

# Growing Tree Fruits

By Jeff Olsen, Extension agent, Willamette Valley, and Anita Nina Azarenko, Extension horticulture specialist; both at Oregon State University. Adapted for Kentucky by John Strang, Extension horticulture specialist (ret.), University of Kentucky.

## In this chapter:

|                                     |    |
|-------------------------------------|----|
| Planning.....                       | 01 |
| Pruning Terminology .....           | 03 |
| Planting and Fertilizing .....      | 05 |
| Irrigating.....                     | 05 |
| Fruit Thinning .....                | 06 |
| Harvest and Handling.....           | 06 |
| Insect and Disease Management ..... | 08 |
| Pruning .....                       | 09 |
| For More Information.....           | 10 |

**G**rowing tree fruits or nuts can provide a great deal of satisfaction, but it takes a commitment to care for your trees year-round.

## Planning

### Variety Selection

When planning your orchard, choose varieties that not only are family favorites but are easy to care for. Remember that dwarf trees are always the best choice for home orchards.

Generally, the more varieties of fruit you grow, the more complex it is to manage them. However, if you enjoy a lot of different fruits and the management challenge, by all means plant a wide range.

Nearly all fruit- and nut-tree varieties (including some hazelnuts) are grafted to a genetically different root system, called a *rootstock*. When you choose a variety based on flavor, harvest period, disease resistance, color, etc., it is the grafted variety you are choosing—not the rootstock.

The ultimate size of a tree depends on the vigor of both the rootstock and the grafted variety. By knowing the vigor ratings of both, you can determine how big a tree will grow. See Table 22.1 for vigor ratings for some apple varieties. See the section on Rootstock Selection to learn more about vigor of various rootstocks.

Not all recommended varieties are included in the lists in this chapter. For apples alone, hundreds of varieties exist, and other fruits could have many more varieties. Consult the resources listed under “For More Information” to learn about additional varieties.

General types of apples include old style, cider, English, or flavor varieties. If you want to have fresh-off-the-tree apples for a long period of time in the summer and fall, choose varieties with staggered maturity dates (Table 22.2).

When buying trees for Kentucky, select disease-resistant varieties (Table 22.3) to reduce the impact of apple scab, cedar apple rust, fireblight, and powdery mildew.

## Rootstock Selection

When choosing a fruit tree, check to see what rootstock it uses. Rootstocks are not chosen for their fruit. Most originally were selected for their ability to control overall tree size. Some were selected for other characteristics, such as the following:

- Efficient yield production
- Disease resistance
- Tolerance of different soil conditions, including poorly drained soils
- Cold hardiness

## Apples

The greatest choice in rootstocks exists with apples. The most vigorous apple rootstocks are seedlings, which are simply sprouted apple seeds. When an apple variety is grafted onto a seedling rootstock, the tree can easily grow more than 30 feet tall. Most home orchardists can't efficiently spray, thin, and harvest a tree this tall.

Researchers in England developed the Malling series of apple rootstocks, which offers the opportunity to select trees that grow to specific heights. The height may be anywhere from dwarf (4 to 12 feet) to semidwarf (16 to 18 feet). Each rootstock in this series is identified by the letter “M” (for Malling) or “MM” (for Malling Merton) and a number. Higher numbers don't represent taller trees (Figure 22.1).

The following list shows approximate sizes as a percentage of the size of a tree on seedling rootstock:

| Rootstock  | Percent |
|------------|---------|
| MM.111     | 90      |
| MM.106     | 60 - 75 |
| M.7, G.30  | 55 - 65 |
| M.26, G.11 | 40 - 50 |
| M.9, Bud 9 | 25 - 35 |
| M.27       | < 25    |

Most home orchardists select dwarf rootstocks, such as Bud 9, which are especially appropriate if you want to train a tree to grow along a trellis. Dwarf trees should be supported by stakes, poles, or wires.

**Table 22.1.** Apple variety vigor ratings.

| High vigor       |                   | Low vigor           |
|------------------|-------------------|---------------------|
| Earligold        |                   | Spur Delicious      |
| Lodi             |                   | Spur Golden         |
| Mutsu or Crispin |                   | Spur Granny Smith   |
| Moderate vigor   |                   | Very low vigor      |
| Akane            | Jonagold          | Spur Arkansas Black |
| Arkansas Black   | Jonathan          | Spur Delicious      |
| Cortland         | Liberty           | Spur Rome           |
| CrimsonCrisp     | Melrose           | Super Spur          |
| Delicious (red)  | Mollies Delicious |                     |
| Empire           | Newtown           |                     |
| Enterprise       | Pixie Crunch      |                     |
| Freedom          | Pristine          |                     |
| Fuji             | Redfree           |                     |
| Gala             | Sansa             |                     |
| Golden Delicious | Rome Beauty       |                     |
| GoldRush         | Stayman           |                     |
| Granny Smith     | Suncrisp          |                     |
| Idared           | Sundance          |                     |
| Jersey Mac       | William's Pride   |                     |

The M.27 rootstock is the only choice for growing apples in containers. For container plantings, use *spur-type* varieties, which are the least vigorous.

M.7 produces semidwarf trees that normally do not require staking. However, some support might be required if early production is encouraged.

MM.106 and MM.111 produce larger trees that require no staking and are suitable for the home orchard. In nursery catalogs, these trees are identified as semistandard.

The ultimate height of any tree can be greatly influenced by pruning, but rootstocks that impart more vigor make it harder to contain trees to the height and width desired.

Other commercially available apple rootstocks provide vigor control, disease resistance, and winter hardiness. The Budagorsky (Bud) series was introduced from central Russia. The G series was developed at Cornell University at the New York State Agricultural Experiment Station in Geneva, New York.

**Cherries**

Most cherry trees in Kentucky are grown on Mazzard rootstocks. However, recent research on growth-controlling rootstocks has produced more choices. New dwarf varieties are now being grown on Gisela rootstocks, and new European rootstocks are being tested each year. The most common Gisela rootstocks are Gisela 5, Gisela 6, and Gisela 12. They produce trees that are 50 percent, 70 to 90 percent, and 60 percent of Mazzard, respectively. Other new rootstocks include MxM2 (100 percent of Mazzard), MxM60 (100 percent of Mazzard), and MxM14 (75 to 85 percent of Mazzard). They bear earlier and have better disease resistance than Mazzard seedlings.

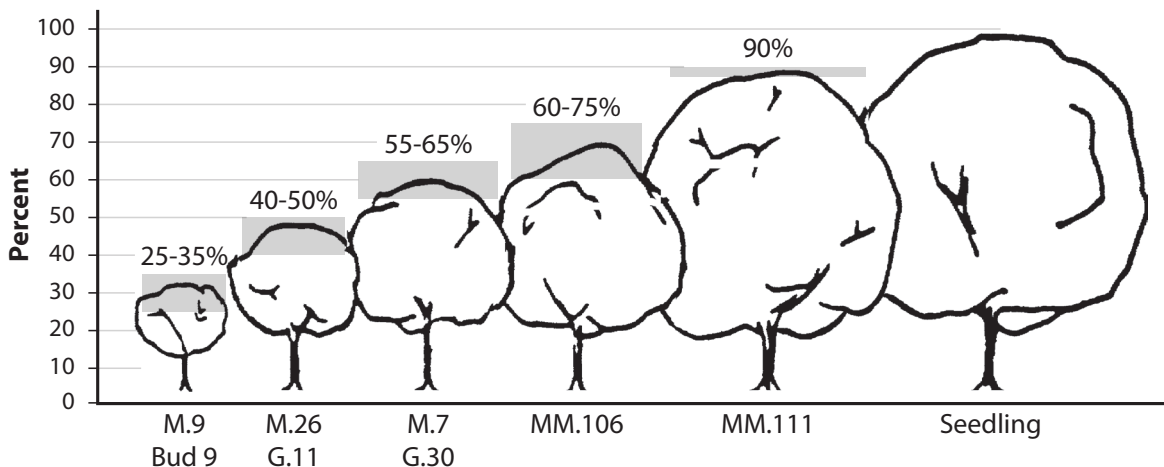
Sweet cherries generally do not survive or produce well in Kentucky. Some of these newer rootstocks are available to home gardeners from a few mail-order nurseries in the Pacific Northwest. See HortFact 3002, *Fruit and Nut Cultivar Nursery Sources*, which is listed in the “For More Information” section at the end of this chapter. See Table 22.4 for cherry varieties.

**Pears**

Most European pears are grown on one of many selections from the Old Home-Farmingdale cross. Asian pears sometimes use these rootstocks but also are grown on two species of *Pyrus*: *Pyrus betulaefolia* and *Pyrus calleryana*. See Table 22.5 for pear varieties.

**Plums and Peaches**

Plums are produced on a wide variety of *Prunus* rootstocks, such as peach, plum, apricot, and almond. Peaches usually are grown on peach seedling rootstocks. There are no suitable dwarfing rootstocks for peaches. See Tables 22.6 and 22.7 for nectarine and peach varieties.



**Figure 22.1.** Approximate size of mature trees grown on various rootstocks, as a percentage of maximum height (100 percent) grown on seedling rootstock.

## Pruning Terminology

**Crotch angle**—The angle formed between the trunk and a limb. The strongest crotch angle is 45° to 60°.

**Leader**—The uppermost portion of a scaffold limb.

**Scaffold limb**—A large limb that forms a tree’s framework.

**Shoot**—The length of branch growth in one season. The bud scale scars (ring of small ridges) on a branch mark the start of a season’s growth.

**Spur**—(1) A short shoot that bears flower buds on the end (terminally) or on the sides (laterally). (2) A short shoot that fruits.

**Table 22.2.** Apple varieties grouped by general time of maturity.

| Early   | Midseason   | Late   |  |
|---|---|--|--|
| Akane<br>Dayton<br>Erligold<br>Jersey Mac<br>Lodi<br>Mollies<br>Delicious<br>Monark<br>Pristine<br>Redfree<br>Sansa | William’s Pride<br>Empire<br>Freedom<br>Gala<br>Ginger Gold | Jonathan<br>Liberty<br>Arkansas Black<br>Cortland<br>CrimsonCrisp<br>Delicious<br>(Golden and Red)<br>Empire<br>Enterprise<br>Fuji<br>GoldRush<br>Granny Smith | Idared<br>Jonagold<br>Melrose<br>Mutsu or<br>Crispin<br>Newtown<br>Pixie Crunch<br>Rome Beauty<br>Stayman<br>Sun Crisp<br>Sundance<br>York |

**Table 22.3.** Disease-resistant apples.<sup>1</sup>

| Variety                   | Resistance To |                 |    |    | Comments  | Harvest    | Stores Until  | Skin Color                                 |
|---------------------------|---------------|-----------------|----|----|---|------------|---------------|--|
|                           | AS            | CR              | FB | PM |   |            |               |  |
| Pristine <sup>2</sup>     | VR            | S               | S  | R  | Good quality for season, not as tart as Lodi, makes excellent applesauce  | early July | short storage | Light yellow with red blush                |
| Williams Pride            | VR            | S               | MR | R  | Good quality for season, corkspot frequently observed, subacid, yellow flesh  | mid-July   | short storage | 70-80% dark red                            |
| Redfree <sup>2</sup>      | VR            | VR              | S  | S  | Firm, summer apple, juicy   | late July  | Oct           | 90-100% dark red on yellow                 |
| Dayton <sup>2</sup>       | VR            | R               | MR | R  | Similar to Prima  | mid-Aug    | Sept          | Up to 90% bright, medium red               |
| Liberty <sup>2</sup>      | VR            | R <sup>3</sup>  | R  | R  | Fruit similar to Macoun, crisp, juicy, yellowish flesh, tart at harvest   | late Aug   | Dec           | 90% dark-red stripes on green-yellow       |
| Nova Easygro              | VR            | VR              | R  | S  | Fruit similar to Cortland, fair quality (for trial)   | early Sept | Dec           | 80% dark red on green-yellow               |
| Spartan <sup>2</sup>      | MR            | R               | MR | R  | Firm McIntosh type, needs thinning to develop size  | early Sept | Jan           | Dark to pale red, depending on weather     |
| Jonafree <sup>2</sup>     | VR            | S               | S  | R  | Fruit similar to Jonathan, but less acid  | early Sept | Dec           | 90% red stripes                            |
| Pixie Crunch <sup>2</sup> | VR            | —               | —  | —  | Small, sweet flavored, super crisp, kid’s apple   | early Sept | Dec           | Deep red                                   |
| Macfree                   | VR            | VR <sup>3</sup> | MR | S  | Similar to McIntosh, mealy under hot conditions   | mid-Sept   | Dec           | 75% medium red over green-yellow           |
| Priscilla <sup>2</sup>    | VR            | VR <sup>3</sup> | VR | R  | Tart, firm, somewhat coarse textured, crisp, juicy, small fruit size  | mid-Sept   | Nov           | 70-90% dark-red blush over yellow-green    |
| SirPrize <sup>2</sup>     | VR            | S               | R  | R  | Fine grain, crisp, tender, bruises very easily, sterile pollen  | mid-Sept   | Dec           | Greenish yellow, slight red blush          |
| CrimsonCrisp              | VR            | MR              | S  | S  | Medium-sized red fruit, firm, crisp, tart, stores very well   | mid-Sept   | March         | 95% red                                    |
| Enterprise <sup>2</sup>   | VR            | VR <sup>3</sup> | MR | R  | Sprightly, subacid, slightly aromatic and spicy, crisp, fine-grained juicy flesh, stores well                                   | early Oct  | Feb           | Washed, 90% light to medium red            |
| GoldRush <sup>2</sup>     | VR            | S               | MR | S  | Fruit very crisp, firm, tart at harvest and sweetens up after storage, very susceptible to black rot. Will store for 11 months. | mid-Oct    | April         | Deep yellow with red blush                 |
| Sundance <sup>2</sup>     | VR            | VR              | VR | VR | Excellent quality with fruity flavor like mild pineapple, fruit does not drop   | mid-Oct    | March         | Yellow, occasionally russet in stem cavity |

AS = Apple Scab, CR = Cedar Apple Rust, FB = Fire Blight, PM = Powdery Mildew

VR = Very Resistant, R = Resistant, MR = Moderately Resistant, S = Susceptible, — = Insufficient Information

Note: All apples require cross-pollination by a different variety. Winesap and SirPrize cannot serve as pollinizers because they have sterile pollen.

<sup>1</sup> Resistance to diseases other than scab has not been fully evaluated and may differ in some locations from that reported here.

<sup>2</sup> Produces high-quality apples in Kentucky.

<sup>3</sup> Although these cultivars are resistant to cedar apple rust, they are susceptible to cedar quince rust.

**Table 22.4.**  
Cherry varieties.

| Sweet   |
|---|
| Black Gold<br>Hedelfingen<br>Lapins<br>Sweetheart |
| Tart  |
| Danube<br>Montmorency<br>North Star<br>Surefire   |

**Table 22.5.**  
Pear varieties.

| European  |
|---|
| Blake's Pride<br>Harrow Sweet<br>Honey Sweet<br>Kieffer<br>Magness<br>Potomac<br>Seckel |
| Asian   |
| Chojuro<br>Korean Giant<br>Olympic<br>Megietsu<br>Shinko<br>Yoinashi                    |

**Table 22.6.**  
Nectarine varieties.

| Nectarines                                  |
|---|
| Fantasia<br>Flavortop<br>Red Gold<br>Sunglo |

## Pollination Methods

Trees can be grouped into two categories: those that bear fruit through self-pollination (called *self-fruitful*) and those that must be pollinated by another variety (called *self-unfruitful*). Peaches tend to flower during spring when frosts and cold weather are still very common in Kentucky. Peach trees can be grown throughout the state but the peach crop is often diminished due to cold temperatures in spring. The somewhat milder climate of Western Kentucky makes this region better for backyard peach production.

### Cherries

Lapins, Black Gold, and Sweetheart are self-fruitful sweet cherry varieties, as are tart (pie) cherries.

Some sweet cherries do not set fruit unless they are pollinated by another pollen-compatible variety. Hedelfingen is pollinated by Lapins or Sweetheart.

### Apples

Some apple varieties, such as Rome Beauty, Newtown, and Transparent, are self-fruitful, but most varieties of apples do not set fruit unless they are pollinated by another pollen-compatible variety. Most apple varieties that don't set fruit when self-pollinated do have pollen that sets fruit on other varieties. For example, Red Delicious doesn't set its own fruit with its own pollen, but sets fruit on Golden Delicious, and vice versa. Gravenstein requires an early-blooming pollinizer such as Lodi, but does not produce good pollen for other varieties. Mutsu does not pollinize other varieties, but requires another variety to set fruit itself. McIntosh is self-unfruitful but pollinizes other early-blooming varieties such as Gravenstein.

### Other Fruits

Most varieties of pears do not set fruit unless they are pollinated by another pollen-compatible variety.

Most European plums are self-fruitful.

See Table 22.8 for nut varieties.

**Table 22.7.** Peach varieties.

| Maturity   |   |  |
|--|---|--|
| July   | August  | September  |
| Gala<br>Harrow Diamond<br>Garnet Beauty<br>Redhaven<br>Sentry<br>Topaz | Allstar<br>Biscoe<br>Blushing Star (White)<br>Bounty<br>Contender<br>Coralstar<br>Cresthaven<br>Ernie's Choice<br>Glowing Star<br>John Boy<br>Loring<br>Madison<br>Redskin<br>Summer Breeze | Encore<br>Flamin' Fury PF-27A<br>Flameprince<br>Lauro<br>Ouachita Gold<br>Victoria |

**Table 22.8.** Nut varieties.

| Hazelnuts (filberts)*  | Walnuts, Persian                   |
|--|------------------------------------|
| Gamma<br>Jefferson<br>Santiam<br>Yamhill   | Allegheny<br>Coble No. 2<br>Kaiser |
| Walnut, Black  |                                    |
| Leon Pounds II<br>Neel No. 1<br>Rowher<br>Sauber No. 1<br>Surprise<br>Thomas-Myers |                                    |

\*Complete resistance to eastern filbert blight (EFB).

Note: Gamma, Santiam and Jefferson are good pollinators for the best variety, Yamhill.

## Planting for Pollination

Plant pollen-compatible trees within 100 feet of each other to ensure adequate pollination, which depends mostly on bees and to a lesser extent on other insect activity. For nuts, pollination depends on wind. The bloom periods of the main and pollinizer varieties must overlap enough to provide at least several days for cross-pollination to take place. Orchards with many pollinizers are more fruitful than those with only one pollinizer.

If no pollinizing varieties are growing nearby, cut a bouquet of blooms from another variety and place it in a pail of water beside your tree while it is in bloom. Or, if you have a single fruit tree that needs a pollinizer, graft a compatible variety onto the main variety.

## Tree Spacing

Apple trees typically are spaced from six feet apart (high density) to more than 20 feet apart. Spacing between rows for other fruit trees ranges from 12 to 24 feet because they often lack growth-controlling rootstocks.

True genetic dwarf trees can, of course, be planted closer. Dwarf trees trained on trellises have the closest spacing.

In planning your orchard, compare the amount of space available to the number of trees you want to grow. Spacing trees very close together does push them into earlier production, but tightly spaced trees require more pruning at an earlier age in order to keep them productive, and foliage does not dry out as rapidly, which can lead to more disease problems.

## Planting and Fertilizing

Orchard trees grow best in deep, well-drained soils. To have adequate room for root development, trees need at least four feet of soil above an impenetrable soil layer or water table. In poor soil conditions, raised beds can be helpful. Always choose a spot that gets full sun.

Fruit trees usually are sold bare root. It's very important to plant a tree at the right level. Try to plant the tree at the same level at which it was growing in the nursery. Make sure the graft union is aboveground; if it is not, the rootstock will produce shoots that may overpower the grafted or budded stock. The scion (grafted variety) may also produce roots that lessen the effect of the rootstock.

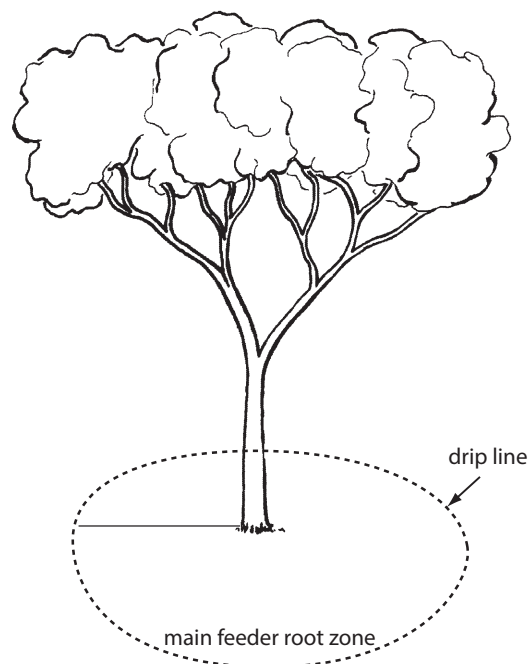
Dig a hole large enough to comfortably accommodate the tree's root system. Don't leave smooth soil on the sides of the hole—roughen the sides with a shovel so the roots can grow into the soil. Place the roots over a low mound of soil in the hole.

Paint the trunk with a white, water-based indoor latex paint to reflect sunlight and help prevent sunburn. To save paint and make it easier to apply, you can dilute the paint with water to 50 or 70 percent paint. A tree protector placed around the trunk will protect it from damage from small animals and sunscald.

Protection from deer is important, too. Fencing is the best method, but caging also works. Hanging soap, human hair, animal scents, or other deer repellents will help prevent damage for only a short time.

A tree's need for fertilizer varies according to the amount of minerals available in the soil. Soil types vary within a specific area and regionally. For example, fruit trees generally don't need much phosphorus in the Central Kentucky area, but they respond to phosphorus applications in most other areas of the state. Consult your county Extension office for specific recommendations.

Fruit trees do need nitrogen. The amount needed varies from very little to two pounds of actual nitrogen per tree for fully mature trees. The best way to gauge nitrogen needs is to watch the amount of annual growth and check for yellowing of older leaves. If a tree has at least 12 to 18 inches of new growth



**Figure 22.2.** A tree's drip line.

each year, it is thriving. Overapplication of nitrogen may cause excessive tree growth as well as physiological problems in the fruit, such as bitter pit in apples.

Most gardeners use a complete fertilizer (one with nitrogen, phosphorus, and potassium) around the yard and vegetable garden. These fertilizers are fine for fruit trees, but if they are used every year, phosphorus and potassium levels build up far in excess of the tree's actual need.

Most home orchardists do not apply boron to their fruit trees. Although boron is needed only in small amounts (it is a micronutrient), it is essential for plant health and productivity, especially for fruit set. Trees that are low in boron have poor shoot growth and poor fruit set.

An easy source of boron is Borax. If you need to apply boron to a fruit tree, add a tablespoon of Borax to two gallons or more of water and apply it to the soil within the tree's drip line (Figure 22.2). If you think your soil has boron deficiency, it is best to have the soil analyzed before adding more. Too much boron is toxic to the trees.

## Irrigating

The amount of water fruit trees need depends on rainfall and soil type. The best way to determine your trees' needs is to check the soil moisture in the root zone at 12 and 24 inches deep.

To test, remove some soil with a soil probe or shovel and squeeze a handful of it into a ball. If it crumbles when released, the trees are dry and need water. If the ball of soil stays together but does not feel wet, the trees have adequate moisture. If the soil ball drips water when squeezed, there is more than enough moisture.

Remember that young trees have an undeveloped root system and cannot absorb much water at a time. In warm weather, watering young trees regularly is very helpful to get them off to a good start.

Drip irrigation is preferred by many orchardists because it allows the foliage, flowers, and fruit to remain dry, an important factor in disease prevention. If you drip-irrigate, take care not to overwater, especially near the base of the trunk, where excessive moisture can lead to crown rot.

## Fruit Thinning

Thinning of apples, peaches, and Asian and European pears is an important part of orchard management. It removes some of the developing embryos that otherwise would produce flowering inhibitors. It improves the size and quality of fruit and helps ensure an adequate crop the next year.

The effect of fruit thinning is greatest on cultivars that tend to have a heavy fruit set. Determine the size of fruit you want and thin accordingly.

There are three ways to thin fruit. Picking the tiny fruit or blossoms by hand is the most commonly used method. Mechanical thinning involves using a tool to knock fruit off the tree. Plant-growth regulators are sprayed onto apple and pear trees in commercial orchards during and after bloom to thin the crop.

## Timing

Early thinning of blossoms or fruit helps stimulate flower initiation for the next year's crop, especially on cultivars that tend toward biennial bearing (bearing fruit every other year). Apples initiate flower buds for the following year's crop within 40 days of full bloom, so thinning has a positive effect on the next year's bloom if done within this period. Pears form buds a little later, so you can thin them within 60 days of full bloom. Attaining adequate return bloom on peaches is seldom a problem, but early thinning generally helps.

Thinning also helps increase the size of harvested fruit by stimulating cell division in the remaining fruit. More cell division means more cells per fruit and thus larger fruit. The period of cell division for apples lasts four to five weeks after petal fall. For peaches, it lasts four weeks after petal fall, and pears continue cell division for seven to nine weeks after petal fall. All fruits continue some cell division in the epidermis layer (the skin) much longer than in the main part of the fruit flesh.

Sometime during the cell-division phase, cell enlargement begins. Enlargement continues throughout the growth of the fruit and often is positively influenced by fruit thinning.

More information on the developmental stages of different fruit crops can be found in Figure 22.3.

## How to Thin

### Apples

Home orchardists generally thin by hand. With apples, remove the smaller fruit first, remembering that the relative sizes of the fruit do not change throughout the season and that the largest fruit early in the season will be the largest fruit at harvest.

Decide how much fruit to leave on the tree based on the vigor and general condition of the tree. In cultivars that tend toward biennial bearing (every two years), leaving every other spur without fruit and spacing fruit six inches apart helps ensure adequate return bloom.

### Asian Pears

Asian pears must also be thinned. Thin early to get large fruit. Each blossom cluster contains several flowers. Save the blossom/fruit in the middle and remove the rest. Research has shown that this middle fruit is the roundest. By keeping that in mind and by counting the flowers as they appear starting from the base of the cluster, you can determine which fruit to remove. For example, if there are seven flowers, save the fourth fruit from the base of the cluster. Depending on the tree's vigor, you might experiment by leaving two fruits per spur and checking the fruit size response.

### Peaches

Thin peaches to about six to eight inches from one another. This spacing gives them adequate room to mature to full size.

## Harvest and Handling

Nursery catalogs, Cooperative Extension publications, and other sources give a general idea about when given varieties ripen. However, ripening times may vary from year to year depending on the weather. Keep in mind that apples with codling moth damage drop about one to one-and-a-half weeks before the crop is ripe.

The best and most time-tested method of judging when to pick fruit is the taste method. When enough starch has been converted to sugar and the flavor is developed, the fruit is ready to eat. Fruit continues to ripen in cold storage, so pick fruit before it is ripe if you intend to store it.

Fruit changes color as it ripens. The *base color*, or ground color, is the color underneath the red striping or blush of peaches, apples, pears, and cherries. In most fruits, the fruit is ripening when the ground color turns green to yellow. The surface color may develop before the fruit is actually mature.

If storing fruit, cool it as soon as possible after picking. The sooner heat is removed from freshly picked fruit, the longer the fruit will keep.

Handle fruit for storage gently. Bruises and wounds allow pathogens to infect the fruit, and disease will spread to adjacent fruits once it gets started.










































|                              | Apple   | Pear  | Peach   | Tart Cherry   | Plum and Prune  |
|------------------------------|---|---|---|---|---|
| <p>Stage</p> <p><b>1</b></p> | <p><b>Dormant</b></p>    | <p><b>Dormant</b></p>    | <p><b>Dormant</b></p>    | <p><b>Dormant</b></p>    | <p><b>Dormant</b></p>    |
| <p>Stage</p> <p><b>2</b></p> | <p><b>Silver tip</b></p>  <p>10% kill<br/>15° F</p> <p>90% kill<br/>2° F</p>       | <p><b>Swollen bud</b></p>  <p>10% kill<br/>15° F</p> <p>90% kill<br/>1° F</p>    | <p><b>Swollen bud</b></p>  <p>10% kill<br/>18° F</p> <p>90% kill<br/>2° F</p>                  | <p><b>Bud burst</b></p>  <p>10% kill<br/>17° F</p> <p>90% kill<br/>5° F</p>      | <p><b>Swollen bud</b></p>  <p>10% kill<br/>14° F</p> <p>90% kill<br/>1° F</p>    |
| <p>Stage</p> <p><b>3</b></p> | <p><b>Green tip</b></p>  <p>10% kill<br/>18° F</p> <p>90% kill<br/>10° F</p>       | <p><b>Bud burst</b></p>  <p>10% kill<br/>20° F</p> <p>90% kill<br/>7° F</p>      | <p><b>Half-inch green</b></p>  <p>10% kill<br/>23° F</p> <p>90% kill<br/>5° F</p>              | <p><b>Green tip</b></p>  <p>10% kill<br/>25° F</p> <p>90% kill<br/>14° F</p>     | <p><b>Bud burst</b></p>  <p>10% kill<br/>18° F</p> <p>90% kill<br/>3° F</p>      |
| <p>Stage</p> <p><b>4</b></p> | <p><b>Half-inch green</b></p>  <p>10% kill<br/>23° F</p> <p>90% kill<br/>15° F</p> | <p><b>Green cluster</b></p>  <p>10% kill<br/>26° F</p> <p>90% kill<br/>15° F</p> | <p><b>Pink</b></p>  <p>10% kill<br/>25° F</p> <p>90% kill<br/>18° F</p>                        | <p><b>Tight cluster</b></p>  <p>10% kill<br/>26° F</p> <p>90% kill<br/>17° F</p> | <p><b>Green cluster</b></p>  <p>10% kill<br/>26° F</p> <p>90% kill<br/>16° F</p> |
| <p>Stage</p> <p><b>5</b></p> | <p><b>Tight cluster</b></p>  <p>10% kill<br/>27° F</p> <p>90% kill<br/>21° F</p>  | <p><b>White bud</b></p>  <p>10% kill<br/>26° F</p> <p>90% kill<br/>22° F</p>    | <p><b>Bloom</b></p>  <p>10% kill<br/>27° F</p> <p>90% kill<br/>24° F</p>                     | <p><b>Swollen bud</b></p>  <p>10% kill<br/>27° F</p> <p>90% kill<br/>24° F</p> | <p><b>White bud</b></p>  <p>10% kill<br/>26° F</p> <p>90% kill<br/>21° F</p>    |
| <p>Stage</p> <p><b>6</b></p> | <p><b>Pink</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>25° F</p>          | <p><b>Bloom</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>23° F</p>       | <p><b>Petal fall</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>25° F</p>                | <p><b>Bloom</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>25° F</p>       | <p><b>Bloom</b></p>  <p>10% kill<br/>27° F</p> <p>90% kill<br/>23° F</p>       |
| <p>Stage</p> <p><b>7</b></p> | <p><b>Bloom</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>25° F</p>         | <p><b>Petal fall</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>24° F</p>  | <p><b>Fruit set:<br/>shucks on</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>25° F</p>  | <p><b>Petal fall</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>25° F</p>  | <p><b>Petal fall</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>23° F</p>  |
| <p>Stage</p> <p><b>8</b></p> | <p><b>Petal fall</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>25° F</p>    | <p><b>Fruit set</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>24° F</p>   | <p><b>Fruit set:<br/>shucks off</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>25° F</p> | <p><b>Fruit set</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>25° F</p>   | <p><b>Fruit set</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>25° F</p>   |
| <p>Stage</p> <p><b>9</b></p> | <p><b>Fruit set</b></p>  <p>10% kill<br/>28° F</p> <p>90% kill<br/>25° F</p>     |   |   |   |   |

Figure 22.3. Phenology (growth development) stages of several fruit crops.

## Insect and Disease Management

Many insect and disease problems can affect home orchards. You can control or prevent them by knowing the probability of such problems and by closely monitoring trees. Keep insects in check through a system called *integrated pest management* (IPM), which integrates cultural, mechanical, chemical, and biological controls in addition to taking the environment into consideration.

The IPM approach differs from a standard calendar approach, which uses dates and developmental stages of the plant to determine when to apply control sprays regardless of whether pests are present.

Successful IPM programs are based on solid research and practical experience. One of IPM's cornerstones is accurate pest monitoring. You can use visual inspection, trapping, and *phenology* models (crop development stage models) to determine the presence or absence of a pest and then measure its population density. Figure 22.3 shows growth stages of several tree fruits.

*Economic thresholds* are the level at which pest damage justifies the cost of control. Economic thresholds are important in IPM. Of course, economics are not as important in home orchards as in commercial situations. Each orchardist must decide how much damage to allow before applying a control. The level of damage considered acceptable can vary from one gardener to another.

*Pheromones* are chemical messengers used by animals to communicate with each other. Pheromones are used in IPM in the following ways:

- Female sex pheromones are used to attract males to a trap.
- Small pieces of glass or plastic containing female sex pheromones are spread throughout an area to confuse males.
- Pheromones are mixed with pesticides, such as an insecticide, to attract pests to the chemical control.

The UK Cooperative Extension publication *Kentucky Backyard Apple Integrated Pest Management Manual* (IPM-9) provides a more in-depth discussion of IPM.

Learning the life cycles of important insects and diseases that may attack your orchard is part of IPM. The next section discusses some of the more common orchard insect pests and their IPM-control strategies.

### Codling Moth

Following are the stages in the life cycle of the codling moth, which typically produces three generations per year.

- It overwinters as a mature larva under loose bark on trees, in leaf litter under trees, or in other protected places.
- It pupates in spring and emerges as an adult in late May to early June.
- Adults begin depositing eggs two or three days after emergence and continue depositing eggs for a month.
- Eggs hatch in 12 to 14 days, and larvae enter fruit.

- Larvae feed for about three weeks then pupate in protected places.
- Second-generation adults emerge one to two weeks later, in early July.
- These adults lay eggs on fruit during July and August.
- Eggs hatch in six to seven days, and larvae enter fruit to feed.
- Larvae stay in fruit for a month then emerge and look for overwintering sites.

### Pheromone-Trapping Program for Codling Moth

- Place traps in the orchard by mid-May.
- Place the traps along all sides of the orchard.
- Check the traps once per week through mid-September. Replace the lures every four weeks.
- If you want to use a threshold approach, apply an insecticide control 250 degree days, base 50°F, after you catch five moths per week in a trap.
- Follow spray recommendations for codling moth control listed in the UK Cooperative Extension publication *Disease and Insect Control Programs for Homegrown Fruit in Kentucky Including Organic Alternatives* (ID-21).
- If you want to use a calendar approach to control, spray 15 to 21 days after petal fall for the first generation and again two weeks later.
- For the second generation, spray the first week in July and again two weeks later.

## Sprays for Disease and Insect Control

### Dormant (Winter) Sprays

Most home orchardists try to control overwintering mites, aphids, and scales with a dormant (winter) oil spray, which essentially smothers the pests.

Winter sprays are also used to control diseases that enter the tree through the buds.

Follow two general rules when applying winter sprays on fruit trees:

- Use a *sticker*, unless the label says not to. Stickers improve the spray's adherence to leaves.
- Obtain good coverage. Timing and the choice of material are important, but if the spray doesn't cover the tree and stay in place, pests will not be controlled.

Peaches need winter sprays to control peach leaf curl and bacterial canker. For peach leaf curl, which causes reddish, twisted, distorted leaves, spray after leaf drop in the fall. Chlorothalonil or fixed coppers are effective.

### Blossom Sprays

Ideally, blossom sprays should be applied at three stages: pink, full bloom, and petal fall (Figure 22.3). Use fungicides and insecticides listed in the UK Cooperative Extension publication *Disease and Insect Control Programs for Homegrown Fruit in Kentucky Including Organic Alternatives* (ID-21).



**Cherries, peaches, and plums**—Applying protective fungicide sprays before, during, and after the blossom period can control brown-rot blossom blight on cherries, peaches, and plums.

Brown-rot blossom blight is caused by fungi. These fungi overwinter on infected peach, plum, and cherry fruit (causing what's called "fruit mummies") and on buds and cankers. The fungal spores are spread mostly by wind but also by splashing rain.

The fungi infect blossoms, and from there they can travel into twigs to cause twig blight and cankers. They also infect fruit later in the season, entering maturing fruit more easily than green fruit.

**Apples and pears**—Blossom sprays can also control apple scab, cedar apple rust, and powdery mildew on apples and pears.

Apple scab must be controlled each year on most varieties. Scab infects leaves and fruit. It overwinters on leaves, so sanitation can help control the problem by removing sources of *inoculum* (fungal spores). Apply sprays at the prepink, pink, calyx, and first-cover stages.

Cedar apple rust must also be controlled annually on most apple varieties with sprays from pink through second cover.

Fire blight is a serious problem on susceptible apple and pear varieties. A final copper spray during the dormant period and streptomycin sprays during bloom are recommended.

Powdery mildew sprays are recommended for four stages: prepink, pink, calyx, and first-cover.

### Summer Sprays

If an orchard has a mite, aphid, or scale problem, a dormant oil spray in winter can reduce populations of these insects. However, some summer control often is necessary.

Look for scale in June. The timing of summer control is important for these tiny insects. You must apply the spray when the insects are in the crawler stage, which is when the young scales move out from their protective shells and are vulnerable to pesticides.

Place double-sided sticky tape or black electrical tape with the sticky side out around infested branches. This traps the crawlers so you can see them with a hand lens (20-power is good). Spray when there is substantial insect activity.

### Bagging

Bagging individual apples and pears on a tree when they are about an inch in diameter provides excellent insect and disease control for the rest of the season. See the *Apple Bagging Alternative Pest Management for Hobbyists* (ENTFACT-218) and the video *Apple Bagging* (VHO-1386). Both are available through county Extension offices.

## Pruning

Pruning is a necessary part of home orchard care. Prune trees to direct growth, maintain health, and manage fruit-bearing

potential. For a more complete discussion of pruning, see Chapter 17. The discussion here covers only guidelines specific to pruning fruit trees.

### Fruiting Habits

Pruning strategy should take into account the fruiting habit of each tree. The type and age of wood that bears fruit varies with the kind of tree. Some fruits bear on more than one kind of wood. For example:

- Persian walnuts produce fruit on the *current season's shoots*.
- Hazelnuts, nectarines, and peaches produce fruit on the *previous season's shoots*.
- Sour cherries, some apples, and some pears produce fruit on the *previous season's spurs and shoots*.
- Some apples, sour cherries, sweet cherries, pears, and plums (European and Japanese) produce fruit on *long-lived spurs*.

Good light penetration is necessary for fruit spur formation and productivity, so trees that fruit on spurs should be maintained in a fairly open form. Those that form their crop on one-year-old wood (such as peaches and hazelnuts) benefit from pruning because it stimulates new wood formation (and more fruit).

### Pruning Guidelines

- Prune all fruit and nut trees at planting time. Cut just above the height where you want the lowest branches to grow (usually 30 to 40 inches above the ground).
- Prune young trees very lightly; heavy pruning delays fruiting.
- Prune mature trees more heavily, especially if they have shown little growth.
- Prune the top portion of trees more heavily than the lower portion.
- Train young trees in the first few years after planting to avoid corrective pruning later. Spread main scaffolds to a 45° to 60° angle from the trunk.
- To keep trees small (unless they are dwarf trees), prune moderately every year and do not apply excess fertilizer, manure, or compost.
- Prune during the dormant season (after fall or early winter freezes, but before full bloom in spring).
- When removing large limbs, first cut partially through from the underside about six inches out from the collar, then make a second cut from the top a little farther out, cutting all the way through until the branch falls away. Finally, cut the stub back to the branch collar. Do not remove the branch collar.
- There is no need to paint pruning wounds. The best protection for a wound is to leave the branch collar intact so the tree is protected from wood-rotting fungi.

## For More Information

UK Cooperative Extension publications

### Fruit/General

*Cultivar Evaluations of Apple, Peach, and Grape Disease and Insect Control Programs for Homegrown Fruit in Kentucky Including Organic Alternatives* (ID-21)  
*Dry Pesticide Rates for Hand-Held Sprayers* (HO-83)  
*Fertility Guidelines for Home Fruit and Nut Plantings* (HortFact-3004)  
*Fruit and Vegetable Insect and Disease Identification Picture Sheets*  
*Fruit Insect-Pest Calendar for Kentucky*  
*Home Composting: A Guide to Managing Yard Waste* (HO-75)  
*Home Fruit Variety Recommendations* (HortFact-3003)  
*Fruit and Nut Cultivar Nursery Sources* (HortFact-3002)  
*Rootstocks for Kentucky Fruit Trees* (HO-82)  
*Reproducing Fruit Trees by Graftage: Budding and Grafting* (HO-39)

### Nuts

*European Red Mite* (ENTFACT-205)  
*Nut Tree Growing in Kentucky* (ID-77)  
*Nut Weevils* (ENTFACT-206)  
*Pecan Insects* (ENTFACT-210)

### Tree Fruit

*Apple Scab* (PPA-24)  
*Bagging Apples: Alternative Pest Management for Hobbyists* (ENTFACT-218)  
*Apple Cultivar Performance* (HortFact-3006)  
*Cherry Fruit Flies* (ENTFACT-217)  
*Codling Moth* (ENTFACT-203)  
*Controlling Apple Insect Pests* (ENTFACT-201)  
*European Red Mite* (ENTFACT-205)  
*Fire Blight* (PPA-34)  
*Green Fruitworms* (ENTFACT-214)  
*Growing Peaches in Kentucky* (HO-57)  
*Peach Fruit Diseases* (PPFS-FR-T-09)  
*Kentucky Backyard Apple Integrated Pest Management Manual* (IPM-9)  
*Leafhoppers on Apples* (ENTFACT-215)  
*Leafrollers* (ENTFACT-216)  
*Lesser Peachtree Borer* (ENTFACT-213)  
*Oriental Fruit Moth* (ENTFACT-212)  
*Peach Cultivar Performance* (HO-6)  
*Peachtree Borer* (ENTFACT-200)  
*Plum Curculio* (ENTFACT-202)  
*Rosy Apple Aphid* (ENTFACT-211)  
*Rust Diseases of Apple* (PPA-23)  
*San Jose Scale* (ENTFACT 204)  
*Training and Culture of Dwarf Apples Using the Vertical Axis System* (HortFact-3501)

## Cooperative Extension Service

Agriculture and Natural Resources  
 Family and Consumer Sciences  
 4-H Youth Development  
 Community and Economic Development

## MARTIN-GATTON COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT

Educational programs of Kentucky Cooperative Extension serve all people regardless of economic or social status and will not discriminate on the basis of race, color, ethnic origin, national origin, creed, religion, political belief, sex, sexual orientation, gender identity, gender expression, pregnancy, marital status, genetic information, age, veteran status, physical or mental disability or reprisal or retaliation for prior civil rights activity. Reasonable accommodation of disability may be available with prior notice. Program information may be made available in languages other than English.  
 University of Kentucky, Kentucky State University, U.S. Department of Agriculture, and Kentucky Counties, Cooperating.

Lexington, KY 40506 Revised 01-2024



Disabilities accommodated with prior notification.