5% Chard N

Davis only

Late bloom, mid-season ripening

Small berries, small clusters

Medium productivity
Victoria Red, A High Quality Seeded Table Grape Fully Tolerant of Pierce’s Disease
Fig. 1. Pedigree of “Victoria Red” grape.
Nurseries Offering Victoria Red
Anticipated 2020 Release, Ark 1400
Sustainable Viticulture Means Training the Next Generation.... Questions?