Growing Fruit & Nut Trees, Berries, and Grapes in the Home Garden

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Master Gardener Training
Feb. 9, 2011
Chilling Requirement

The number of hours below 45°F required by a fruit species or variety between November 1 and February 15

Lack of chilling causes:
Death of buds, extended bloom, and poor fruit set
Three zones with low-chill winters
## Chilling Hour Requirements
*(Newer varieties may have lower requirements)*

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Almond</strong></td>
<td><strong>250-500</strong></td>
</tr>
<tr>
<td>*<em>Apple</em></td>
<td><strong>500-1000</strong></td>
</tr>
<tr>
<td><strong>Apple (low chill)</strong></td>
<td><strong>400-600</strong></td>
</tr>
<tr>
<td>*<em>Apricot</em></td>
<td><strong>300-800</strong></td>
</tr>
<tr>
<td><strong>Cherry, sweet</strong></td>
<td><strong>700-800</strong></td>
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<tr>
<td><strong>Fig</strong></td>
<td><strong>100</strong></td>
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<tr>
<td><strong>Peach/nectarine</strong></td>
<td><strong>500-800</strong></td>
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<tr>
<td>*<em>Pear</em></td>
<td><strong>700-800</strong></td>
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<tr>
<td><strong>Pear (Asian)</strong></td>
<td><strong>350-450</strong></td>
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<tr>
<td><strong>Pecan</strong></td>
<td><strong>250</strong></td>
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<td><strong>Persimmon</strong></td>
<td><strong>100-200</strong></td>
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<tr>
<td><strong>Pistachio</strong></td>
<td><strong>800</strong></td>
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<tr>
<td><strong>Plum, European</strong></td>
<td><strong>600-800</strong></td>
</tr>
<tr>
<td><strong>Plum, Japanese</strong></td>
<td><strong>700-800</strong></td>
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<tr>
<td><strong>Pomegranate</strong></td>
<td><strong>100-150</strong></td>
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<tr>
<td><strong>Walnut</strong></td>
<td><strong>500-700</strong></td>
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## Accumulated Chilling Hours

**Nov. 1 – Feb. 28**

<table>
<thead>
<tr>
<th>04-05</th>
<th>05-06</th>
<th>06-07</th>
<th>07-08</th>
<th>08-09</th>
<th>09-10</th>
<th>Avg.</th>
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<tbody>
<tr>
<td>817</td>
<td>503</td>
<td>920</td>
<td>879</td>
<td>916</td>
<td>663</td>
<td><strong>783</strong></td>
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</tbody>
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**10-11 to date**

~700

Site Selection

- 6-8+ hours of full sun
- Shelter from high winds
- Some trees may benefit from warm south wall
- Avoid planting where fruit falls on walks or driveway
- Soil should be at least 3 ft deep
Pollination of Fruit Trees

- **Pollenizer**: A tree of one variety used to provide pollen to a nearby tree of a different variety to produce fruit

- **Pollinator**: An insect (usually a bee) that carries pollen from one tree or flower to another
What if You Have No Pollinizer Nearby? Plant, Graft, or:
Soil Amendments

- No amendments in planting hole
- Uncomposted amendments rototilled months before planting
- Avoid pockets of undecomposted organic matter in heavy soils
- Add mulch or compost to surface
Fruit Tree Terms

• **Rootstock/Stock** – tree below graft union
• **Scion** – above union; bud or shoot grafted
• **Crown**: trunk below ground (also canopy)
• **Tree size**
  - **Standard** – 20-25 ft.
  - **Semi-dwarf** (dwarfing rootstk) - 12-20 ft.
  - **Genetic dwarf** (std. rootstock) - 8-12 ft.
    - Peaches, nectarines, apple, citrus
Genetic Dwarf Peach/Nect.
INTERNODE LENGTH

Standard Peach

Genetic Dwarf Peach
More Fruit Tree Terms

- **Scaffold branch**: main structural limb
- **Spur**: short fruiting twig
- **Shoot**: current season elongated growth
- **Water sprout**: vigorous shoot from branch
- **Sucker**: shoot from rootstock or roots
Cherry

A. pear

Eur. pear

Apricot

Spurs
Peach Fruiting Branches

Veg. bud

Flower buds
Choosing and Handling Trees

- Bare root cheaper than potted
- Use $\frac{1}{2}$ to $\frac{5}{8}$ in. caliper trees
- Avoid drying of bare roots
- “Heel in” bare root trees if planting is delayed
Heeling in
Planting Fruit Trees

- Check roots, cut off dead or damaged
- Hole size: **Wide**, and deep if compacted
- Plant on mound to keep crown dry
- **Plant high!** – Reduces chances of crown & root rot
  - Graft union well above soil
  - Previous soil line at or above soil level
  - Allow for soil settling
Undercutting the Trees
Planting a Bare Root Tree

- Dig hole to fit roots
- Lightly tamp soil
- Emitters 1 ft. away

Lightly tamp soil
Planting a Containerized Tree

Pull out wound roots

Water in

Don’t cover soil in pot
Post-Planting Care

• Head tree at 18-36 in.
• Cut back well-placed laterals to 3-8 in., remove all others
• Paint trunk white
  ➢ Interior latex paint & water, 50:50
  ➢ Entire trunk & 2 in. below soil
  ➢ Prevents sunburn & borers
Pruning a Bare-Root Tree

Branches thinner than 3/16

Branches thicker than 3/16
New Shoots on Branches of Newly Planted Tree
Pruning a Bare-Root Tree with Branches
(Central Leader)

Before

After
Paint Trunks White
(Hot Climates, Afternoon Sun on Trunk)
The Beautiful New Orchard!
Irrigation

• Best = drip and microsprinkler irrigation
• Also, furrow, doughnut ring, sprinkler
• Worst = in a lawn
• Water should reach at least 2 ft. deep
• A 2-year-old tree can use about 2 gal./day
• A mature tree can use >50 gal./day
Drip Irrigation

Mulch pulled back
Second Drip Line Added
(Inline emitter tubing)
Microsprinkler
Fertilization

• Don’t overfertilize! Little N required.
• Use no more than 1 lb. actual N per year on mature trees
• Too much N → excessive growth, shading of lower wood
• Other nutrients usually sufficient
• Use organic amendments
Basics of Pruning
Heading Cut

- Removal of part of branch or shoot
- Used to promote branch development, especially on young trees
- Stimulates growth just below cuts
- Can reduce sunlight penetration
Thinning Cut

- Removal of entire branch or shoot, or back to a branch >1/3 the thickness of cut branch
- Used to prevent crowding and improve sunlight penetration
- Defines main branches
Thinning & Heading Cuts on Plum Tree
Narrow vs. Wide Branch Angles

Bad

Good
Spread Shoots & Branches Where Practical
Summer Pruning of Young Trees

• **Purpose:** promote scaffold branches
• **Head unwanted shoots to 4-6 in.**
• **Pinch 2 ft. long scaffold branches to promote side branching**
• **Reduces training time, shortens time to first fruit production**
Summer Pruning for Training
(Open Center)

Before

After
Summer Pruning of Mature Trees

- Purpose: To increase sunlight & productivity of lower fruiting wood
- Remove unwanted vigorous, upright shoots 1-2 times during season
- Bring down tree height
- Large branches may sunburn if pruning is excessive
Specific Fruit & Nut Tree Training Methods

- Open center
- Central leader
- Modified central leader
- Perpendicular “V”
- Fruit bush
- Espalier
Open Center

- Most common method
- Stone fruits and almonds; can also use for apples, pears, figs, persimmons
- Select scaffolds during first 2 growing seasons, touch up in dormant season
- Keep center open during summer from the start
Open Center

Stake branches outward if necessary (cherry)

Radial separation of scaffold branches (apricot)
Must have Vertical Branch Separation, Wide Crotch Angles
Specific Fruit & Nut Tree Training Methods

• Open center

  Pruning stone fruits

  peach/Nectarine
Peach/Nectarine Fruiting Branches
(Bear on long, 1-yr.-old wood)
Pruning a One-Year-Old Peach
Pruning a Two-Year-Old Peach
Pruned Three-Year-Old Peach
Pruning a Mature Peach
Tying Open Center Peach Tree
Cut back 2-year-old branches to healthy 1-year-old branches
Prune Apricots and Cherries in August to Avoid Branch Diseases
Specific Fruit & Nut Tree Training Methods

- Open center
- Central leader
- Modified central leader
- Perpendicular “V”
- Fruit bush
- Espalier
Central Leader Apple
(Genetic Dwarf)
Central Leader Training

- Used for apples, pears, Asian pears
- Maintain leader, remove at certain height
- Tie or stake lateral branches outward
- Create 3-4 whorls of branches
- Branches offset from those below
Central Leader Training

Diagram showing the stages of central leader training:

1. Scaffold branch
2. Spreader
3. Central leader
Spread branches, keep leader dominant
Ideal tree shape & branch spread from regular maintenance pruning

Robert Stebbins 1976
Specific Fruit & Nut Tree Training Methods

- Open center
- Central leader
- Modified central leader
- **Perpendicular “V”**
- Fruit bush
- Espalier
Perpendicular V
(Peach/Nect.)

Keep center open

Train one shoot each direction on stake
Specific Fruit & Nut Tree Training Methods

- Open center
- Central leader
- Modified central leader
- Perpendicular “V”
- Fruit bush
- Espalier
Fruit Bushes Kept at Desired Height
Fruit Bushes
Pruning – Years 1 & 2

• At planting, head trees to 18-24 in.
• Mid-spring – cut back new growth by half
• Mid-summer – cut subsequent growth back by half
• Thinning cuts for sunlight penetration
• May need to prune 1-2 more times
Cutting New Shoots in Half
Mid-Summer
Fruit Bushes
Pruning Mature Trees

• Cut back new growth above selected tree height 2-3 times during growing season

• Thinning cuts for sunlight penetration
Mature Fruit Bush
Maintaining Tree Height

Before

After
Cherry, Pome Fruits Ideal for Fruit Bush
Apricot, Plum/Pluot Fruit Bushes
Vigorous Growth – Extra Work
Apricot, Plum/Pluot FruitBushes
Vigorous Growth

Before

After
Fruit Bushes

• **Advantages**
  ➢ Tree maintenance without ladder
  ➢ Trees for small spaces
  ➢ Sequential ripening

• **Disadvantages**
  ➢ Less fruit
  ➢ No shade
  ➢ Timing of pruning critical
Key Summer Pruning Missed
Specific Fruit & Nut Tree Training Methods

- Open center
- Central leader
- Modified central leader
- Perpendicular “V”
- Fruit bush
- Espalier
Espalier Pruning
Growing Season

Growth on lower arms tends often to be less vigorous than on top tier.

Basal third of new shoots has ripened.
What to Do About Overgrown Trees
Methods of Reducing Height of Large Trees

1. Cut to desired height in thirds over 3 years
   - Thin upright shoots in summer to provide light for lower fruiting wood
Pruning Overgrown Apple

What else can be done?
Methods of Reducing Height of Large Trees

1. Cut to desired height in thirds over 3 years
   - Thin upright shoots in summer to provide light for lower fruiting wood
2. Bring down height in one year
   - Saw off limbs well below desired height
   - Leave one “nurse” limb to feed roots
   - Thin new shoots, train tree as desired
   - Paint exposed limbs white
Pruning Overgrown Apple – One Year
Regrowth
Weeks Later
Regrowth That Summer
Fruit Thinning

Before

After

Harvest
Fruit Thinning
Total Yield vs. Fruit Size

Increasing No. Fruit/Tree

Yield vs. Fruit Size
Reasons for Fruit Thinning

• Increases fruit size
• Improves fruit color
• Reduces diseases (esp. brown rot)
• Reduces alternate bearing
• Reduces limb breakage
Methods of Fruit Thinning

- **Hand thinning**
  - Most thorough but time consuming
  - Selectively eliminate small, damaged fruit

- **Pole thinning**
  - Short hose piece on mop handle
  - Quick, but not selective
  - May damage fruit
Fruit Thinning
Timing and Spacing

- **Timing**: ¾ to 1 in. dia. (late April-early May)
- **Spacing**
  - Depends on tree vigor
  - Fruit should not touch at harvest
  - Peaches: 5-6 in.  Apricots: 4-5 in.
  - Apples: Thin to 1 fruit per cluster or 6 in.
  - Pears: Thin to 1 fruit/cluster (Bartlett – no thinning)
Flowering and Fruiting Problems

- Few or no flowers
  - Lack of chilling, overcropping, severe pruning, too young. Re-graft (?)
- Fruit drop
  - Some is normal
  - Lack of pollination, frost, drought
  - Worms, diseases, fruit load
- Small fruit
  - Overcropping, rootstock sucker (?)
Lack of flavor
  - Variety, overirrigation, soil factors
Split fruit or pits
  - Variety; drought followed by over irrig.
Growing Citrus Trees
Citrus Types

- Standard – to 20 or more feet!
- Dwarf – to 6-10 ft.
- Good variety selection in dwarf
• Roots are shallow (1-2 ft.)
• Good drainage essential
• Avoid heavy clay soils
• Raised beds or containers if soil is poor
• Provide plenty of water
Citrus Have Shallow Roots
Citrus Pruning

- Little required – control size, shape, & suckers
- Timing – early spring after frost is best
- Usually thinning cuts
- Thin out strong upright shoots
- Keep “skirts” pruned up off ground
- Older trees respond well to shearing or rejuvenative pruning
- Whitewash exposed limbs to prevent sunburn
2-Year-Old trees: Little Pruning
Branches floppy when young. Those bending down help develop mounding canopy common on older trees.
Branches may shoot out at odd angles. Keep them; they’ll bend over too.

Fruit weight will tame them.
Branches pruned off the ground

- Reduces fruit rot
- Makes weed control easier
Not much needed once trees are mature

Prune mainly for size control and ease of picking
Watch for Rootstock Suckers
Exclude ants with Tanglefoot

– They protect scales from parasitoids
Frost Protection
“Holiday” Tree Lights for Warmth
<table>
<thead>
<tr>
<th>Citrus Variety</th>
<th>Cold Hardiness</th>
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<tbody>
<tr>
<td>Mexican Lime</td>
<td>29</td>
</tr>
<tr>
<td>Bearss Lime</td>
<td>28</td>
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<tr>
<td>Regular Lemon</td>
<td>26</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>25</td>
</tr>
<tr>
<td>Meyer Lemon</td>
<td>22</td>
</tr>
<tr>
<td>Sweet Orange</td>
<td>21</td>
</tr>
<tr>
<td>Mandarin / Tangerine</td>
<td>20</td>
</tr>
<tr>
<td>Kumquat</td>
<td>19</td>
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Orange Grafted with Known Good Variety
Pest Management for Fruit Trees
Codling Moth
Eggs and newly hatched larva

Pupating larvae
Codling Moth
Characteristics

• Pest of apple, pear, quince, walnut
• Overwinter as larva in cocoon
• Mating begins during or just after flowering (temp. dependent)
• 3 generations per year
• Extremely difficult to control
Codling Moth
Control Methods

• Take what you get, cut damage out
• Remove/destroy infested fruit early
• Bag individual fruits
• Mass trapping of males
• Pheromone confusion (large scale)
• Organic products: Oil, virus, spinosad
• Chemical: Sevin (kills beneficials!)
Pheromone Confusion
(Mating Disruption)
Pheromone Trap
Scale Insects
Hard (Armored) Scale
Waxy Outer Covering
Soft Scale (Lecanium)
No Covering – Shell is Female Body
Kuno Scale

Females in Winter

Females in Spring
Kuno Scale

Females in Summer
Eggs in late May

Nymphs in June
Scale Insects
Characteristics

- Soft scale
  - Kuno, lecanium, brown, black, etc.
  - Covering is body of adult female
  - Excrete honeydew

- Armored scale
  - Calif. Red, San Jose, Euonymus, etc.
  - Covering is waxy secretion
  - Little honeydew

- Cottony cushion scale
Scale Insects
Control Methods

• Tanglefoot to prevent ants (soft scale)
• Dormant oil spray at bud swell
• Monitor crawlers with sticky tape - May
• Spray oil after crawlers emerge (June)
  » Foliage hinders good coverage
Monitoring Scale
Double-sided tape
Borers
Pacific Flatheaded Borer

Larva

Adult
Borers

- Control methods:
  - Keep trees healthy
  - Prevent sunburn!
    - Paint new trees and exposed branches white
    - Proper dormant & summer pruning
Fire Blight
Shoot dieback

Bark/cambium damage
Fire Blight
Characteristics

• Bacteria – enters through flowers under warm, moist conditions
• Affects apple, pear (esp. Bartlett), Asian pear, flowering pear, quince, loquat, pyracantha, hawthorne
Fire Blight
Control Methods

• Cut shoot or branch 12 in. below infection zone
  » Sterilize shears between cuts (20% solution of bleach)
• Spray copper product twice during bloom
Shot Hole Disease
Peach Leaf Curl
Shot Hole Disease and Peach Leaf Curl

- Shot hole affects peaches, nectarines, apricots (not plums!)
- Peach leaf curl affects peaches, nectarines
- Fungal diseases spread by rain, wind
- Spores overwinter in buds and twigs
Control of Shot Hole Disease and Peach Leaf Curl

- For both diseases:
  - Late Nov. copper spray
    (Fixed copper, basic copper sulfate, etc.)

- For peach leaf curl:
  - Also spray copper or lime sulfur in Feb. as flower buds begin to swell
Brown Rot of Stone Fruits
Brown Rot of Stone Fruits

- Fungal spores enter through flowers, kill spurs
- Attacks fruit during ripening
- Control not necessary in dry springs
- Remove mummies, thin fruit
- Copper spray at bud swell (P.L.C. too)
- 1-2 copper sprays during bloom
Specific Fruit & Nut Tree Training Methods

- Open center
- Central leader
- **Modified central leader**
- Perpendicular “V”
- Fruit bush
- Espalier
Modified Central Leader

- Walnuts & persimmons; can also use for apples, pears, and figs
- Start tree as central leader, then cut out the leader part way up
Specific Fruit & Nut Tree Training Methods

• Modified Central Leader

Pruning different species

➢ Walnut
➢ Pecan
➢ Persimmon
Persimmon

- Bears laterally on current season’s growth
- Terminal & first few lateral buds on 1-year-old branches are mixed
  » Both male & female flowers
Persimmon Fruitful Shoots at Tips of 1-Year-Old Branches
Training Young Persimmons

- Modified central leader
- 3 - 5 main scaffolds
  - 1 foot intervals
  - 1st & 2nd year can pinch shoots to promote branching.
  - Head branch ends you want to keep growing into scaffolds.
Unheaded Branches on Young Trees – Lost Scaffold Branches, Sunburn
Pruning Mature Persimmons

- Dormant, annual pruning
- Primarily small cuts
- Thin out to invigorate and increase fruit size