Home Fruit Cultural Disease Management

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Why Have a Home Orchard?

• Fresh, full flavored fruit
  • Better than store bought
  • Greater variety

• Know where food comes from

• Gardening therapy
  • Off couch, away from TV
  • Move, exercise
  • Be outside
  • Something to do

• Other reasons?
However

• Growing fruit successfully is hard work!
  • Many hours
  • Hot conditions
  • Continued vigilance
  • Tolerance for failure

• Don’t expect to get store quality fruit
  • Blotches, blemishes, rots, and worms

• You have to be very dedicated and passionate!
Why?

-Because a lot of effort goes into producing quality fruit!
Think Ahead

• Many options are available to reduce
  • Time and labor
  • Intensity of management
  • Pest pressure

• What are the most likely pests?
  • Life cycle, infection period, and controls

• Fruit species selection
  • + cultivar selection - ripening period

• Keep an open mind!
Disease Triangle
(also insect)

- All factors must be present
  - If one or more is missing, disease does not occur
- Including time
  - Disease intensity affected by duration of all three factors
  - i.e.: the longer each is present the more severe a pathogen becomes

- A useful concept for understanding
  - And avoiding disease
- Goal = reduce/eliminate one or all
The Host

- Susceptibility to disease is affected by many factors
  - Growth stage – bud burst, bloom, etc.
  - Genetic predisposition - cultivar
  - Stress – too much water, too little water, shade, weed comp., wounding, etc.

- Areas affected (symptoms)
  - Crown, trunk, limbs, buds
  - Leaves, flowers, fruit, etc.
  - Includes things like: canker, gummosis, leaf spots/blotch/blight, stunting, rots, etc.

A triangle showing the strength of relationship for each factor

Homeowners have the most control over what host is present
The Environment

- Includes
  - Temperature
  - Rainfall
  - Light intensity
  - Humidity
  - Soil type and drainage
  - Soil pH
  - Air movement
  - Light duration (leaf wetness)
  - Irrigation
  - Fertility
  - Sprays, chemical controls

A triangle showing the strength of relationship for each factor

Homeowners have less control over the environment, but can be favorably adjusted
The Pathogen

- Pathogens are parasites
  - Derive nutrients from another organism
  - Are infectious
    - Spread from plant to plant
    - Produce signs of infection (spores, ooze, etc.)

- Includes
  - Fungi (and fungi-like water molds)
  - Bacteria
  - Viruses
  - Nematodes, etc.

A triangle showing the strength of relationship for each factor

Homeowners have very little control over what diseases are present
What Steps can be Taken

1) Site selection and preparation
   • Adapted species
     • Choose resistant cultivars!!!
   • Practice pathogen avoidance
     • Advanced maturity

2) Crop selection
   • Pruning + training
   • Proper fertility + timing

3) Cultural practices
   • Reduce competition
     • Plant spacing, weeds, excess fruit, etc.

4) Pesticides
The Most Important Year in the Life of Planting is....

• The year in which site preparation is done
  • Once planted, most mistakes cannot be corrected later

• Best to get things right at start
  • Site selection
  • Site preparation
  • Soil testing and amendments

• Develop a thorough plan before single plant is placed in soil
Where to Plant? – Site Selection

• Moderate fertility with **good soil drainage**! – loams best
  • pH: 6.0-7.0 most fruit, 4.5-5.2 blueberries, depth: +2.5’

• Soil test pre-plant: adjust pH, N, P, K, others
  • Blueberries: most soils must have pH lowered
    • Sulfur or aluminum sulfate (biological or chemical)
    • 4-6 mos. wait vs. more immediate (60-90 d. recheck)
    • Need 6x more $\text{Al}_2(\text{SO}_4)_3$ than S
  • Aft. planting – 0.9 lb. S/100 ft$^2$ in spring

• Higher elevation and 2-10% slope

• Full sun (8 hrs. +), near water hook-ups
  • Near house (scouting), but watch spray drift
Tree Rootstocks

• Apples – dwarfing best for disease management
  • Easily accessible with small equipment
  • Smaller trees ≈ smaller canopies, higher light intensity
  • Semi-dwarf: M. 7, G. 202, G. 11, G. 41

• Pears – OH x F 87 and 97, P. betulaefolia

• Peaches – Lovell and Halford
  • Plums – Myrobalan. Tart cherries - Mahaleb

• Other tree fruits – seedling rootstocks
Space Appropriately

• Planting too close is detrimental
  • Causes shading, prolongs leaf wetness
  • Reduces fruit quality, yield
  • **Creates favorable disease environment!**
  • Also, harder to work around
  • Single rows + aisle best

• When in doubt always give more room
  • But, not too much as this wastes space
  • Be aware of rootstock effect (esp. apples)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Minimum within row x bet. row (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strawberry</td>
<td>1’ x 3’</td>
</tr>
<tr>
<td>Currants and Gooseberries</td>
<td>3’ x 8’</td>
</tr>
<tr>
<td>Blackberries and raspberries</td>
<td>4’ x 10’</td>
</tr>
<tr>
<td>Blueberries</td>
<td>5’ x 10’</td>
</tr>
<tr>
<td>Grapes</td>
<td>8’ x 10’</td>
</tr>
<tr>
<td>Figs</td>
<td>8’ x 12’</td>
</tr>
<tr>
<td>Semi-dwarf apple</td>
<td>14’ x 20’</td>
</tr>
<tr>
<td>European pears</td>
<td>16’ x 22’</td>
</tr>
<tr>
<td>Tart cherry, plum, peach</td>
<td>18’ x 24’</td>
</tr>
<tr>
<td>Full size trees, natives</td>
<td>25’ x 30’</td>
</tr>
</tbody>
</table>
Dormant Spring Planting

• Bare root plants from nursery
  • Can be planted immediately
  • Kept in box ≈ 1-2 wks. (moist, cool, no fruit!)
  • Heeled into soil - longer

• Dig large hole, 2x root ball (soil not too wet)
  • Cut off broken roots, shoots
  • Set at same nursery depth (tree graft union 2-4”)
  • Place soil around roots, firm, water to settle
    • + during summer, esp. if drought occurs

• Make map of where planted
  • Type, cultivar, rootstock, etc.
Weed Control

• Keep weed free 2-3’ around base
  • Trees – first 3 years at least
  • Small fruits – permanently weed free

• Short mown grass
• Landscape fabric (watch for voles!)
  • May remove during winter
• Shallow hoeing, mulch
  • Don’t pile mulch around base
  • No weed eaters! = trunk damage
• Careful herbicide application
  • Glufosinate (burn-down), avoid trunk
Pruning and Training

- Helps with disease control by
  - Reducing canopy size
  - Improving light/spray penetration
  - Improving drying time
  - Partially reduces crop
  - Removes diseased wood
    - Cankers, twig blights
    - Fruit rots, etc.

- Trees: don’t leave branch stubs
  - Use branch spreading

Diseases:
- Fire blight
- Crown gall
- Nectria canker
- Cane blight
- Bacterial canker
- Twig blight
- Black knot
- Cytospora canker
- Perennial canker
- Phomopsis stem canker
- Botryosphaeria stem canker
Fruit Crop Fertilization

• Fertilize based on plant growth
  • May not be needed on very fertile sites
  • Lawn fertilization may take care of the fruit crops.

• Once the pre plant fertilizer is applied usually only annual applications of N are needed.
  • Apply fertilizer beneath drip line of crop and keep away from the trunk

• Keep balance between fruiting and vegetative growth
  • Root to shoot ratio – fertilizer promotes shoot growth, root growth
  • For older trees – heavy pruning is like fertilizing
## Tree Fruit Fertilization

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Desired New Terminal Growth (mature trees)*</th>
<th>Rate (Applied at bloom)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peaches &amp; Plums</td>
<td>14-20”</td>
<td>1/3 lb 10-10-10/yr of age</td>
</tr>
<tr>
<td>Tart Cherries</td>
<td>8”</td>
<td>1/3 lb 10-10-10/yr of age</td>
</tr>
<tr>
<td>Apples</td>
<td>12-15”</td>
<td>½ lb 10-10-10/yr of age</td>
</tr>
<tr>
<td>Pears</td>
<td>Less than 12”</td>
<td>¼ lb 10-10-10/yr of age</td>
</tr>
</tbody>
</table>

*1-3 year-old trees may double this amount of growth (½ lb. granular fertilizer is equal to approximately 1 cup)
# Small Fruit Fertilization

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Desired Growth</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackberries &amp; Raspberries</td>
<td>Dark green</td>
<td>10-30 lb/ 100 ft. row, May</td>
</tr>
<tr>
<td>Strawberries</td>
<td>Dark green, avoid leggy growth</td>
<td>5 lb 10-10-10/100’ row, L. Jun. after renovation</td>
</tr>
<tr>
<td>Grapes</td>
<td>Dark brown, 3/8” diam. current seasons canes</td>
<td>¾ lb 10-10-10/vine, early May, and ¾ lb 10-10-10/vine, at Fruit set</td>
</tr>
</tbody>
</table>
Fruit Thinning

• Fruit dev. uses a lot of plant energy
  • Un-thinned fruit trees
    • Will be smaller and weaker in youth
    • Will bear less fruit overall at maturity
      • Fruit smaller, less palatable
  • Distinct source-sink relationship
    • Carbohydrate (energy) partitioning: 1) fruit →
      2) shoots, leaves → 3) roots

• Weak plants will have
  • Smaller, less ripe fruit
  • Less return bloom next year
  • Less able to fight competition + disease
Fruit Thinning - Immature

• Complete removal
  • Tree fruit → for 3 years after planting
    • Apples, pears, peaches, etc.
  • Small woody fruits → for 2 years after planting
    • Blueberries, grapes, currants, etc.
  • Small non-woody fruits → first (1) only
    • Blackberries, raspberries, strawberries, etc.

• Timing (winter and spring)
  • Tree fruit: pruning + at dime-quarter size (diam.)
  • Small fruits: mostly pruning, some flower
  • Strawberries: during bloom

1st yr. affect of fruiting on strawberry runner formation
Fruit Thinning – Mature

• Tree fruits easily thinned by hand
  • Exception – Apple and Pear
    • Sevin at insecticide rate from bloom to 30 d. after
    • Follow up by hand ≈ 1 fruit every 6-7”
  • Peach and plum ≈ 1 fruit every 8-10”
    • At quarter size – pull by hand, wand, KY bumper
  • Other trees – not needed

• Small fruits
  • Good pruning practices
  • Grapes – follow-up cluster thinning (if growth weak)
  • Strawberries – post fruiting bed renovation

Preferentially remove ones that are damaged

About right
Crop Selection

• KY has a humid subtropical climate
  • Humid warm rainy summers
  • Moderately cold winters
  • Late spring frosts are common

• Favors high pop. of pathogens
  • Longer disease season
  • More generations per year

• Narrows the selection of fruits that can be reliably grown
  • Without repeated sprays
  • And a lot of labor!
Crop Selection - Choose

• Adapted species
  • Later blooming
  • Tolerant of high humidity + rainfall
  • Fewer serious diseases and pests
  • Natives?

• Resistant cultivars
  • Selected for disease tolerance
  • Not well known
  • But still high quality

Vs.
Crop Selection – Pathogen Avoidance

• Important strategy for disease + insect management
  • Plants without fruits often have fewer pests (juvenile)
  • Many insect pests attack fruit more than leaves
  • Higher pressure when fruit present

• Choose early ripening cultivars
  • Fewer problems than later ripening
  • In fruit when populations are lower
  • Populations increase as season progresses

• Be willing to accept a few blemishes
Major Insect Pests that Attack Fruit

- Japanese beetle
- Green June beetle
- Oriental fruit moth
- Codling moth
- Spittle bug
- Sap beetle
- Spotted wing drosophila
- Grape berry moth
- Brown marmorated stink bug
- Plum curculio
- Tarnished plant bug
- Green stink bug
- Plum curculio
- Oriental fruit moth
Selected Crops for Home Orchards

• More reliable for KY based on past experience
  • Cultivars chosen based on crop selection criteria
    • Tolerant of climate, disease resistant, pest avoidance, etc.
  • Goal: less intense labor (but, still some!)

• Ordered by amount of mgmt. req.
  • Labor, pests, weeds, site req., reliability, etc.
  • Generally, labor declines within group as well

• High input – req. lots of mgmt. for good results
• Medium input – less intense, easier small scale
• Low input – very little pest control required
High Input Crops

• Often need lots of pesticide sprays
  • Every 7-10 days during spring
  • 10-14 days during summer
  • From dormant to harvest

• Have many disease and insect pests
  • Can be expensive to manage
    • Lots of equipment, chemical, and labor
    • Difficult to get good results

• Don’t expect store quality (cultivars)
High Input - Peaches

• Stone fruit
  • Self fertile (only 1 needed)
  • Needs high sites
    • Flower buds and wood are often winter injured
  • Well drained sites
  • Select cold hardy ones with bacterial spot resistance

• Insect pests are an important consideration! – (choose earliest)
  • Incl. some non-fruit: peach borers
  • Permethrin (Bionide 8) – 2 trunk drench sprays, 1st E. Jun., 2nd L. Jul.

• Flamin’ Fury PF 5: E. Jul.
• Redhaven: M. Jul.
• PF Lucky 13: L. Jul.
• White Lady: L. Jul.
• Coralstar: E. Aug.
• Contender: M. Aug.
High Input - Plums

- Stone fruit
  - Similar pests as peaches
    - Esp. brown rot and borers
    - High sites, well drained
  - Choose self fertile European types (only one needed, bloom later)
    - Castleton: E. Aug.

- Japanese beetles a problem!
  - Attack first bef. anything else
  - Leaf and fruit feeding

- Birds!
High Input - Grapes

• Choose hybrids
  • Avoid European *V. vinifera*
    • Cold tender, disease susceptible
  • Many diseases and insects
    • Wide variation in susceptibility
    • Brianna (W): E. Aug.
    • Mars (B, seedless): M. Aug.
    • Sunbelt (B): L. Aug.
    • Cayuga White (W): L. Aug.

• Require a trellis + lots of labor
  • Pruning, canopy mgmt., spraying
• Birds!

Japanese beetles
Black rot
Downy mildew
Powdery mildew
Phomopsis
Anthracnose
Mars
Cayuga White (W): L. Aug.
High Input – Dwarf Apples

- Pome fruit: member of rose family
  - Need 2 diff. for cross pollination
  - Trees grow and survive well
- Even with disease resistance - must still control insects!
  - Starting at green tip (late March)
  - Choose earliest for less pressure
- Wildlife also like apples
  - Deer, squirrels, voles, rabbits, etc.

<table>
<thead>
<tr>
<th>Variety</th>
<th>AS</th>
<th>CR</th>
<th>FB</th>
<th>PM</th>
<th>Harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liberty</td>
<td>VR</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>L. Aug.</td>
</tr>
<tr>
<td>Spartan</td>
<td>MR</td>
<td>R</td>
<td>MR</td>
<td>R</td>
<td>E. Sept.</td>
</tr>
<tr>
<td>Priscilla</td>
<td>VR</td>
<td>VR</td>
<td>VR</td>
<td>R</td>
<td>M. Sept.</td>
</tr>
<tr>
<td>Sundance (Y)</td>
<td>VR</td>
<td>VR</td>
<td>VR</td>
<td>VR</td>
<td>M. Oct.</td>
</tr>
</tbody>
</table>

AS = apple scab, CR = cedar apple rust, FB = fire blight, PM = powdery mildew

Yield from 6 yr. old Liberty (no sprays) Disease resistant insecticide sprays only (sooty blotch, flyspeck)

Apple scab  Cedar apple rust  Fire blight

Black rot  Bitter rot  White rot
High Input – Tart Cherries

• Stone fruit
  • Trees survive well
    • Blooms earlier than peaches
    • Crop losses are possible (2/10 yrs.)
  • Insects: less trouble (same as plums)
    • Borers sometimes problematic
• Self fertile (only 1 needed)
  • Montmorency: M. Jun.
  • North Star: M. Jun.

• Brown rot
• Birds!
High Input – Pears

• Pome fruit like apples
  • Asian can stand-in for apples
    • But, bloom earlier, less cold hardy
  • Need 2 diff. for pollination
    • A. can pollinize E., but only if overlap

• A lot of the same pests as apples
  • But, just less intense
  • Except fire blight - can kill outright!
    • A. = only mod. tol., E. = some res.

• Downside: pruning can be diff.
  • Upright growth habit, narrow branch angles, watersprouts
  • When to pick? – A. vs. E.

<table>
<thead>
<tr>
<th>European</th>
<th>Asian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunrise</td>
<td>E. Aug.</td>
</tr>
<tr>
<td>Blake’s Pride</td>
<td>M. Aug.</td>
</tr>
<tr>
<td>Potomac</td>
<td>L. Aug.</td>
</tr>
<tr>
<td>Seckel</td>
<td>L. Aug.</td>
</tr>
<tr>
<td>Shenandoah</td>
<td>E. Sep.</td>
</tr>
<tr>
<td>Yoinashi</td>
<td>E. Sep.</td>
</tr>
<tr>
<td>Shinko</td>
<td>M. Sep.</td>
</tr>
<tr>
<td>Olympic</td>
<td>L. Sep.</td>
</tr>
<tr>
<td>(Korean Giant)</td>
<td></td>
</tr>
</tbody>
</table>

Blake’s Pride
Shenandoah
Fruit Bagging
(Apples, Pears, Peaches, Plums, Grapes)

• Barrier to summer insect pests and diseases
  • Still need to control spring fruit pests before bagging
  • Sprays still required for leaf diseases/insects

• Apply bags once fruit reach ½-¾” diameter
  • About 3 wks. after petal fall
    • Specialty bags for apples
    • White/brown lunch bags suitable for others
    • Combine with hand thinning
    • Note: 1 or 2 insecticide sprays needed bef. bagging
  • Remove 10-14 d. bef. harvest to color
  • Entfact-218
Medium Input Crops

• Compared to high input corps
  • Less intense mgmt. for good results
  • Fewer sprays needed
    • Esp. if choosing early ripening
    • Summer vs. fall bearing types

• Good pruning + cultural practices
  • Very successful in reducing spraying
  • Sprays mostly bef. bloom, fewer after
  • Bird netting is required for crop!
  • Gen. less pest intensity (except for one!)
Spotted Wing Drosophila - SWD

- Serious prob. of all soft fruits
  - Black./rasp./blueberries, etc.

- Female punctures skin and lays eggs at start and during ripening

- Active April until hard frost
  - 10-14 gen./yr.; Pop. ↑ till end of season

- Cultural controls
  - Avoid fall/ever-bearing/day neutral types
  - Remove and destroy damaged fruit
    - Refrigerate or freeze clean fruit immediately
  - Exclusion netting? – Protek Net
  - Prune to open canopy. Avoid shading. Control weeds.

- Insecticides (PHI):
  - Imidan (3-14), Malathion (1-3), Entrust (1-7), Sevin (7) Pyganic (0)
  - Apply early morning or late evening when most active.

Monitor with cider vinegar traps. Detect to apply controls. For more info read Entfact 229, 230, and 231.
Medium Input - Blueberries

• “The goldilocks plant”, req.
  • Low soil pH: 4.5-5.2
  • High organic matter: 5-12%
  • Consistent soil moisture
    • Lacks root hairs (1/10th uptake)
    • Poor lateral trans. (water both sides!)
    • But not continuous → root rots

• Number of diseases, few serious
  • Leaf spots, fruit rots, cane dis., etc.
  • Phytophthora → 8-12” raised beds
    • Build raised beds, or don’t plant!

Alternaria fruit rot
Anthracnose fruit rot
Mummy berry

High pH: iron chlorosis

Raised beds with liberal peat moss add.

Blueberries:
• Bluejay: M-L. Jun.
• Patriot: M-L. Jun.
• Spartan: M-L. Jun.
• Toro: L. Jun. – E. Jul.

Drought injury

Red leaves, poor growth: Phytophthora root rot
Medium Input – Strawberries

- Bloom early, low growth habit
  - Frost susc. – high elevation
  - Choose June bearing types
- Needs well drained soil and consistent irrigation
  - 50-90% roots in top 6” (≈1”/wk.)
  - Phytophthora root rot
- Additional labor required for
  - Weed cont. – always a problem
  - Mulching for winter protection
  - Post-harvest renovation
  - Rotation to new site (3-5 yrs.)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Season</th>
<th>Leaf Spot</th>
<th>Leaf Scorch</th>
<th>Red Stele</th>
<th>Vert. Wilt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earliglow</td>
<td>0</td>
<td>T</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Flavorfest</td>
<td>4</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Mesabi</td>
<td>6</td>
<td>T</td>
<td>T</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Redchief</td>
<td>7</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Allstar</td>
<td>9</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
</tbody>
</table>

Season: days after Earliglow. T = tolerant, R = resistant
Medium Input – Raspberries

• Bramble: like blackberries (Rubus)
  • June bearing only!: red, purple, black
    • Boyne (R): M.-L. Jun.
    • Jewel (B): M.-L. Jun.
  • Less adaptable to hot summers
    • Tolerant of afternoon shade
• Susc. to aphid transmitted viruses
  • Keep blacks, purples away from reds
    • Reds may carry latent mosaic virus
  • Keep reds away from blackberries
    • Blackberries may carry leaf curl virus
  • Separate at least 100 + ft.

Reds only: ring spot virus (nematodes)

Anthracnose cane blight (all, but worst on black, purple)

Botrytis gray mold

Raspberry crown borer

Spur blight
Medium Input - Blackberries

- Well adapted bramble crop (Rubus)
  - June bearing only! – come in thorny, thornless erect/semi-erect types
    - Thorny less tolerant of orange rust
    - Semi-erect ripen later (Jul. – Aug.), ↑ SWD
  - Choose orange rust tolerant thornless
    - Osage: E.-L. Jul.

- Anthracnose, cane blight sprays
  - Dormant: sulfur, copper
  - Pre-bloom: Captan
  - Post bloom not needed unless severe prob.
Medium Input – Black Currants

• Ribes: short shrub (4-6’ tall max)
  • Once common, but banned in early 1900’s because of WPBR
  • Tart fresh: mainly for baking, jams
    • Come in black, red, white

• Choose white pine blister rust, PM and septoria leaf spot resistance
  • Black: Titania, Consort
  • Ripen: M. Jun. – E. Jul.

• Better suited to a cool site
  • Southern limit in KY
  • Shade tolerant – plant on N side
Medium Input - Gooseberries

- Ribes: Short shrub (4’ tall max)
  - Closely related to currants
  - Have the similar diseases + uses
  - Come in green, red when ripe
- Choose white pine blister rust, PM, leaf spot resistance + thornless
  - Red: Hinnomaki Red, Amish Red
    - Others not disease resistant
- Similar prob. with summer heat
  - Shade tolerant – plant on N side
  - Woodland species – maybe more tolerant of tree competition? – PD?

White pine blister rust
Powdery mildew
E. Summer leaf spot, powdery mildew defoliation
Low Input Crops

• Much less management required
  • Fruits have very few pests
  • Good success with no spray culture
  • Selective care
    • Pruning – thin branches, some spreading
    • Weed control when young
    • Light fertilization when young

• These are uncommon fruits
  • Not as well known - most not considered dessert-type
    • Usually processed – baked, jellied, juice, etc.
  • I include only adapted ones that can have fresh use (but, many others!)
Low Input - Figs

• Choose hardiest for in-ground
  • Brown Turkey, Chicago Hardy
  • Like lots of (full) sun and heat

• Top killed if unprotected bel. 10°F
  • Regrow and fruit in L. summer – Fall
  • Can bend over, weight down suckers, mulch heavily

• Can be potted in 15 gal. + pots
  • Fertilize well early season (Osmocote plus, N-P-K + micro), water regularly
  • Kept in unheated garage over winter, moved in/out based on spring frost

• Downsides – lower yielding, birds may take a few, white sap from stem may irritate skin (gloves), dried fruit most familiar (taste)
Low Input – Jujubes (Chinese Dates)

• Small tree: 15-35’ tall, wide
  • Partially self fertile
  • Only hardy in W. KY (zone 7)
  • Drupe - single seed (like olive pit)
    • 1-2” long: depends on cultivar

• Typically processed: steamed or dried
  • Dried fruit sweet, tastes similar to date
  • Fresh: crisp texture, apple-like flavor

• Ripe Aug. – Sep.: Lang, Sherwood, GA-866, SO
  • England’s Orchard and Nursery (KY): http://www.nuttrees.net/

• Downsides: some have spines, small fruit size, fresh flavor pretty mild
Low Input - Mulberries

• Small tree: 20-30’ tall
  • Self fertile
  • Wide range of hardiness based on background (native x non-native cross)

• Listed cultivars hardy to -25°F
  • **Illinois Everbearing** – dark purple, sweet 1.5” fruit, ripen from L. Jun. – E. Aug.
  • **Collier** – similar to Illinois Everbearing, 1.5” fruit, but 2 weeks earlier
  • **Silk Hope** – similar to Illinois Everbearing, but slightly larger fruit

• Downsides – messy (staining), birds, hand harvest difficult (ladders), stems must be removed from fruit before processing
Low Input - Pawpaws

- Largest fruit native to U.S. (4-6” long, ¼-½ lb.)
  - Attractive small tree (15-25’), pyramidal, large leaves
  - Harvest when begin to soften (L. Aug. – Sep.)
    - Yellowish, may have sooty appearance, black spots
    - Unique banana-like flavor, mushy texture (spoon out pulp + seeds, separate, puree, freeze)

- Purchase grafted cultivars (+ other KSU)
  - KSU-Atwood, Shenandoah, Potomac, Overleese, Sunflower, Susquehanna
  - Require cross pollination (by carrion flies) – 2 cultivars needed

- Downsides: Love-em or hate-em type fruit
  - Diff. to transplant – req. temporary shade 1st year
  - Better processed: freeze, breads, puddings, ice cream
Low Input – American Persimmon

- Fruit native to N. America
  - Tree: 30-40’ tall, fruits 1-1.5”, astringent until ripe
  - Related to Oriental (kaki) persimmon (not hardy)
  - Dioecious – need a female and male tree
    - But, N. pop. (n=90) can fruit w/o male (most improved ones)
- Selected cultivars: Early Golden, Lehman 100-42 and 100-46, Claypool, Morris Burton, Prok
- Downsides: 8-10 yrs. to harvest, must be bletted
  - Inedible unripe (very astringent) – don’t pick from tree!
    - Must be allowed to drop (not associated with frost)
    - Often split or pop when fall → require soft (straw, cloth) mat
  - Better processed: baking, preserves, toppings

Bletted fruit darkens, skin thins/wrinkles, flesh softens into jelly-like consistency

Jerry Lehman, Terre Haute, IN
Low Input - Elderberries

- **Sambucus canadensis** (N. American) and **S. nigra** (European)
  - European types not adapted
  - Medium to large bush – 6-9 ft. tall/wide
    - Canes arise from crown - spreads by suckers
    - Forms an attractive hedge
    - M. June flowering – Aug. to Sep. ripening
  - Many uses (processed)
    - Fruit: baking, jelly, juice, wine, liqueurs
    - Flowers: added to batter, wine, tea
- Selected cultivars: Bob Gordon, Wyldewood (U. of M.), Johns, Adams, Nova
- Downsides: SWD, birds, harvest, processing
  - Ripe fruit may upset stomach in some people
Again, Think Ahead bef. Planting!

- Knowing which factors (in a home setting)
  - Hard to control
  - Are easy to control
  - Somewhere in between

- Will help in choosing
  - What to plant
  - What not to plant
  - And how much

- Use cultural practices to your advantage, before resorting to pesticides
Cultural Practices Calendar - Dormant

• Prune to remove
  • Cankers, dead and dying wood/canes
    • Remove 6” past (down) from canker
    • Sanitize pruners with alcohol after cut
  • Crossed or broken branches, insect galls

• Prune to allow
  • Increased air movement (narrow row, thin canopy)
  • Promote drying, increased spray coverage

• Remove fruit mummies (don’t compost)
Cultural Practices Calendar – Early Growth

• Take time to remove any alternate hosts
  • Fire blight (crab apples), cedar apple rust (cedars, junipers)
  • Adjacent wild fruit species, perennial weeds
• Remove new leaf growth showing disease signs
• Avoid excess nitrogen at this time

• Replace mulch, weed barrier fabric
• Remove grape leaves with insect galls
  • Thin shoots to 4-6 per ft. of cordon for air movement
  • Comb shoots to separate tendrils when 10-12” long
Cultural Practices Calendar – Bloom/Spring

- Remove any remaining fruit mummies missed
- Thin dense fruit clusters
  - Apple, pear, plum: 1 per cluster, and 6-8” apart
  - Peach: 1 fruit per 8-10” of shoot
- Bag developing fruit no later than ¾”

- Remove infected leaves and diseased fruit
  - Includes severely insect damaged fruit

- Avoid overwatering at this time
- Practice continued weed control to increase air movement
Cultural Practices Calendar – Summer Growth

• Remove any noticeably diseased or rotted fruit
  • From tree canopy and from ground (drops)
  • Any fruit with insect damage or frass protruding
  • Also, rake diseased and dropped leaves
  • Dispose of cleaned fruit/leaves (don’t compost)

• Remove any bramble plants infected with orange rust
  • Including roots (don’t compost)

• Irrigate when needed during very dry weather
  • Ex. 2-3 good watering's/wk. during no rain
Cultural Practices Calendar - Harvest

- Remove any fruit bags 10-14 days before harvest
- Continue to remove diseased/infested fruit/leaves
- When harvesting berry crops
  - Pick berries frequently
    - Every 2-3 days
  - Dispose of damaged fruit
    - Outside of field (don’t compost)
    - Have a 2nd bucket for damaged
    - Imp. for SWD – clear plastic zip bags, solarize
- Wash fruit only if noticeably dirty
  - Refrigerate/freeze berries immediately
Cultural Practices Calendar – Post-Harvest/Fall

- Remove all remaining fruit, fallen leaves
  - Including drops and mummies
  - Destroy (don’t compost): buried, burned, bagged
  - Are important sources of overwintering innoculum

- For apples/pears
  - Remove galls from ornamental cedars and junipers

- For berry crops
  - Mulch around plants, prevent drought stress
  - Strawberries: renovate planting, mow leaves, remove debris
  - Brambles: remove spent (fruited) canes, rust infected plants
Wildlife Management

• Animals like fruit as much as people!
• Voles (short tailed mice)
  • 24” T x 18” W x 2-3” deep hardware mesh pen
  • Tree guards alone not effective
  • Keep bare area under tree
• Rabbits
  • White tree guards
  • Hardware mesh
• Deer
  • 3-4 T-posts and flagging tape
  • Wire fencing (inconvenient)
• Birds
  • Exclusion by netting
  • Applied bef. coloring and softening
Home Fruit Fungicides
(Always Check Label First!)

• Captan
  • Crops: apples (not labeled for pears), stone fruit, berry crops, grapes
  • Diseases: scab, rust, fruit and leaf spots/rots, cane and twig blights, etc.

• Mancozeb (Dithane)
  • Crops: pome fruits, stone fruits, grapes, (not berry crops)
  • Diseases: scab, rust, fruit and leaf spots/rots, cane and twig blights, etc.

• Streptomycin (bactericide)
  • Crops: apples, pears
  • Diseases: fire blight
Home Fruit Fungicides
(Always Check Label First!)

• Chlorothalonil (Daconil)
  • Crops: stone fruits
  • Diseases: plum black knot, peach leaf curl, cherry leaf spot, peach scab

• Myclobutanil (Immunox, Rally)
  • Crops: pome fruits, grapes
  • Diseases: scab, black rot (is systemic and rainfast)

• Thiophanate-Methyl (Topsin M)
  • Crops: pome fruits, stone fruits, grapes, strawberries (no other berry crops)
  • Diseases: scab, rust, fruit and leaf spots/rots, cane and twig blights, etc.
Home Fruit Fungicides

(Always Check Label First!)

• Copper products (Bordeaux mixture, Kocide, etc.)
  • Crops: pome fruits, stone fruits, brambles, grapes
  • Diseases: fire blight, scab, leaf curl, brown rot, cane/spur blight, black rot, etc.

• Sulfur products (lime sulfur, sulforix, etc.)
  • Crops: pome fruits, stone fruits, blueberries, blackberries, grapes
  • Diseases: scab, leaf curl, brown rot, cane/spur blight, anthracnose, etc.

• Beware of phytotoxicity: do not apply copper (1) or sulfur (2) prior to
  • 1) Prolonged leaf wetness period (ex. cool, cloudy, misty, no rainfall)
  • Temperatures immediately before and after above 85°F

• Do use sulfur within 10 days of applying oil or Captan
Home Fruit Insecticides
(Always Check Label First!)

• Oils (dormant, horticultural, neem oil)
  • Crops: pome fruits and stone fruits
  • Insects: aphids, scales, mites, insect eggs, Japanese/green June beetles, etc.
  • Works by suffocation – **Do not over-concentrate! (2-4%)** → leaf phytotoxicity

• Malathion
  • Crops: pome fruits, berry crops, grapes
  • Insects: aphids, leaf hoppers, BMSB, SWD, Japanese/green June beetles, etc.

• Spinosad (Entrust)
  • Crops: pome fruits, stone fruits, berry crops
  • Insects: codling moth, oriental fruit moth, stink bugs, SWD, etc.
Home Fruit Insecticides
(Always Check Label First!)

• Sevin (flares mite pop., kills predatory mites)
  • Crops: pome fruits, stone fruits, berry crops, grapes
  • Insects: Japanese/green June beetles, spittlebug, grape berry moth, etc.

• Imidan
  • Crops: pome fruits, stone fruits, blueberries, grapes
  • Insects: codling moth, plum curculio, blueberry maggot, grape berry moth, etc.

• Permethrin: pome, stone fr. → stink bugs, plum curc., etc. (flares mites)
• Insecticidal soap: pome and stone fruits → aphids, mites

• Save the Bees!!! – Do not apply insecticide around bloom
Home Fruit Spray Equipment

• Best ones are durable (5-10 yrs.)
  • Remember, you get what you pay for!

• Hand pump sprayers: 1-2 gal.
  • Relatively inexpensive: $25-50
  • Good for short range spraying
    • Separate one for herbicides!!!!

• Backpack sprayer: 3-5 gal.
  • $100-200 range (best: pressure bulb, gauge)
  • Improved spray height with wand extension

• Battery powered ATV spot sprayer

Flat fan or hollow cone nozzles
Home Fruit Spray Guides

- PPFS-FR-T-21: Apple Disease Mgmt.
- PPFS-FR-T-24: Grape Disease Mgmt.
- PPFS-FR-T-25: Berry Disease Mgmt.
- PPFS-GEN-05: Fruit, etc. Sanitation

Plant Pathology Publications
- [http://plantpathology.ca.uky.edu/extension/publications#FruitsNuts](http://plantpathology.ca.uky.edu/extension/publications#FruitsNuts)
Home Fruit Spray Guides

• ID-21 contains sections on, etc.
  • Cultural practices
  • Using pesticides safely
    • Including spray equipment
  • Spraying small quantities
    • Measurements and calculations
  • Spray timing and chemicals
    • Including organic
  • Explanation of major pests

• Plant Pathology Publications
  • http://plantpathology.ca.uky.edu/extension/publications#FruitsNuts
Many Home Pesticides are Multipurpose
(But some are more effective than others)
Where to Buy?

- Keystone Pest Solutions: [www.keystonepestsolutions.com](http://www.keystonepestsolutions.com)
- Do My Own Pest Control: [www.domyownpestcontrol.com](http://www.domyownpestcontrol.com)

From Homeowners Guide to Fungicides, PPFS-Gen-07

- Local garden centers
- Farm supply
- Co-ops

### Finding Dealers

<table>
<thead>
<tr>
<th>Dealer</th>
<th>Web site</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayer Advanced</td>
<td><a href="http://www.bayeradvanced.com">http://www.bayeradvanced.com</a></td>
<td>Use 'Locate a Store' to find local dealers.</td>
</tr>
<tr>
<td>Bonide</td>
<td><a href="http://www.bonide.com">http://www.bonide.com</a></td>
<td>Use 'Dealer Locator' tool to find garden centers near your ZIP code.</td>
</tr>
<tr>
<td>Ferti-lome</td>
<td><a href="http://www.fertilome.com">http://www.fertilome.com</a></td>
<td>Use 'Find a Local Garden Center' tool to locate a dealer near your ZIP code. Ferti-lome also manufactures Hi-Yield branded products.</td>
</tr>
<tr>
<td>Garden Tech</td>
<td><a href="http://www.gardentech.com">http://www.gardentech.com</a></td>
<td>See 'Contact Us' for toll-free consumer support and dealer locator.</td>
</tr>
<tr>
<td>Planet Natural</td>
<td><a href="http://www.planetnatural.com">http://www.planetnatural.com</a></td>
<td>An online supplier of organic gardening supplies.</td>
</tr>
</tbody>
</table>
Spray Scheduling

- Directions by plant growth stage
- Based on pest presence
- When conditions favor activity

**Remember the disease triangle!**
- Host, pathogen, and environment

**Spray Intervals**
- 7-10 days: dormant to 1st summer cover
  - More rain = expectation of frequent wash-off
- 10-14 days: summer and fall
  - Less rain = less wash-off
# Understanding Spray Schedules

<table>
<thead>
<tr>
<th>Time of Year</th>
<th>Growth Stage</th>
<th>Cultural Practices</th>
<th>Disease</th>
<th>Insect</th>
</tr>
</thead>
<tbody>
<tr>
<td>February/ Early March</td>
<td>Dormant (before buds swell)</td>
<td>Fire blight, Fruit rots/spots, Scab, Insect/mite</td>
<td>Prune cankers and dead, dying and diseased wood; Prune to allow for increased air movement, to speed drying, and allow for thorough spray coverage; Remove fruit mummies; Plant resistant cultivars.</td>
<td>Fire blight</td>
</tr>
<tr>
<td>Late March</td>
<td>Green tip to half-inch green (1/2 inch of green buds are visible)</td>
<td>Fire blight, Scab</td>
<td>Remove alternate hosts.</td>
<td>Fire blight</td>
</tr>
<tr>
<td>Late March/ Mid-April</td>
<td>Pink (just before blooms open)</td>
<td>Cedar-apple rust, Scab, Rosy apple aphid</td>
<td>Prune and destroy cedar apples found on ornamental junipers and cedars; Remove new leaf growth that is tightly curled.</td>
<td>Cedar-apple rust</td>
</tr>
<tr>
<td>Mid-April/ Early May</td>
<td>Bloom (20-60% of blossoms are open)</td>
<td>Cedar-apple rust, Scab, Fire blight</td>
<td>Remove alternate hosts.</td>
<td>Cedar-apple rust</td>
</tr>
<tr>
<td>May</td>
<td>After petals fall</td>
<td>Cedar-apple rust, Scab, Fruit rots/spots, Aphids, Codling moth, Plum curculio</td>
<td>Thin dense fruit clusters by hand; Bag developing fruit when they are 3/4 inch in size; Remove fruit with crescent shaped scars</td>
<td>Cedar-apple rust</td>
</tr>
</tbody>
</table>

*Note: Copper* is a common fungicide used for controlling fungal diseases. Immunox and Mancozeb are bactericides and fungicides, respectively. Sulfur is a fungicide that helps prevent fungal diseases. Malathion is an insecticide commonly used to control aphids. Dormant oil is used to control overwintering pests. Aphids scale, Dormant oil, San Jose scale, and Horticultural oil are all pests or problems that can be controlled with the mentioned management strategies.
Home Fruit Spray Timing

- Most are contact (preventative)
  - Must be present as a barrier to prevent infection
    - Washed off by rain, degraded by outside conditions
    - Require frequent re-application for good control
  - Exceptions: Immunox (Rally), Tospin-M
    - Locally absorbed by leaves → prevents wash off
    - Excellent for heavy rainfall periods (spring)

- Important to spray before disease appears
  - ***And before rainfall!!***
    - Once infection occurs can’t “clean-up” the diseased site
    - Will only prevent new infections when present
Home Fruit Spray Timing

• Because they must form a barrier for control
  • Sprays must be applied before rainfall (not after!)
    • Then reapplied again after wash off
    • Why I like systemics for early season sprays
  • Sprays may occur more often than 7 days in spring
    • Can expect 50% to wash off with every ½” of rainfall
    • Can be one time or cumulative over # of days

• Early season sprays are the most important
  • Reduce pest population early-on
  • Makes control easier later (cond. less favorable)
Measuring and Mixing

• Measuring equipment (per gallon)
  • Powders: small scale, Tbs., tsp.
  • Liquids: Tbs., Tsp., graduated cylinder
  • Keep several sets on hand
  • Keep and label ones for herbicides separate

• Mixing procedure (check incompatibilities)
  • Start with clean bucket/tank – fill ½ with water
  • Add measured amount of chemical
  • Fill rest of way, mix by shaking/stirring with rod
  • Spray immediately – do not let sit!
PPE and Safety

• Follow PPE (personal protective equipment) as described on label. Usually consists of:
  • Long sleeved shirt, long pants, hat
  • Disposable gloves, face mask, goggles
  • Sometimes: rubber boots and respirator

• Don’t eat, drink, or chew gum/tobacco
  • Avoid touching face/skin with gloved hands
  • Wash hands after applying
  • Wash hands before using toilet
Application

• Choose period of low wind (3-5 mph), moderate humidity (50-70%), and moderate temp. (60-80°)
  • E. morning or L. evening (6:00-8:00 a.m., p.m.) best
  • Reduces drift, volatilization, evaporation

• Spray canopy (or area of control, ex. fruit) evenly
  • Stand back with nozzle 1-2’ away from leaves, etc.
    • Pump sprayer to achieve consistent pressure
    • Adjust nozzles so that fine spray emerges
  • Using forward and back motion, ensure even coverage
    • Evenly cover surface with fine droplets
    • Stop before dripping (exception: trunk/limb drench for scale, mites, borers)
Clean-up and Storage

• After spraying is completed
  • Go to washing station (garden hose) and rinse tank till clean (2-3 flushes)
    • Flush the lines (water + air), let air dry, then store
    • Helps preserve integrity of lines, gaskets, valves – grease gaskets at season end
  • Shower and change into clean clothes
    • Wash with hot water – may use separate load if very contaminated

• Pesticide storage
  • Most for 2-3 yrs. without loosing effectiveness (powders – maybe longer)
    • Keep locked-up at temps. below 100°F and above 40°F (no freezing)
  • Discard ones that have degraded
    • Separation, lumping, leaking containers, lost labels
    • Bring to regional hazardous waste disposal events
Check Pesticide Label: REI, PHI

- **REI**: re-entry interval
  - Time between spraying and working in area again
  - Can be greater or equal to PHI

- **PHI**: pre-harvest interval
  - Time between spray and harvest (not storage)

- Based on decay curves and half-life
  - Developed from field testing at multiple sites
    - And over multiple years
  - Uses safe consumption conc. (no-affect rate)
    - Time at which PHI established, conc. is
    - Less than 100x the min. for adults
    - Additionally 10x less than min. for children
In Review

• Think ahead and be critical
  • Choose the appropriate fruit species, cultivar/rootstock combo to fit your needs
    • Be realistic about the time and labor requirements, likely pest pressures and appropriate controls
  • Be patient, prepare – don’t rush out and plant

• Practice sound cultural management techniques
  • From site selection through life of planting, annually

• Familiarize yourself with chemical pest controls
  • Pest lifecycles, control timing, appropriate pesticides
  • Always read, follow label – REI, PHI, PPE, application, storage
  • Keep resources on hand for future reference
Resources

- County extension office
  - ANR and Hort. Agents
  - Publications, DVD’s, testing, and demonstrations
    - Fruit facts newsletter; strawberry, grape, blueberry alerts
  - Diagnostic labs: disease, insect, and weed ID’s

- Web: pubs., power point pres.
  - Plant Pathology Dept. pubs.: [http://plantpathology.ca.uky.edu/extension/publications](http://plantpathology.ca.uky.edu/extension/publications)
  - Entomology Dept. pubs.: [https://entomology.ca.uky.edu/fruit](https://entomology.ca.uky.edu/fruit)

Don’t plant too much all at once!
Steep learning curve, so it is best to start slowly
It is difficult to justify this type of sprayer for a home planting