The first question...

- Where/How do I sell my fruit?
- Local-Direct vs. Regional
- Fresh market vs. Processing market
- Wholesale vs. Value added (e.g. crunch packs, cider, jams, etc.)

The Second Question

- Where/How do I get certified?
- Certification kicks in after 3 years of “transition”
- 1st step is to contact and select a certifier
- MDA maintains a list of organic certifiers at: http://www.michigan.gov/mdard/0,4610,7-125-1569_25516---,00.html

The KEY Concept!!

- All pests are CYCLICAL! and PREDICTABLE!
- Diseases follow moisture and temperature cycles
- Plants and Insects follow temperature cycles

The third question...

- How do I know what to do?
- SCOUTING: of ultimate importance in apple PM
- Many, Many pests
- The worst are well described
- Use phenological models to guide scouting and PM tactics

Weeds: Friend, Enemy, or Neighbor?

Pheromone Trap

OfM Flight
Weed Management: Older Trees

- Mowing: 2-3 times per season
- Light tillage
- Grazing
- Flaming

Weed Management: Young Trees

- Site preparation: multiple years of cover crops
- Mulches: Wood, Straw, Synthetic
- Cover crops: "CHOOSE YOUR WEED"

"Wonder Weeder"

Weed Cover

Weed Management: Complications

- Rodents like cover
- Weeds or Mulches
- Girdle and perennial crops
**Weed Management: Complications**

- Arthropod diversity tied to plant diversity
- NE's and pollinators
- Also some pests: Stinkbugs, Mites, Aphids

**Natural Enemies**

![Country Mill, Pitfall catch 2012](image)

**Weed Management Program**

- New Plantings: apply mulch — use tree guards!
- Swiss Sandwich: Strip cultivate from drip line to row center beginning in March/April and repeating 2-5 times
- Other alternatives: Swing arm mowers, flaming — use caution!

**Organic Disease Management**

- Fungicides do not provide much "back action"
- Focus on Prevention!

**Apple Scab: Venturia inaequalis**

**Apple Scab**

- Primary infection
  - Sexual cycle
  - Infects leaves
- Secondary infection
  - Asexual cycle
  - Infects leaves and fruit
### Apple Scab Management: Prevention

#### Resistant Varieties
- Liberty, Crimson Crisp, Gold Rush
- Most effective tactic
- Marketing??

![Liberty](image1)
![Goldrush](image2)
![Crimson Crisp](image3)

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### Apple Scab Management: Prevention

- Sanitation: Clean up leaves
- Competitive/antagonistic BC... Mechanism?
- Predation by earthworms and other shredders
- Fall fertilizer applications (High N)

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### Organic Scab Fungicides

#### Major Classes of Fungicides

- **Copper**
  - The most effective fungicide
  - Can help with Fireblight management
  - **Phytotoxic after 1/2” green**
  - Accumulates in soil

- **Sulfur**
  - Three sub-classes
  - Some provide secondary insect control
  - **Cannot be mixed with oils**
  - Can flare mites

---

### Organic Scab Fungicides

#### Copper
- 2-3 applications between silver tip and 1/2” Green
- Use a 4-7 day interval for applications
- Will suppress fireblight canker
- Newer products are “micronized”
  - May provide better control at lower rates

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### Organic Scab Fungicides

#### Sulfur
- 3 Major Types
  - Lime Sulfur
  - Wettable Sulfur
  - Flowable Sulfur
- Must be reapplied after rainfall events
- Products provide 3-5 days protection
- “Micronized” products are superior —smaller particle size = better coverage
- Provides control for some other late season diseases

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### Organic Scab Fungicides

#### Lime Sulfur
- Liquid formulation 1.5-2 gallons/acre
- Coverage must precede rainfall
- Must be reapplied after rainfall events
- Can provide limited “back action” 12-48 hrs
- Will thin or russet if applied after tight cluster
Organic Scab Fungicides

Wettable Sulfur
- Powder formulation
- Can be applied in a liquid formulation or using a duster
- Duster applications made during or just after rainfall events
  - Rain will "carry" sulfur into the canopy
- Apply 6 lbs/acre

Organic Scab Fungicides

Flowable Sulfur
- Liquid formulation
- Provides better coverage than wettable —smaller particle size
- Is not rainfast —must be reapplied following rainfall events
- 5 qts (6F)/acre to petal fall, 2.5 qts per acre thereafter
- Check with certifier for all fungicides!

Scab Management Program

<table>
<thead>
<tr>
<th>Timing</th>
<th>Fungicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grown tip to 1/2” Grown</td>
<td>Copper or Lime Sulfur or Flowable/Wettable S.</td>
</tr>
<tr>
<td>Tight Cluster</td>
<td>Lime Sulfur or Flowable/Wettable S.</td>
</tr>
<tr>
<td>Open Cluster</td>
<td>Flowable or Wettable Sulfur</td>
</tr>
<tr>
<td>Bloom</td>
<td>Flowable or Wettable Sulfur</td>
</tr>
<tr>
<td>Petal Fall</td>
<td>Flowable or Wettable Sulfur</td>
</tr>
<tr>
<td>5-7 days post PF</td>
<td>Flowable or Wettable Sulfur</td>
</tr>
<tr>
<td>7-14 day intervals</td>
<td>Flowable or Wettable Sulfur</td>
</tr>
</tbody>
</table>

Cultural Alternatives — Targeting Overwintering Inoculum
- Gather leaves in the Fall and Spring
- Flail Mow? Burn?
- OPM lab currently researching this beginning

Kuhn Haybob® rake-tedder purchased by the MSU OPM lab for use in the test orchard

Preliminary Data

- Leaves collected from 3 subsamples of 5 20x50 cm quadrats under trees and from drive row.
- Almost no leaves under “win-rowed” trees
- Flailing reduced “leaf survival” by more than twenty fold
- > 90% of surviving leaves carried pre psuedothecia

Many Insect/Arthropod Pests!!
- Moths/Worms
- Beetles
- Flies
- Aphids
- Mites
Monitoring insects in orchards

- Pheromone traps for moth pests
- Tower traps for plum curculio
- Sphere traps for apple maggot
- Traps tell us if we have a problem!

Plum Curculio

- Small dark weevil
- Native insect adapted to apples
- Attacks stone and small fruit
- Larvae feed within the fruit
- Especially difficult for Organic apples

PC Life Cycle

- Spring Damage
- Summer Damage

PC Chemical Tactics

- Cover sprays applied in Spring or at Harvest
- "Surround" Kaolin clay
- "Pyganic" Pyrethrins

Plum Curculio Management

- Small plot trials comparing Surround with conventional chemistries
- Surround applied 4x
- Guthion® applied 2x
- Intermediate performance in 2001
- Comparable performance in 2002

Trevor Nichols Small Plot Surround Trials

Mean followed by the same letter are not significantly different at p = 0.05.
Plum Curculio Management

• Large plot trials testing Surround®
• Surround® applied 6x
• Significant reductions in damage at both sampling dates
• Large plot performed better than small - Behavioral mode of activity?

2003 Trevor Nichols Large Plot Surround Trials

![Graph showing 2003 Trevor Nichols Large Plot Surround Trials]

Mean followed by the same letter are not significantly different at p = 0.05.

Hogs Providing: PC Management

% Plum Curculio Damage 2007 and 2008

- Summer feeding significantly reduced both years
- Numerical reduction of oviposition in 2008

PC Management Program

<table>
<thead>
<tr>
<th>Compound trade name</th>
<th>Chemical class</th>
<th>Activity on adult plum curculio</th>
<th>Crop</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyganic</td>
<td>Pyrethrum</td>
<td>Lethal via contact. Repellent</td>
<td>Pome fruit, Stone fruit</td>
<td>-</td>
</tr>
<tr>
<td>Surround WP</td>
<td>Particle film</td>
<td>Repellent</td>
<td>Pome fruit, Stone fruits</td>
<td>Usually 16 lb by first cover</td>
</tr>
</tbody>
</table>

Crop Stage and Initial Control Timing (GDDa)
- Petal fall (approx. 250 GDD)
- Petal fall (approx. 175 GDD)
- Multiple applications (less than 24 hour residual)
- Multiple applications starting before bloom to achieve complete coverage

ADDITIONAL TACTICS:
- Begin monitoring/mass trapping using pyramid traps by April 1.
- Remove/destroy dropped fruit during “June Drop”

PC Physical/Cultural Tactics

- Mass Trapping along edges
- Sanitation During June Drop
- Livestock
- Mechanical removal?

Organic Pest Management: The Future

- Quantify “suppressive” potential of soils
- Quantify impact of Fungicides on soil ecology and insect pest management
- Develop cultural and physical pest management recommendations for insects and diseases
- Refinement of Swiss Sandwich systems
- Reintegration of animals into orchards.....

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  - Larry Gut John Wise
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  - Nate Walton
- Organic Apple Grower Collaborators
  - Jim Koan Steve Tennes
  - Gene Garthe
Additional Resources

- **Organic Pest Management Website**
  [www.opm.msu.edu](http://www.opm.msu.edu)

- **MidWest Organic and Sustainable Education Apple Fact Sheet**

- **MSU Fruit Extension website**
  [http://msue.anr.msu.edu/topic/info/fruit](http://msue.anr.msu.edu/topic/info/fruit)

- **West Virginia/Ohio Organic Disease Management**
  [http://www.caf.wvu.edu/kearneysville/organic-apple.html#Option 2](http://www.caf.wvu.edu/kearneysville/organic-apple.html#Option 2)