Organic Apple Orchard Establishment

- 200 trees planted
  March 2007
- High density planting
- Trees staked with 10’ tall metal posts, 6” from trunk
- Trees 6’ apart; rows 18’ apart
- 270’ long rows
Establishment

- White plastic tree guards used to deter rodent damage
- Watch out for girdling
- Replace annually
- Best for 1 ½” caliper trees
- Trickle irrigation used
Training - Vertical Axis System

- Designed to grow tree to desired height quickly by:
  - heading central leader only at planting
  - establishing 4-5 permanent lower scaffolding branches, balancing top growth with root system
  - removing all competitive shoots within 12” of leader’s terminal bud position at start of each growing season
Training - Vertical Axis System

- Easier to spray for disease and insects, thin unnecessary fruit, and harvest
- Should be possible to ‘look through a tree’ that is properly pruned
Dwarf Rootstocks

- All cultivars grafted onto rootstock chosen to control mature tree size, enhance insect and disease resistance
- Dwarfing rootstocks are precocious; can bear fruit in 2-4 yrs
- Dwarf trees can produce 2-4 bushels per tree
- Varieties planted are mostly resistant or only moderately susceptible to major diseases such as apple scab, powdery mildew, fire blight
Dwarf Rootstocks

- **B.9 dwarfing rootstock** – 20 to 30% of standard size – Pristine, Akane, Goldrush, Priscilla, Redfree, Crimson Crisp, Enterprise

- **M.9 dwarfing rootstock** – 30 to 40% of standard size – Sundance, Freedom, William’s Pride

- **G.11 dwarfing rootstock** – 30 to 40% of standard size – Sir Prize, Splendour
Cultivar Selection

- Three varieties - Redfree, Crimson Crisp, and Enterprise - represented in main experimental area with twelve replicated blocks, each with three tree sub-blocks.
- Guard row varieties include Sir Prize, William’s Pride, Splendour, Freedom, Liberty, Goldrush, Akane, Wolf River, Sundance, Pristine, Priscilla, Rezista Releika, Rezista Rajka, Rezista Resi, Rezista Goldstar
New Varieties for 2010

- Fortune
  - Resistant to cedar apple rust
  - Harvest mid-September

- NovaSpy
  - Resistant to apple scab, fire blight
  - Harvest mid-October
Fertility

- Best soil pH for apples between 6.0 - 6.5
- Nitrogen recommendation 100 lbs of N per acre
- 400 lbs of 13-0-0 applied in early spring
- Broadcast 1’ out from trunk to edge of branches
- Fertilizer increased or decreased based on annual terminal bud growth
  - young trees should have 24” - 30” of growth/year
  - bearing trees should have 8” - 12” of growth/year
Fertility 2008-2009

- ‘Redfree’ average twig length growth
  - 17.28 in
- ‘Enterprise’ average twig length growth
  - 16.21 in
- ‘Crimson Crisp’ average twig length growth
  - 17.96 in
Fertility - 2009

- ‘Redfree’ average tree diameter - 1.09 in
- ‘Enterprise’ average tree diameter - 1.26 in
- ‘Crimson Crisp’ average tree diameter - 1.04 in
- Starting tree diameter in 2007
  - Redfree – 5/8 in
  - Enterprise – ½ in
  - CrimsonCrisp – ½ in
Common Apple Diseases in Kentucky

- Fire blight*
- Cedar apple rust*
- Flyspeck*
- Sooty blotch*
- Powdery mildew
- Apple scab
- Black rot
- Bitter rot
- White rot
- Corkspot

* most serious in 2009
Fire Blight

- Characterized by ‘shepherd’s crook’ on blighted shoots at tips
- Dead leaves cling to affected twigs
- Prune out twigs/limbs 8-10” below infection point
- Spray fixed copper, streptomycin
**Fire Blight**

- Fixed copper sprayed when trees are dormant or at silver tip, but before $\frac{1}{2}$" green tip
- Starts the season with a clean slate
- Can cause fruit russetting if sprayed too late
- Spray streptomycin at bloom – before rainfall
Blossom blight phase

Bacteria spread to young twigs by insects

Shepherd’s crook

Bacteria migrate down to the branch

Insects carry bacteria to flowers

Droplets of ooze containing bacteria

Spring

Bacteria overwinter in margins of cankers

R.D. Koski and W.R. Jacobi, Colorado State Univ.
Cedar Apple Rust

- Cedar apple rust requires alternate host – eastern red cedar (*Juniperus virginiana* L.)
- Affects both leaves and fruit
- Fruit is inedible and unmarketable
- Spray sulfur for moderate control – plant resistant varieties
Cedar Apple Rust

- Infection period occurs between pink and 1 week after petal fall
- Remove/destroy cedars near orchard
Sooty Blotch/Flyspeck

- Sooty blotch and flyspeck almost always found together on fruit
- Only affects the epidermal layer
- Cosmetic problem
- Sulfur may be used for control
- Good light and air penetration help
Apple Alert

- UK Plant Pathology Department
  - Notices sent out for likely infection periods for cedar apple rust, fire blight
  - New Maryblyt 7 program
    http://www.caf.wvu.edu/kearneysville/Maryblyt/index.html

- UK Extension Service - Fruit Facts
  - http://www.ca.uky.edu/fruitfacts/
Common Apple Insect Pests in Kentucky

- Codling moth*
- Plum curculio*
- Apple maggot
- Stinkbug
- Oriental fruit moth
- Woolly apple aphid
- Fall webworm
- Eastern tent caterpillar
- Potato leafhopper
- Red mites

*most serious in 2009
Codling Moth

- 3 generations each year
- Female moths lay eggs on fruit, leaves, or stems beginning in late April or early May
- Larva tunnel to center of fruit
- Larvae exit and pupate beginning around bloom
- Brown frass often present near calyx end of fruit
Codling Moth Control - 2010

- Important to have good control of 1st generation
- Hang traps high in trees; change lures once/month, April through September
- Mating disruption ties
  - Install April 1; lasts first half of season
  - Replace July 1
  - 1/tree; ~150/A
Codling Moth Damage

[Images of apple damage]
Plum Curculio

- 1 generation per year
- Adults overwinter in ground litter; migrate into orchards in spring
- Active ~7 days after petal fall, when night temperatures are above 60° F
- Adults are active only for 10 day period
Plum Curculio

- Eggs are deposited in fruit; leave characteristic crescent-shaped cut
- Larvae hatch, burrow into fruit
- Larvae exit fruit when fully developed, leaving clean exit holes
Plum Curculio Control

- Sanitation
- Adults overwinter in leaf litter and plant debris; orchard floors should be kept clean
- Pick up June drops
- Spray Entrust, Surround at pink and petal fall stages
- Reapply 4-5 days later
Three Bagged Treatments

- Physical exclusion of insect pests, diseases
- Thinning should be done prior to bagging, with 1 fruit per fruit cluster per 6-8” of limb
- Individual fruits bagged in spring when ½” - ¾” diameter, about 3 wks after petal fall
- Bags remain on fruits until 3 wks before harvest, then removed to allow coloration
Three Bagged Treatments

Deli paper bags

Japanese fruit bags

Nylon ‘footies’
Apple Bag Data 2009

- **Codling moth**
  - Japanese bag: 19%
  - Deli bag: 8%
  - Nylon footie: 55%
  - Control: 69%

- **Cedar apple rust**
  - Japanese bag: 16%
  - Deli bag: 12%
  - Nylon footie: 33%
  - Control: 25%

- **Stinkbug**
  - Japanese bag: 1%
  - Deli bag: 3%
  - Nylon footie: 12%
  - Control: 7%

- **Sooty Blotch**
  - Japanese bag: 19%
  - Deli bag: 46%
  - Nylon footie: 92%
  - Control: 88%

% - damaged fruit
Two Bagged Treatments - 2010

- Japanese bags
- Deli bags
- Per tree: 1/3 Japanese bags, 1/3 deli bags, 1/3 control
  - Thin when bags are put on to 6-8” between apples
  - Apple size at ~1/2”
Spray Schedule

- **Subjective:**
  - Close monitoring necessary; every orchard is unique
    - Dormant oil sprayed on March 9 for scale
    - Copper/dormant oil sprayed on March 30

- **Tentative schedule**
  - Sulfur for powdery mildew – apple tight cluster
    - April 9
Spray Schedule

- Streptomycin for fire blight control
  - April 21

- Lime sulfur solution/fish oil for thinning experiment
  - April 22

- Lime sulfur solution/fish oil for thinning experiment
  - April 29
Spray Schedule

1. Apple Dormant to Silver Tip
   Before growth begins; temps. above 45°F
   For fire blight: Fixed copper

2. Apple Green Tip
   For aphid/red mite eggs: Neem or dormant oil

3. Apple Half-Inch Green
   For aphid/red mite eggs: Neem or dormant oil
Spray Schedule

4. Apple Tight Cluster
   For powdery mildew: Sulfur

5. Apple Pink
   For aphid/red mite eggs: Insecticidal Soap

6. Apple Bloom
   For fire blight: Streptomycin
   For powdery mildew: Sulfur or Kaligreen
   Put out pheromone traps for codling moth

4 5 6
Spray Schedule

- **7. Apple Petal Fall**
  For powdery mildew: Sulfur or Kaligreen
  Scout for leaf rollers and plum curculio: Entrust, Surround

- **8. Apple First and Second Cover**
  For powdery mildew: Sulfur or Kaligreen
  Scout for leaf rollers, plum curculio, mites, leaf hoppers, apple maggot: Entrust, Surround
Weed Control

- **Weed Badger**
  - Side-mounted rotary cultivator spins angled tines at predetermined depth of 2 to 4”
  - Cultivates 30” swath
  - Requires cultivation once/month during growing season
Weed Control

- Spring weed badger – week of March 29
  - Last (winter) weeding done in November
  - Weed cover left in place over winter
  - Monitor for voles
Harvesting

- Base skin color changes from green to light green to yellow; inside turns greenish to white
- Many varieties ripen unevenly over two to three weeks
- Grading done according to USDA standards; grades include extra fancy, fancy, no. 1, and utility
- Apples continue to ripen in storage
Harvesting

- Pristine – early July
- Williams Pride – mid-July
- **Redfree** – late July
- Liberty – late August
- **Crimson Crisp** – mid-September
- Priscilla – mid-September
- Sir Prize – mid-September
- **Enterprise** – early October
- Goldrush – mid-October
Questions?