HO-57

UK COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY — COLLEGE OF AGRICULTURE

Growing Peaches in Kentucky

Joseph G. Masabni and John G. Strang, Horticulture; John R. Hartman, Plant Pathology; Ric Bessin, Entomology

Peaches are a popular fruit with Kentucky growers and consumers. Kentucky consumes more peaches than it produces, which provides a potential market for additional peach production. The size of home peach plantings should be determined by the space available or the amount of fruit you want to grow. Commercial growers should determine their markets in advance of planting. Market choices in Kentucky, in order of popularity, are roadside markets, farmers markets, local retail outlets, U-pick orchards, and shipping-to-terminal markets.

Once you know what market or markets you will target, you can determine how much you want to plant based on production level and when you want to harvest. Other factors that can help define how much you should plant include available labor, equipment cost, and equipment capability. For example, a grower-roadside market operator might report moving 600 pecks a day from mid-July until school starts, when demand falls. The grower's planting would need to produce this volume within this time frame.

A good sprayer for insect and disease control is one of the more expensive equipment items. Matching equipment capacity to production acres will lower the cost for equipment per acre. Fifteen to 20 acres will keep one person reasonably busy, with additional labor needed during peak seasons for pruning, thinning, and harvesting.

Kentucky's Climate for Peaches

Kentucky's climate for growing peaches is both good and bad. One of its good points is the intense sunshine, which builds carbohydrates and helps produce high-quality fruit. The rainfall is sufficient for good growth and good fruit sizing in most years. On the other hand, winters are unpredictable. Fluctuating temperatures often cause fruit buds to start growth too early. Warm periods can occur at the end of dormancy in early January. When that happens, hardiness is lost, which increases the potential of wood injury. Late frost often occurs in the spring about bloom time, which can kill fruit buds. Some localities seldom have crop failures from freezing, while others seldom have crops because of winter or spring fruit bud killing. For these reasons, selection of the peach orchard site is probably the most important single factor in peach production.

Site Selection

Since the site is of utmost importance for a perennial crop like peaches, select it carefully. Some areas have very few suitable sites, while others have many. The shaded portion of the map shows areas that, in general terms, are promising for peach production (Figure 1). However, even in these areas, you need to choose a site very carefully.

With a good site, you could have a successful orchard even in an area where peach production is not normally recommended. By the same reasoning, the wrong site in an area generally recommended for peach production can cause crop failure. Elevation, slope and direction, and soil should be considered in the selection of an orchard site.

Elevation

The site should be considerably higher than surrounding areas, with good slopes suitable for air drainage. Cold air, like water, flows downhill and collects in low places, so that during cold periods, the temperature at the foot of the hill could be several degrees colder than at the top (Figure 2). That difference in temperature is called a "radiation frost event."

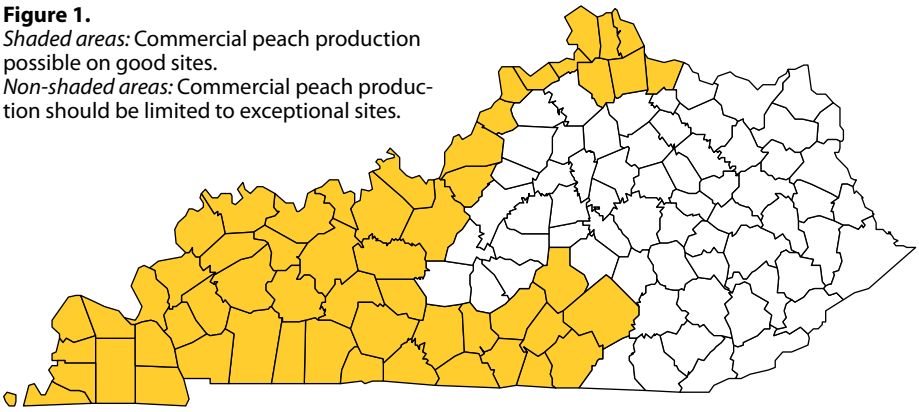


Figure 1.
Shaded areas: Commercial peach production possible on good sites.
Non-shaded areas: Commercial peach production should be limited to exceptional sites.

In selecting a site, you will need to know how much the temperature of the site differs from that of the lower surrounding areas. Determine this by placing maximum/minimum thermometers in various locations on the site and in surrounding areas. Read them regularly during the winter and spring and record the temperatures. The higher location should be warmer by two to four degrees or more, especially in the spring. This temperature differential could well mean the difference between successful crops and failures.

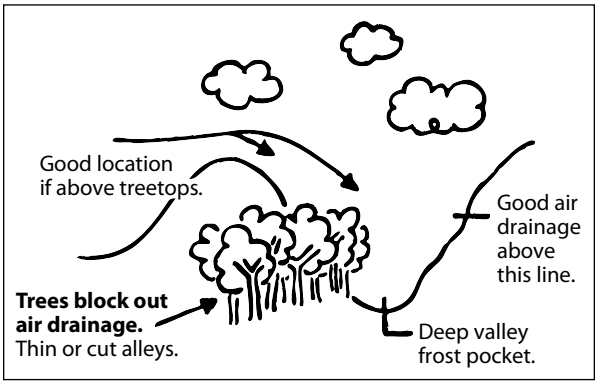


Figure 2. Air drainage.

If local trees have a history of regular cropping, chances are much greater that you can find locations where weather won't be a deterrent.

Slope and Direction

A gentle slope (or pitch) is preferred; however, if the site is terraced, steeper slopes can be used. Both soil and air drainage are generally much better on sloping ground. The direction that the slope faces is usually not as important as the slope itself, but trees on a southern slope may bloom early and be more prone to frost injury.

In addition, soils on southern slopes tend to be thinner, lower in organic matter, and more droughty than those on northern slopes. On the other hand, northern slopes may subject the trees to a greater chance of winter injury unless there is good air drainage. Sites that slope away from the wind's prevailing direction may help prevent the wind's drying effects. A preferred slope, then, would face east, southeast, northeast.

Soil

Peaches do well on a wide variety of soils if both surface and subsoil are well drained and the soil is 3 or more feet deep. It is generally thought, however, that sandy soils and other lighter types of soils are best. Peaches will not tolerate "wet feet"—water-saturated soils—for extended periods.

Trees planted in soils that drain poorly often die or produce poorly, depending upon the level of drainage. The soil should be as fertile as for most other fruit crops. If it is not, it should be enriched by use of animal manures, green manures, and chemical fertilizers. Soil samples should be taken to determine the native nutrient levels of potential sites before making the final decision. The sample can be sent to the local Extension office for analysis. An ideal soil for peach production should have a pH of 6.0 to 6.5 and have a minimum of 60 lbs of P_2O_5, 250 lbs of K_2O, and 150 lbs of Mg per acre. Peaches can be grown on sites that have marginal water drainage by planting on a raised ridge that is 12 to 18 inches high. Subsoiling breaks through the hard pan and often improves internal drainage, but only temporarily, because the hard pan will re-form.

Cultivar Selection and Planting Stock

Select cultivars based on when you want the fruit to mature, how many chilling hours are available, and how much disease resistance you want the cultivars to have.

Consumers prefer a high quality, yellow-fleshed, freestone peach, relatively fuzz-free, well-colored, and flavorful. There is also a substantial demand for nectarines; however, they tend to be more susceptible to brown rot, Japanese beetle, and green June beetle damage.

Fruit destined for shipping should be firm and store well. Most growers choose cultivars with an overlapping production season so that peaches are continuously available throughout the desired market period. Many home gardeners prefer to have three to four cultivars that ripen at different times during the season instead of having all the fruit ripen at the same time. Just about all peach cultivars are self-fertile, so cross-pollination is not usually an issue. The Cooperative Extension Service publication *Peach Cultivar Performance* (HO-6) describes cultivars currently recommended for Kentucky.

Peach planting stock is produced commercially by budding or grafting a desired cultivar onto a seedling rootstock. Rootstocks come from open-pollinated seed, and the rootstock is named after the female parent. While peaches can be budded successfully onto most *Prunus* species, the majority of the commercial trees are budded onto Lovell, Halford, Bailey, or Tennessee Natural. Lovell and Halford are the preferred rootstocks for Kentucky because they have shown better long-term survivability than other certified rootstocks.

Reliable nurseries offer a choice of sizes and grades of the most popular and promising cultivars. Preference should be given to nurseries that raise peach trees on fumigated soil. "June buds," 1-year-old nursery trees that are 2 to 3 feet tall or 3 to 5 feet tall, are usually the most desirable to plant. Since the demand for nursery stock is great, commercial quantities of trees should be ordered four to 24 months in advance of planting. If you want to plant in early spring, order dormant-budded trees. If you want to plant in the fall, order June-budded trees—they will be the right size by then.

Shipped nursery stock should be inspected immediately upon arrival. Any damage, order error, shortage, dried-out roots, or other problems should be reported at once to the nursery. Nursery stock should be stored in a cool place (32° to 40°F) so the roots won't dry out or freeze until they are planted. If stored properly, trees may be kept in their shipping container for a few weeks.

If cold storage is not available and plants cannot be planted within three to five days of delivery, heeling in is recommended. Heeling in is done by placing the trees in a trench in a sloping position with the tops pointed south and by packing the roots with damp soil. Care should be taken to distribute and pack the soil around the roots.

Time to Plant

Peaches may be planted in the fall after the trees are dormant or early in the spring, usually February to March. Fall-planted trees often lose the tips of the limbs because of loss of moisture. Fall-planted trees should not be headed back (pruned at the branch tip in order to encourage lateral branching) until the following spring. Trees planted in late spring usually survive better than trees planted in late fall or heeled in from fall till spring.

Trees with extensive new growth before planting will suffer shock at planting. The best way to prevent premature new growth is by cold storage or by heeling in, choosing a shaded area such as the north side of a building.

Site Preparation and Planting

Peaches should be part of a long-term rotation program. Using cover crops and improving fertility programs before planting will help get the trees off to a good start. When replanting a peach orchard, remove as much old tree root from the soil as possible. Allow two to three years for the remaining roots to break down. Be aware that if the previous orchard was diseased, some soilborne peach diseases are persistent enough that peaches should not be replanted in the same place.

Develop a Planting Plan

Develop a planting plan before you order trees. First determine the margin that must be clear at the ends of the rows to allow equipment to turn. That is usually 30 to 40 feet. Then, if the site has obstacles such as a tall building or a tree on its east, south, or west side, the distance to the closest obstacle should be 2 ½ times the height of the obstacle to prevent excessive shading. The remaining space is usable orchard space.

Next, determine how much space you want between trees. Consider equipment size, which helps determine the width between rows. Generally, in-row spacing ranges from 16 to 24 feet and between-row spacing from 20 to 28 feet. Many orchards are planted on a 20 ft-by-20 ft grid. Growers can mow in both directions, across and along rows. However, planting on the square requires more mowing, which means more time and money. Currently, the most common spacing is 18 ft between trees and 20 ft between rows. On poorer soils, trees can be spaced a foot or two closer in the row.

When designing your orchard map, also consider the size you ultimately want your trees to be. More peaches are now being trained to be pruned and picked primarily from the ground. This means smaller trees and less fruit per tree. Smaller trees require less space, so the number of trees per acre can be increased to achieve the yield of larger trees.

Peaches can be planted on the contour of the land if erosion is a problem. With contour planting, the point rows (short rows that start and end where the slope is less steep) are a problem to spray and pick. To minimize this problem, many growers use a modified contour plan when the slope is not steep, setting a base row on the contour then planting the other rows parallel to the base row.

Soil Testing

Soil tests should be taken during the site preparation so that the soil can be amended as needed to bring the it up to recommendations. Kentucky fertility recommendations are contained in the Cooperative Extension publication *Lime and Fertilizer Recommendations* (AGR-1). It is highly advised that the recommended amount of lime, K, P, and Mg be applied during soil preparation before planting. Subsoiling, if needed, should also be done at this time. If erosion is a problem or the site has a desirable cover crop, disk only strips where the rows will be located. If you are planting the trees in the spring, you can subsoil and apply herbicides in the planting strips the previous fall.

A site with poor drainage is improved greatly if trees are planted on a raised ridge. Raised ridges help elevate tree roots above the water table. They can be constructed using various methods. The objective is to move enough soil above the original soil level to contain a significant volume of roots. The slope on the side of the ridge should be gradual enough to facilitate tillage. One method of constructing a ridge with a two-bottom plow is illustrated (Figure 3).

Adjusting pH

The optimum soil pH for peach trees is between 6.0 and 6.5. If soil is acidic (low pH), pH can be raised with lime. Several light applications of lime are better than one heavy application. A high soil calcium level would result from a heavy application, reducing root absorption of potassium and magnesium and causing nutrient deficiency.

If soil is alkaline (high pH), pH can be reduced by applying sulfur. Best results are achieved if sulfur is incorporated during field preparation. If pH needs to be reduced after planting, ammonium sulfate, a highly acidifying nitrogen fertilizer, can be used as the nitrogen source.

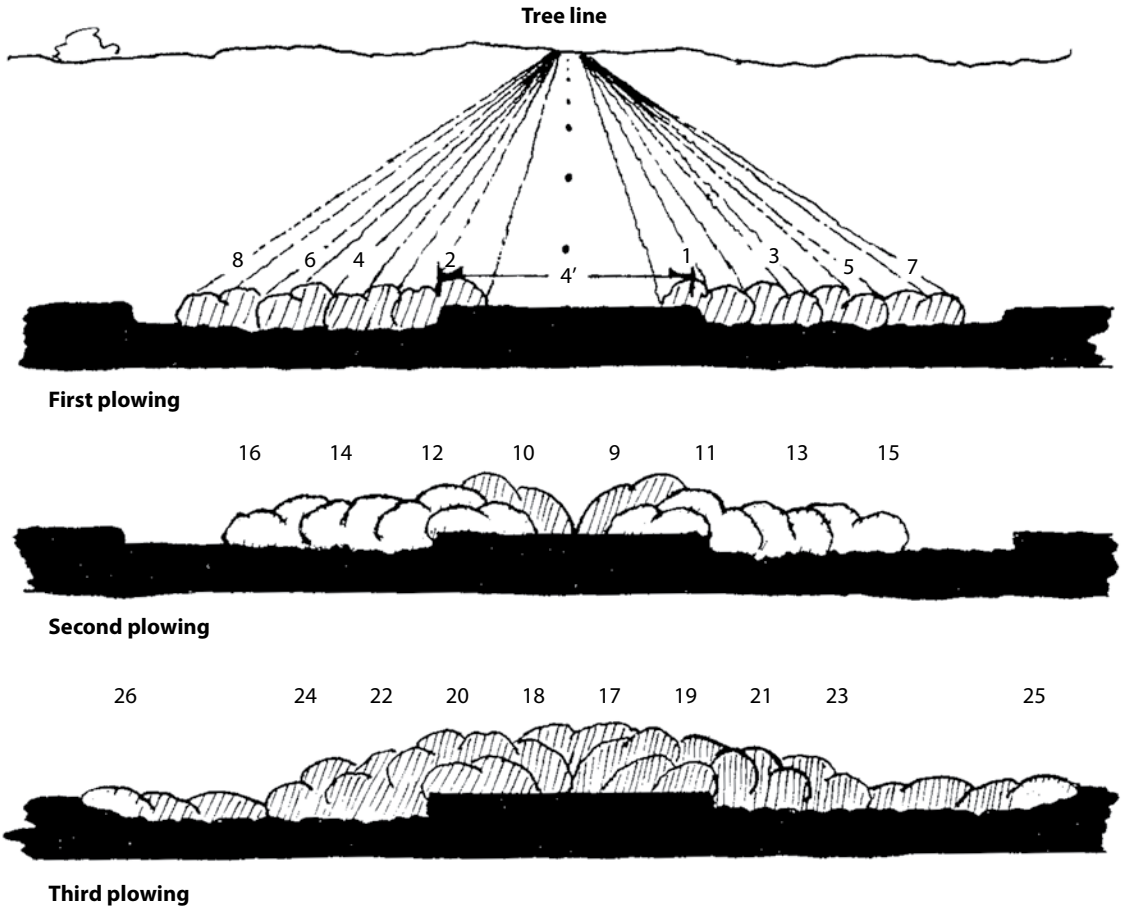


Figure 3. Construction of a ridge using a two-bottom plow. Numbers indicate the sequence of plow passes needed to build the ridge.

Locating the Trees

The exact location of each tree should be determined. Sighting with reference stakes is usually adequate to lay out the rows. Mark the hole location by striking the ground with a lime-filled cloth bag or sack or by using small stakes. The planting hole should be big enough so that the roots of a tree can be spread out to a diameter of 18 to 24 inches and a depth of 1½ to 2 feet. Commercially, planting holes are usually dug with a PTO post-hole auger that is 18 to 24 inches in diameter. However, you can run the risk of glazing of the hole walls—the surface of the hole wall hardens solid, inhibiting root penetration and growth into the surrounding soil. If you weld projections on the auger, you will reduce glazing by scoring the sides of the hole. You also will improve root penetration.

Before planting the tree, examine the roots and prune off any damaged or discolored parts. Take precautions to prevent the roots from drying out or freezing between storage and planting. Many growers haul the tree to the planting site on a wagon in a 55-gallon drum containing water.

Planting

Plant the tree by setting it 1 to 2 inches deeper than it was planted at the nursery (look for the soil line). Do not cover the bud or graft union. If the prevailing wind consistently blows from one direction, trees should be slanted 10° to 15° toward that prevailing wind to help maintain vertical growth. Fill the space around the roots with the soil. Where it is practical, place the topsoil in the bottom of the hole and tramp the soil firmly after planting. Water the trees well to settle the soil around the roots. Fall-planted trees may have soil mounded 9 to 2 inches around the trees to reduce the possibility of freeze damage to the roots. This mound should be removed early in the spring.

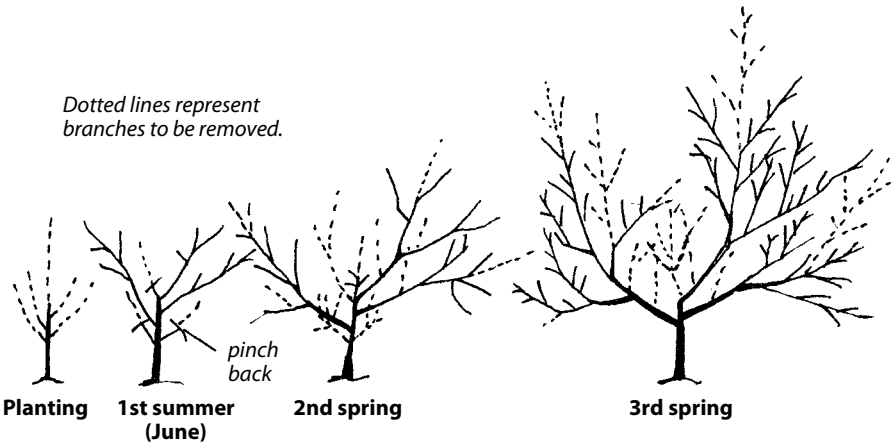


Figure 4. Open-vase system for training peach or nectarine trees. The strong, wide-angled branches (three scaffolds) are resistant to winter injury and breakage by fruit weight.

During a dry summer, a depression around the tree helps to contain supplemental water that may be needed. The depression should be filled in before freezing weather to prevent ice from girdling the tree. It is not recommended that you add fertilizer to the planting hole—fertilizer salts could burn the roots.

Tree Training and Pruning

Pruning is used to develop and maintain the tree size and shape, and it will affect fruit quality, yield, and even ease of spraying. The kind of pruning you do is determined by your equipment and pruning methods. Young nonbearing trees are pruned and trained differently than mature, bearing trees. Pruning for both should be done in late February, after the worst of winter is over. A common practice is to prune after bud break in order to gauge winter kill and overall tree health. Pruning after bloom reduces the incidence of canker disease.

Pruning at Planting

Peach trees are headed back at planting unless the trees are planted in the fall, in which case the trees are headed back the following spring. Peaches are usually trained to an open vase shape with two to four scaffold limbs per tree (Figure 4). The height of the scaffold limbs above the ground is determined by their height when the trees are headed. Most commercial growers prefer to have their scaffold limbs 20 to 24 inches above the ground to allow for the use of herbicide sprayers and other equipment beneath the lowest limbs. New trees should be headed 3 to 4 inches above the desired scaffold limb height. Limbs below the

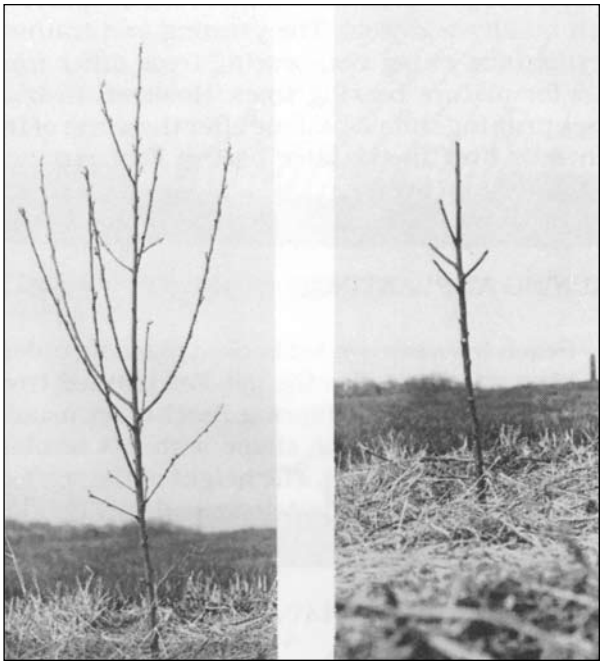


Figure 5. One-year-old peach tree at planting (left). Same tree after pruning to develop an open center framework (right).

heading back cut should be stubbed to 2 to 4 inches when the trees are headed back to promote the development of strong, wide-angled scaffolds (Figure 5). Any limbs that are 15 inches or less from the ground should be removed. Small June-budded trees that have not reached the desired height are not headed, and lateral branches are tipped to promote stiffer growth.

During the first summer's growing season, new shoots less than 15 inches above the ground are removed (Figure 6) and the tips of dominant upright limbs are pinched to promote growth of wide-angled branches below them.

Pruning Young Non-Bearing Trees

Following the first growing season and winter, select the desired scaffold limbs and cut off all other limbs flush with the trunk. Remove any lateral growth on the first 20 inches of the selected scaffold limbs and head back slightly those scaffolds where growth is more than 30 inches with little or no branching. Scaffolds that have less than 30 inches of growth and have several side branches should be pruned to leave two or three well-spaced side branches. Any laterals growing toward the ground should be removed. The stubbed central leader may be left to produce foliage in the center of the tree to encourage formation of wide crotch angles for the scaffolds.

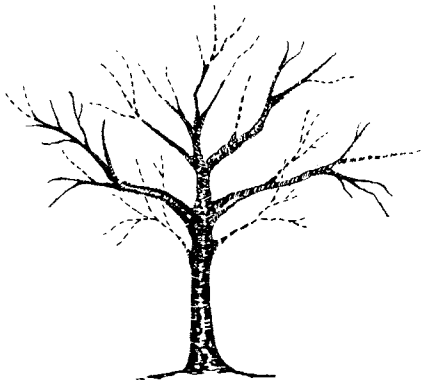


Figure 6. Pruning of a peach tree in June of the first year after planting:
1) Select three well-spaced, wide-angled scaffold branches to save as future main branches. 2) Remove all side branches below these three scaffold branches. 3) On branches above the three scaffold branches, head each back to 2-inch stubs.

Figure 7. Peach tree from Figure 5 in the spring of the second year after planting. Before pruning (left) and after (right).

From the second to the fourth year, remove any branches that grow inward or straight up through the center of the tree. Do only minimal corrective pruning and training to control the direction of growth and remove overlapping and damaged limbs (Figure 7). To avoid limb breakage with a good fruit load, do not allow limbs to become horizontal. During the spring of the second year, the central leader may be again headed back and in the third growing season, it can be removed down to the selected scaffold limbs (Figure 8).

Pruning Bearing Trees

When pruning bearing peach trees, remember that peaches are produced laterally on shoots that grew the previous year. You want to stimulate one-year shoots by fertilizing and pruning in order to obtain maximum fruit yields. A vigorous one-year shoot usually contains three buds at each node. The smaller center bud is a leaf bud, and the two plump outer buds are flower buds. Less vigorous shoots usually contain one flower bud and one leaf bud at each node.

When the tree reaches the desired size (9 to 12 feet for most growers), it should be held at that height by heading back the high scaffolds to an outward-growing lateral branch (Figure 9). These renewal points should be changed periodically to prevent thick, bushy growth in the tree top, which limits light penetration. Remove weak, broken, or diseased branches as well as those that grow straight up, across the center, downward, and those that interfere with mowing or spraying.

It may be necessary to thin out a few of the more vigorous branches where they are too numerous. Long, thin (leggy) branches should be headed back to stiffen them and induce lateral branch development near the trunk. Retain a few young branches on the inner portion of the tree to help prevent production of bearing wood too far away from the trunk. These branches should be located so that they will replace older wood. Small shoots in the lower part of the vase can be left for fruit production for one or two years before removing them.

Figure 8. Heading back the center stubby growth so as not to compete with other growth of the tree.

Figure 9. The upright growth in peach trees needs to be headed back annually. The principle is the same on young and old trees: maintain the desired height of the tree by heading back excessive growth to either an out-facing branch or out-facing bud.

Pruning Trees Injured in Winter

Injury from low winter temperatures can cause flower buds to die, and in severe cases, it can kill the wood. Examine buds and wood for injury as described in the section *Winter Injury.* How much new wood you should remove depends in part on the severity of the injury and on the number of buds per foot. If all buds are killed, you have the chance to reduce the amount of old wood without affecting any crop. Reducing old wood will promote development of new growth nearer the trunk.

When the wood has been severely injured, it is best not to prune the tree until growth begins. At that point, remove only weak shoots on the tree's interior and dead branches, because the tree will need as much leaf surface as possible to help recover from winter injury.

Mechanical Pruning

Some growers maintain the desired tree height and width by mechanically hedging the tree. The primary advantage of mechanical pruning is that it reduces pruning labor.

Mechanical hedging is effective when you follow it up by hand pruning to prevent the development of thick bushy growth on the top and sides of the tree.

Weed Control

Weeds in the orchard compete with the peach trees for available moisture and nutrients, and they harbor pests and diseases. Cultivation, herbicides, or cover crops can be used to control weeds in peach orchards. During the first year, keep a 5-foot-wide, weed-free strip down the row. Home gardeners may prefer organic mulches to clean cultivation. Mulch conserves moisture, but also provides a desirable habitat for destructive rodents. Organic mulches and the labor required to apply them make them too expensive for use in commercial orchards.

Trashy Cultivation

Most commercial orchards use either trashy cultivation or permanent sod along with herbicides in row middles. With trashy cultivation, the orchard is kept disked until the fruit has sized. Then, the row middles are allowed to grow up in weeds. Weeds, especially crabgrass, are advantageous because they tie up nitrogen in early fall and prevent erosion in winter. If the cover crop is disked in late winter or early spring, bare earth will absorb heat and radiate it back at night. These orchards are reported to be one to two degrees warmer than sod orchards on frost nights in the spring. A variation on trashy cultivation is to replace the weeds with a fall small grain cover crop. Vetch is not a satisfactory cover crop for a peach orchard, as it releases nitrogen at the wrong time of the year, and it is difficult to keep the vines off the trees.

Permanent Sod Cover

A permanent sod cover is preferred over trashy cultivation in Kentucky peach orchards. It controls erosion and allows orchard operations, particularly spraying, to be carried out under wet conditions. The ideal sod cover should be shallow-rooted and compete minimally with peach trees during the growing season. Cool-season grasses such as fescue, orchard grass, and bluegrass work well. Sod has several

disadvantages, however. It competes for moisture during drought conditions, especially important during fruit sizing. It also creates cooler soils in spring and is a fire hazard under dry conditions. With supplemental irrigation, such as trickle, sod middles are the preferred choice.

Herbicides

A grower should first identify the problem weeds and then identify which herbicides will control those weeds. Herbicides save labor; almost all commercial fruit growers use them. Always read the herbicide label and all instructions in detail for safe and effective herbicide use. Note the interval to harvest (also known as PHI, or pre-harvest interval) and all other safety precautions. Most growers treat a band 4 to 6 feet wide down the row for young trees and a band 8 to 12 feet wide for mature trees. In orchards where tree spacing is wide enough, an area 4 by 6 feet is treated at the base of each tree. Preemergence herbicides are best applied to a ground surface free of vegetation and trash.

One herbicide program that works well for many growers is an early spring (early to mid-March) tank mix application of a contact herbicide plus a preemergence herbicide. The contact herbicide kills overwintering vegetation, and the preemergence herbicide often provides a two to three months of weed control. By mid-June or early July and before the limbs start drooping with fruit, examine the herbicide strip to determine if you need an additional herbicide application. Current herbicide recommendations are in the Cooperative Extension publication *Midwest Commercial Tree Fruit Spray Guide* (ID-92).

Fertility

Peach trees require a good fertility program. In Kentucky, nitrogen deficiency is generally the most important mineral limiting peach tree production. Potassium deficiency is also a factor. Mature peach trees do not appear to respond to phosphorus and deficiencies of the minor elements. Boron, manganese, and zinc are usually not a problem, as long as soil pH is kept in the desirable range of 6.0 to 6.5. At a higher pH, Kentucky orchards have shown a magnesium deficiency.

Timing of Application

The time of fertilizer application is a primary factor in the tree's vegetative growth, fruit color development, and winter hardiness. Too much nitrogen will cause excessive vegetative growth, making it difficult for spray coverage throughout the canopy and hindering fruit harvest. Excessive nitrogen also increases pruning costs and reduces fruit coloration. Cultivars that do not normally develop high coloration, such as Elberta and Loring, develop even less red coloration under high nitrogen conditions. This lack of coloration does not seem to be a problem with highly colored cultivars such as Redhaven. High nitrogen levels or late summer nitrogen applications can cause trees to grow late into the fall, making them susceptible to injury in fall and winter.

Choosing a Fertilizer Program

There are two basic fertilizer programs that work well in Kentucky. One is the application of fertilizer in February followed by a second light application in May, if needed. The primary disadvantage of this program is that if the crop is frozen out, nitrogen levels in the tree may be excessive. The second approach is to fertilize at about two weeks after petal fall, when the crop size can be estimated.

The fertilizer program for peaches should be based on the amount of terminal shoot growth made the previous season or on the results of leaf tissue analysis.

Trees of bearing age should average 14 to 20 inches of new terminal growth per shoot. Shoots longer than 20 inches generally indicate that nitrogen should be reduced or that pruning is too severe. Terminal growth of less than 14 inches indicates that you need to add nitrogen or prune more heavily.

Leaf tissue analysis accurately measures the tree's nutritional level and is the most reliable method of determining fertilizer needs. It is more accurate than soil tests and provides additional information on the levels of minor elements. When tissue analysis is used over a period of years, the grower can obtain a precise record of the orchard's nutritional status. This record enables the grower to more carefully gauge fertilizer applications and detect nutrient deficiencies, even before visual symptoms are apparent. The best time to collect peach leaf samples for tissue analysis is from July 15 to August 15. A soil test to monitor soil pH is valuable if it is done at the time of tissue testing. By comparing the results of the two tests, you will have a more comprehensive analysis of plant fertility level. Contact your county Cooperative Extension agent for additional details.

Many growers find that observations of growth and yield records from the previous year are the most practical and useful in understanding overall tree health and determining fertilizer needs.

General Fertilizer Guidelines

It is impossible to recommend a fertilizer program without examining the orchard. Here is a guide for use in an orchard of average fertility. It should be used as a basis for fertilizer applications and adjusted based on tree growth.

Tree Age	Rate	Material
1 Year[1]	1 lb/tree	10-10-10
2 Years	2 lb/tree	10-10-10
3 Years	3 lb/tree	10-10-10
3 Years +	1 lb/tree/yr of age with a maximum of 6 lb/tree[2]	10-10-10

[1] Apply in spring after newly planted trees have leafed out. It is usually not needed if soil has been fertilized according to a soil test prior to planting. All other applications should be made in February or March.

[2] This rate should be modified annually depending on tree vigor, growth, and fruiting ability.

Thinning

Peach trees usually set too many fruit. Therefore, fruits should be thinned. A properly-thinned peach tree will have about the same volume of fruit as an unthinned tree, but fruit size and sugar content will be much better. Additionally, it takes less labor to pick a bushel of large peaches. (A standard bushel contains 293 2-inch diameter peaches, but will hold only 159 2 ½-inch fruits.) Also, large peaches command higher prices.

It takes approximately 35 leaves per fruit to obtain adequate fruit size. This translates to about one peach every 6 to 8 inches along the twig. Peaches are usually thinned following May or June drop. The earliest ripening cultivars should be thinned first, since they have a shorter period to size. Pruning after bloom can reduce the fruit number, but it is difficult to reduce the fruit load properly after bloom without overpruning.

Figure 10. Thinning peaches with a Kentucky bumper.

Most growers use a pole or Kentucky bumper for thinning (Figure 10). The 4-to-8 foot pole is wrapped with a large piece of inner tube, and padded on one end with foam rubber. The pole is then tied with grass twine or rubber tubes. Hit each scaffold at right angles along the branch until you have removed the desired amount of fruit. Some cultivars thin more easily than others using this method. When pole thinning, the best that can be hoped for is thin to an average of one fruit every 6 to 8 inches. The fruit will not be uniformly spaced, but this is not a problem as long as the fruit is not so close that it deforms during sizing. It is estimated that 65 trees per day can be pole-thinned. Some growers follow up the bumping by thinning clusters that are too thick using a short piece of hose attached to a pole.

Pest Control Recommendations

Peach pest control generally involves a preventive spray schedule using a few pesticides that have curative properties or kickback action. Consult the Cooperative Extension publications *Midwest Commercial Tree Fruit Spray Guide* (ID-92), and *Midwest Tree Fruit Pest Management Handbook* (ID-93).

Obtain uniform coverage and apply the products safely and in accordance with legal guidelines, found on the product label. If you are a home fruit grower, you may find it more convenient to use an all-purpose spray for fruit trees despite the extra cost. It eliminates the need to keep and mix several different products.

Most pest control problems are due to improper timing of application, poor coverage of the tree, and use of the wrong or insufficient material for the problem. Read and follow the information on the label.

Peach Harvest, Handling, and Storage

Most Kentucky peaches are grown for the fresh market. Consequently, flavor, sugar content, size, color, and texture are major concerns. When peaches are grown for the early market, it is best to grow early varieties rather than to harvest starchy, immature fruit that do not sell.

When to harvest depends on the following factors:

- Fruit firmness
- Size of the crop
- Availability of refrigeration
- Distance to market
- Weather conditions
- Labor supply

If the weather is hot, ripening is accelerated; if it is cool, ripening is slowed.

Picking the Fruit

Because all peaches on a tree do not ripen at the same time, the tree should be picked from three to five times. You should select the largest, softest fruit each time. Roll the wrist toward the stem and twist gently to free the fruit without breaking the twig or branch. Pickers should be gentle to guard against bruises and cuts in the peach skin. Provide good ladders and padded picking buckets with canvas drop bottoms to help protect fruit from bruising. Fruit should be carefully slipped, not dropped, into bushel baskets and loaded into trucks. Some orchards have replaced bushels with large shallow bins that can be moved by forklift to the packing house. Trucks and trailers for transporting peaches from the orchard should be equipped with rubber tires and springs to reduce jolting and bruising of fruit. Cool the fruit to 32°F as soon as possible after harvest.

Distance Shipping

For distance shipping, peaches should be picked at the mature-firm stage, which is a few days earlier than for local sales. Mature-firm is the point at which the flesh color changes from green to yellow. Mature-firm fruit will have better flavor, color, and size after storage than fruit picked when it is slightly immature, even if both fruits are stored the same amount of time. If the peaches are shipped some distance, choose varieties better suited for shipping.

Flesh firmness and storage life can be measured with a hand-held pressure tester. This testing can be done with a 5/16-inch diameter plunger applied to the bare flesh of the peach cheek. Elberta and other peaches are often harvested when they test 10 to 14 lbs, which is considered mature-firm. Peaches picked at 14½ lbs can be held for three weeks at 32°F, after which they would test 9 to 10 lbs.

Pick-Your-Own

Pick-your-own marketing can be used for peaches, but it requires good supervision and consumer education. The main problem is teaching the pick-your-own customer how to pick a peach that is of the ripeness or quality that he or she desires. There is some tendency for consumers to pick immature or starchy peaches and then, when they get home, decide that the peaches aren't very sweet. Most insurance companies will not permit the use of ladders for consumer harvest. Consequently, trees planned for pick-your-own harvesting should be trained so that they can be picked from the ground. Color coding trees by painting or tying ribbons on the trunks will help customers pick from the right trees.

Peaches rank as one of the most popular fruits sold through farmer-to-consumer markets. At the roadside stand or market, peaches offered to the customer should be ripe and of good size, color, and flavor. If the grower is picking for sale at a roadside stand, he or she may find that grading and picking directly into the sales container will save handling costs. Above all, growers selling directly to consumers should be friendly and courteous. A positive attitude, coupled with quality peaches and fair prices, produces satisfied customers and word-of-mouth advertisement.

The Split Pit Problem

Split pit is a recurring problem in many growing areas in Kentucky. Any treatment that promotes fruit growth at the start of pit hardening tends to increase the number of split pits. Split pits also may result from early excessive thinning caused by frost that is followed by irrigation or rains. Girdling of tree limbs by wire and excessive nitrogen may also promote the problem. Early maturing varieties are particularly prone to split pits, as are varieties such as Elberta, in which pit hardening is relatively late.

After-Harvest Care

After-harvest care includes preventing post-harvest decay, disease control, storing, and packing.

Post-Harvest Decay

Post-harvest decay is a serious problem for Kentucky's peach growers. It is more prevalent when rainfall or humid conditions occur near harvest time. Brown rot and Rhizopus rot are the two fungal diseases of peach that cause major storage problems. The level of brown rot in the orchard will influence the severity of brown rot in storage. (Read more about brown rot in the section *Peach Diseases*.) On the other hand, Rhizopus rot occurs primarily in storage. The development of these fungi and subsequent decay of the fruit can be halted by cooling the peaches below 50°F.

Temperatures must be above 60°F during the ripening stage, making the fruit susceptible to decay at that time. Therefore, other control measures must also be used.

Disease Control

A good disease control program should be maintained in the orchard throughout the season to prevent establishment of the brown rot fungus. Sprays one to two weeks ahead of harvest may reduce the level of brown rot at the time of harvest.

When peaches are destined for storage or shipping, an ice water bath is recommended immediately after harvest, such as hydro-cooling peaches in the packing house, which extends the fruit shelf life and reduces precooling time in refrigerated trucks. During hydro-cooling, peach containers move on a conveyor through a shower of cold water maintained near 32°F. Fruit temperature can be cooled 20° to 30°F in 10 to 15 minutes. The cooling rate depends on initial fruit temperature and size.

To prevent build-up of fungal residue in the cooling water, which would spread infection, chlorine is added at a concentration of 100 to 120 ppm.

Chlorine is easy to use in the form of calcium or sodium hypochlorite (household bleach). This method prevents the spread of disease during cooling but does not eradicate infections established while fruit is in the orchard. Try to keep the cooling water clean, especially when using chlorine. If it's dirty, chlorine will react with organic debris in the water and be less effective against the fungi.

Storing

After harvest, warm fruit ripens quickly. Mature-firm fruit is fully ripe in just two to four days at 70° to 80°F. The rate of ripening is cut in half for every 10°F drop in storage temperature. Thus, two-to-four days ripening time is slowed by half at 60°F, and by half again at 50°F. Above 60°F, peach fruit ripen with good flavor and aroma, but at 50°F, flavor is ruined. At 40°F (the temperature of most household refrigerators) extremely slow ripening permits internal breakdown before the peach is palatable. Ripening is practically prevented at temperatures between 32° and 36°F. Since peaches freeze at 30°F, they can be stored safely at 32°F or above. In this temperature range and at 85% relative humidity, peaches may be stored for two to four weeks and then should ripen satisfactorily at room temperature in two to three days. The effect of temperature on the ripening process can best be seen in the table below:

Storage Temperature	Flesh Firmness Loss/Day
80°F	4 lbs
60°F	2 lbs
40°F	0.3 lb
32°F	0.2 lb

Peaches cannot be left at temperatures below 50°F until they ripen. A dry, mealy condition will develop before normal ripening will occur. This condition occurs with prolonged storage of most peach varieties and is referred to as "wooliness." In some varieties prolonged cold storage results in browning and a translucent appearance.

Shelf life can extend to six and sometimes nine weeks with controlled-atmosphere storage, in which oxygen levels are lowered from 21 percent to 1 percent, and carbon dioxide is increased from a trace amount to 5 percent.

Packing

Packing sheds may be centrally located cooperatives or individually owned and placed close to the orchard. They should provide enough space for equipment and workers to comfortably handle expected fruit loads. Fruit brought to the shed in field containers is hydrocooled or air cooled and then released onto conveyors for sorting, defuzzing, grading, sizing, and packing.

Market objectives, distance to market, labor, and cost of materials all determine the most suitable container. In Kentucky, bushel, half-bushel, peck, and quart baskets are used in fresh market sales. Most peaches are now sold retail in smaller containers. Corrugated and fiberboard boxes are good for shipping. They may have cupped trays to protect large, fancy fruit or a sheet of perforated polyethylene to reduce weight loss and shriveling during shipment. Growers are urged to stay current on new developments in the packing industry.

Winter Injury

Winter injury to peach trees hampers production in all areas of the state. Several types of damage may occur, depending on the tree condition and the time of year when critical temperatures occur. For instance, a cold snap following a warm spell may cause more damage than very low temperatures that have developed gradually. Various types of damage include trunk or cambium (inner bark) injury, wood injury, and bud mortality.

Cambium Injury

Tree trunks and crotches are the last part of the tree to harden after leaf fall. When low temperatures occur early in the fall, before cellular activity in the cambium has stopped, it may result in damage to the cambium. Trees that are growing vigorously into the fall are susceptible to this condition. Young trees that have not produced a crop are also prone to this condition.

To identify this injury, cut through dry-looking bark which may be in patches or completely girdling the tree. If the cambium is injured, it will have a brown discoloration. Depending on severity, the tree may die early the following summer or struggle through one or two more seasons. Replanting is recommended for young orchards if cold-injured trees begin to die under the stress of bloom and fruiting.

Wood Injury

Winter sunscald causes serious trunk damage and makes the tree more susceptible to disease and insect invasion. The southwest side of the tree is warmed by exposure to the sun. Rapid contraction of the bark on this side of the tree, which occurs at nightfall or when the sun goes behind a cloud, causes the bark to split. Painting the first 16 to 24 inches of the trunk from the soil surface with white exterior latex paint will reflect the sun's heat, moderate temperatures inside the trunk, and reduce the chances of sunscald injury. Diluted paint may be

sprayed on the trunk and scaffolds of mature trees in late fall. A car mitten or long napped roller with a small brush for crotches is a good applicator for young trees. Cracked bark should immediately be secured with wide-head roofing nails and sealed with grafting wax to prevent drying of the cambium and allow the wound to heal.

Injury to the wood can also occur during severe cold in mid-winter after trees have hardened. The damage is evidenced by a browning of the wood from the center out to the cambium. Depletion of carbohydrate reserves seems to make trees more susceptible to wood injury. Manage the orchard to promote healthy growth without excess vigor in the fall (see fertility section). Therefore, you should avoid producing excessively heavy crops, competition from weeds that restrict growth, early pruning before leaf fall, and allowing occurrence of disease that causes foliage to drop prematurely.

Bud Mortality

Winter injury to dormant flower buds may be seen when temperatures occur below the critical low temperature for that variety (approximately 10° to 12°F). Severity of bud kill will indicate how much pruning is advisable in the spring.

To determine the extent of bud damage, a survey can be taken after the cold period has passed. Wait at least 48 hours after the critical temperature to allow for drying up of dead tissue. Select five shoots about 12 to 24 inches long from each variety. Cross-section the plump flower buds with a razor blade and examine the centers. Brown discoloration of the normally greenish white tissues indicates a dead bud. Record the number of live and dead buds, and calculate the percentage of live buds for each cultivar. It is believed that if 10 percent of the buds survive, an adequate crop may be produced.

Spring Frost Damage

In Kentucky, crop failure frequently is due to spring frosts that kill tender buds after they have begun to swell. Buds become increasingly tender as the flowers open until fruit reaches at least ½ inch in size. When selecting a site, avoid low-lying ground, where frost is more likely to occur, to minimize the risk of spring frost damage (See *Elevation* and *Slope and Direction* in this publication for more information). Also, plant hardy peach varieties.

Prevention of Cold Injury

There are no guaranteed preventive measures against cold injury, but there are several helpful measures the grower can take. These measures are summarized below:

- Select a good site. (See *Site Selection* section.) During a radiation frost event, you may gain several degrees of warmer temperatures with a good site.
- Select varieties and rootstocks recommended for your area. You may gain a few more degrees.
- Train trees with wide-angled crotches. Narrow crotches are more subject to cold injury.
- Paint or spray trunks with white outdoor latex paint. Sunlight is reflected instead of being absorbed and keeps internal trunk temperature more uniform, preventing winter sunscald.
- Prune after midwinter (as late as possible). Early pruning causes tree to be more subject to cold injury.
- Use moderate general pruning to maintain trees in a vigorous productive condition.
- Avoid excessive or late nitrogen fertilization. This causes trees to grow too late in fall and not harden off properly. In Kentucky, fertilizing after July 1 is not recommended.
- Use cover cropping or allow weeds to grow in late summer to promote early hardening by removing nitrogen and moisture.
- Stay current with your insect and disease spray program to maintain trees in healthy condition.
- Thin fruit early to keep trees in a vigorous and healthy condition.
- Consider frost prevention practices in the spring, such as sprinkling, fans, heaters, etc.
- Consider early spring or later winter cultivation. Cultivated wet ground radiates heat and helps protect flower buds.

The best treatment for severely cold-damaged trees is an early, generous nitrogen application and moderate pruning—severe pruning has been shown to drastically reduce the crop for several years. Cold injury to roots can occur but is not common in Kentucky.

Peach Diseases

Common peach diseases in Kentucky include brown rot, bacterial spot, peach leaf curl, perennial canker, peach scab, and phytophthora root and collar rot. Less common is peach tree short life disease.

Brown Rot

Brown rot (Figure 11) is a destructive disease of apricot, peach, nectarine, plum and cherry, wherever they are grown. The disease reduces yields in the orchard. After harvest, the threat of fruit decay is constant. In seasons with climatic conditions favorable for infection, entire crops may be lost, almost overnight. Brown rot is caused by the fungus *Monilinia fructicola* and occurs on all stone fruits.

Brown rot attacks blossoms, spurs, shoots, and fruit. Infected blossoms wilt, turn brown, and remain attached to the tree into summer. When the fungus moves into the woody tissue, small cankers form. As the cankers expand, they may girdle the branch or twig and cause terminal growth to wither and die. Gummosis, the large amount of gum oozing from diseased tissue, may accompany the blighting of

Figure 11. Brown rot on peach fruit.

spurs and formation of cankers. Succulent shoots are sometimes blighted by direct infection near their tip. Fruit decay, the first symptom noticed by many new growers, most often affects mature fruit, although immature fruit may develop the disease under certain conditions. Most rotted peaches are the result of brown rot. Initially, small, circular, light brown spots develop on the surface of the fruit and expand rapidly if conditions are favorable, destroying the entire fruit in a few hours. Rotted fruit may fall to the ground or persist as mummies (dead, dried fruit) on the tree. Under wet, humid conditions, ash-gray tufts of fungal growth develop over the surface of the lesions. These structures, called sporodochia, produce conidia, or reproductive bodies, which are important in spread of the disease. Appearance of the fungus on a lesion is the most obvious characteristic of brown rot.

The brown rot fungus overwinters in mummies on the tree or ground and in twig cankers. In the spring, upon wetting, spores are forcibly ejected from mummies on the ground into the air and carried by wind to the blossoms, where they infect. Infection may also arise from conidia produced on the surface of mummies and cankers in the tree. Spores are carried by wind or splashing rain to susceptible tissues. A relative humidity of 85 percent or higher is necessary for conidial production. In summer, brown rot activity increases as the fruit start to mature. Wounded fruit are infected much more readily than unwounded fruit. Since rotting and spore production can occur in just a few days, the disease is able to build up rapidly. Warm, wet humid weather is particularly favorable for brown rot. Mature fruit decays in 36 to 48 hours under optimum conditions for disease development.

Control starts with the removal of all fruit, mummies, and blighted twigs from trees after the last picking. This removal reduces the amount of brown rot overwintering in mummies and twig cankers. Cultivation, just before bloom, will reduce spore production by disturbing the mummies. Fungicide sprays applied at bloom and during the weeks before harvest are essential to reduce losses caused by brown rot. Nectarines are much more susceptible to brown rot than peaches.

Bacterial Spot

Bacterial spot (Figure 12) is a problem on susceptible apricot, peach, nectarine, and plum varieties. It causes severe defoliation and fruit spotting, which weakens the tree and makes the fruit unmarketable. It is caused by *Xanthomonas pruni*.

The bacteria infect the leaves, fruit, and tender growing shoots. Leaf lesions are small and generally angular in outline. Initially, lesions appear as water-soaked areas, primarily on the underside of leaves, and later as spots that are brown to black in color. Often, the centers of the spots fall out and their outer edges have a reddish coloration. The disease is generally worse at the tip of the leaf, where an inch or more may be killed. Severely infected leaves soon turn yellow and fall to the ground. On sensitive varieties, a few lesions result in severe defoliation; tolerant varieties require many more lesions before they defoliate. Heavy defoliation early in the summer reduces fruit size and weakens the tree.

Fruit infected early in the growing season develop cracks or checks in the skin. Lesions extend into the flesh, resulting in deep pits. Under certain weather conditions, fruit lesions show gumming. Late-season infections are superficial, giving the fruit a mottled appearance. Twig infection resulting in cankers is less common than leaf or fruit infection.

Figure 12. Bacterial spot on a peach leaf.

Overwintering of the bacteria occurs in cankers. When canker development is resumed in spring, the bacteria ooze out of the lesions and are carried in water droplets to young leaves, fruits, or shoots. Hard, driving rains are more apt to initiate new infections than gentle rains. The force of the rain is why bacterial spot can be proportionally more severe on one side of the tree than on the other. Periods of frequent rainfall, moderate temperatures, and fairly high winds are favorable conditions for infection.

Use of resistant varieties is the primary method for controlling bacterial spot. Relatively resistant varieties include Bisco, Candor, Clayton, Coralstar, John Boy, New Haven, and Sweethaven.

Some of the highly susceptible varieties are Cullinan, Elberta, and Sweet Sue. Other susceptible varieties include Carolina Gold, Cresthaven, Encore, Garnet Beauty, Harvester, Jayhaven, Loring, Madison, Norman, Red Haven, Redskin, Rio Oso Gem, Ruston Red, Sentinel, Topaz, and Winblo.

In addition to using resistant varieties to reduce bacterial spot problems, locate new plantings away from older ones that contain susceptible varieties. Use balanced fertilization programs. Also, some spray programs help control bacterial spot.

Figure 13.
Peach leaf curl.

Peach Leaf Curl

Leaf curl (Figure 13) is a springtime leaf disease of peach, nectarine, and, to some extent, ornamental species closely related to peach. Foliage is lost in early summer, but not every year. The cause of peach leaf curl is the fungus *Taphrina deformans*.

Leaves infected by the leaf curl fungus appear in May and are easily distinguished from healthy ones as they become puckered and thick. Puckering of the leaves is primarily along the midrib, with part or all of the leaf infected. The leaves are usually flushed with red or purple when they first appear, but later become yellow to brown before dropping from the tree. Defoliation can result in reduced production. As the season progresses, areas on the diseased leaves develop a powdery-gray appearance, resulting from production of fungus spores. The grayish appearance distinguishes leaf curl from curling of leaves due to other factors.

Environment is a factor in curl infection and is the reason why the disease does not occur in a given area every year. Rain is necessary for infection; leaf curl is worse when the weather is cool and wet. The tree is susceptible only during the relative short period of bud swelling and opening. Spores of the leaf curl fungus are relatively resistant to adverse weather conditions and can remain lodged on the surface of the twigs for two or more years.

A single spray, if applied at the correct time and if the correct fungicide is used, provides nearly perfect control of leaf curl. To be effective, the application must be made before the buds begin to swell. Fall sprays after most of the leaves have fallen or spring sprays within three to four weeks of bud swell also are effective, if they are applied thoroughly. Once the fungus enters the leaf, the disease cannot be controlled.

Perennial Canker

Perennial canker, also known as Cytospora canker or Valsa canker, is caused by two related fungi, *Leucostoma cincta* and *Leucostoma persoonii*. Both species attack peach, apricot, prune, plum, and sweet cherry. The disease is common in peach orchards and is a frequent cause of dying limbs and the death of peach trees.

Perennial cankers are oval to linear in outline and eventually are surrounded by a roll of callus at outer edges. Cankers enlarge gradually on a year-to-year basis until the limb or trunk is completely girdled. Active cankers often have gum associated with them, but gummosis is not unique to canker, since it may be caused by several unrelated factors.

The fungi overwinter in cankers or in dead wood. Infection occurs through damaged or injured bark. Cold injury is the most important factor predisposing trees to canker, but pruning wounds, mechanical damage, insect punctures, borer injury, and leaf scars are other entry points.

Control may involve the following:

- Avoid soils with poor internal drainage and remove wet spots by tiling before establishing new plantings.
- Do not plant young peach orchards or replant trees next to older orchards or next to trees with canker.
- Delay orchard pruning until the worst of winter is over, because early pruning can severely weaken or kill trees. Late pruning promotes quick healing.

- Remove badly cankered limbs, branches, or trees. Burn cankered limbs soon after pruning, because sanitation is a must during the early life of the orchard.
- In cultivated orchards, plant a cover crop by July 1 and mow after that.
- Fertilize early and according to recommendations.
- Try to avoid mechanical and insect injury, and do not leave pruning stubs.
- Apply fungicide sprays after pruning but before rain.
- Prune after bloom to reduce canker infections.
- Avoid weak-angled crotches when shaping trees.
- White latex paint applied to the southwest side of trunks and lower scaffold branches may help prevent cold injury.

Peach Scab

Peach scab (Figure 14) occurs frequently in Kentucky. It is worse where a good spray schedule is not followed early in the season. The fungus that causes it, *Cladosporium carpophilum*, also attacks apricot and nectarine. Peach scab results in unsightly fruit and weakens the tree.

Although the disease also occurs on the twigs and leaves, it is most often observed on the fruit. Early infections appear as small, greenish, circular spots on the surface of the fruit. These spots do not generally appear until the fruit are half-grown, and they tend to be concentrated at the stem end. Older lesions become black and velvety in appearance as spores are produced. Lesions may run together when they are numerous, resulting in abnormal growth of the fruit, and, in severe cases the skin and flesh of the fruit cracks.

Figure 14. Peach scab.

The fungus overwinters in lesions on the twigs, and conidia are produced in the spring. The conidia begin to infect the peach a few weeks after petal fall, and the fruit remain susceptible until harvested. Forty to 70 days elapse from the time the spore lands on the fruit until the disease is visible. Thus, the disease is usually not observed until the fruit are well grown. Spores from the fruit re-infect the twigs and leaves. Early maturing cultivars may never exhibit symptoms on the fruit.

The disease is controlled primarily with fungicide sprays, although pruning increases air circulation and reduces infection.

Phytophthora Root and Collar Rot

Root and collar rot frequently occurs in Kentucky where peaches are planted in poorly drained sites. Symptoms include decayed absorptive and support roots, decayed bark on the lower part of the trunk, and sometimes lower trunk cankers. Peeling back the bark of an infected lower trunk will reveal reddish-brown streaks or a brown decayed area where the bark meets the wood. Root and collar rot disease is usually caused by *Phytophthora cactorum*, but other *Phytophthora* species in the soil can also cause root and collar rot.

Be sure that peaches are growing in a well-drained site. If the soil is saturated for short periods, that is enough time for the fungus to produce specialized swimming spores that can move through the water from diseased roots to healthy roots nearby. Soil drainage can be improved by applying field drainage tiles or by planting peaches on raised berms. In some circumstances, fungicides can be applied to suppress *Phytophthora* root and collar rot.

Peach Tree Short Life Disease

Peach trees are not considered long lived when compared to other fruit trees. One factor is the Peach Tree Short Life (PTSL) disease. PTSL is a disease complex characterized either by 1) failure of portions of trees or entire trees to start growth in spring or 2) growth starts followed by collapse of trees or portions of trees, usually during bloom or early leaf development. Additionally with PTSL, trees are killed only to the soil line, trees in their third to sixth growing season are most likely to be affected, and the disease is more likely to occur when trees are replanted in locations where peaches were recently grown.

PSTL is not common in Kentucky. The disease is caused by a nematode that thrives in sandy soils, which aren't commonly found in the state.

Common Peach Insects in Kentucky

Common peach insects in Kentucky include oriental fruit moth, plum curculio, peach tree borer, lesser peach tree borer, San Jose scale, those that cause catfacing, and plant bugs.

Oriental Fruit Moth

Oriental fruit moths are gray with some chocolate markings on the wings. They resemble codling moth, to which they are related. As with codling moth, the damaging stage of oriental fruit moth is the larva. Although fruit moths do attack fruit, they prefer to burrow in new, tender shoots. The injury causes twig dieback. Injury to fruit is similar to that caused to apples by codling moths. Oriental fruit moths prefer peach as a host, but other stone fruits, and to some extent pome fruits (such as apples), are attacked as well.

The first generation moths emerge about peach bloom time and they lay their flat, white eggs on leaves and twigs. The larvae from these eggs burrow into the tips of tender green twigs. In about two weeks, the larvae mature and leave the twig to pupate nearby. New moths emerge in about 10 days, and the cycle is repeated, with new twigs being attacked by each generation as long as the twigs are tender. When twigs harden off, the larvae begin to attack the fruit. The presence of tender twigs at harvest in early maturing peach varieties attracts the larvae, thus reducing fruit damage. Lack of tender twigs at harvest in late maturing varieties causes the larvae to switch attention to the fruit. Six to eight generations of oriental fruit moth occur annually in Kentucky.

Plum Curculio

Plum curculio (Figure 15) is primarily a stone fruit pest, but it also attacks apples and quince. Injury results from the spring feeding of adults, then from egg laying, next from grubs in the fruit, and finally by early fall feeding by the adults. Curculio is also a major agent for spreading brown rot.

The beetles hibernate in protected places in or near the orchard and appear with early spring foliage. They feed for five to six weeks, during which eggs are laid in fruit of sufficient size. First signs of egg laying appear when nighttime minimum temperatures approach 60°F. The eggs are laid in small, chewed-out cavities that are also marked by crescent-shaped cuts next to the cavity. Even if the larva fails to develop, the egg-laying scar remains and reduces fruit quality. Fruit may be deformed by early feeding and egg-laying scars.

Eggs hatch in about five days and larvae feed for two to three weeks before reaching full development. They leave the fruit through a clean exit hole, drop to the ground, then pupate in the soil. In apples, the worms reach full development only in prematurely fallen fruit. In a month, new beetles emerge, feed on fruit for a period, then either lay more eggs for another generation or go into hibernation. In Kentucky, only one generation occurs per cycle.

Chemical control, destruction of fallen fruit, and regular scouting are effective methods in reducing the number of beetles. Parasites and winter mortality also contribute to beetle control.

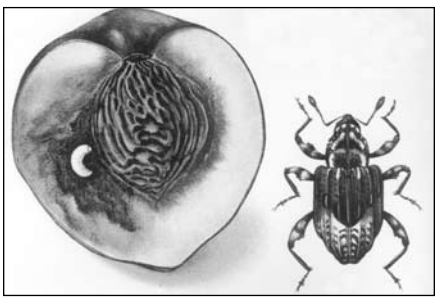


Figure 15. Plum curculio larva in fruit (left), and the adult.

Peach Tree Borer

The peach tree borer (Figures 16 and 17) is the most destructive pest of peaches, because its damage can quickly lead to tree death. Besides peaches, wild and cultivated cherries, plums, nectarines, and apricots are attacked. Damage is done by the worm stage of this moth. It burrows in trunk bark from 2 to 3 inches below ground level to about 1 foot above ground. Masses of gum mixed with brown frass or sawdust exuding from the trunk indicate where the borers are working. Bark areas eaten out or killed by the borers interrupt sap flow, and the trees are either seriously weakened, or, if the damage sufficiently girdles the trunk, die quickly. Trees injured by previous infestations or by machinery such as mowers seem more attractive to egg-laying moths.

This pest overwinters in burrows in various stages of larval development. Wintering larvae may vary in length from ¼ to ¾ inch. In spring, the worms become active again and continue their development. Larger borers will complete their growth from mid-to-late May, and the smallest borers may not mature until late summer. Full-grown larvae are 1 inch long, white, and have a dark-brown head and cervical shield.

The first moths appear in early July. Most emerge in August, but emergence continues into September as the smaller overwintering larvae complete their development. Because of the moths' appearance and daytime flying habits, they are sometimes mistaken for wasps. The female is about 1 inch long, blue-black, and has a broad orange band on the abdomen. The front wings are more or less fully scaled, but the hind wings are largely unscaled and transparent. The male moth is slightly smaller than the female and has several narrow yellow bands on the abdomen. Both wings are unscaled except for the outer wing edges and a band across the front wing.

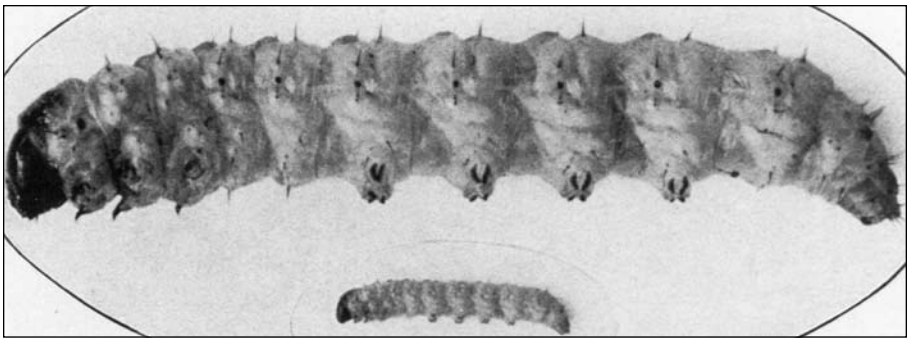


Figure 16. Larvae of the peach tree borer.

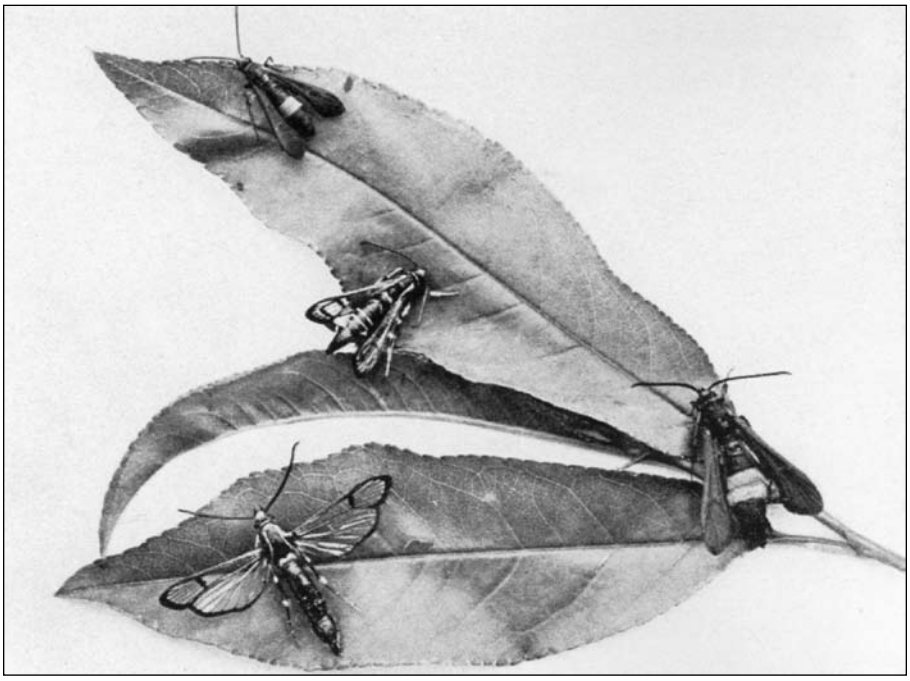


Figure 17. Peach tree borer moths. The insects at top and right are females.

Only one generation occurs each year, but the beginning of a cycle for any single insect can occur from July to October. This staggered cycling of the peach tree borer accounts for the various stages of development of larvae going into winter.

Lesser Peach Tree Borer

Lesser peach tree borer is related to, and in many respects similar to, the peach tree borer, but has some distinct differences in appearance and habits. Although peach is the preferred host, nectarine, plum, cherry, and juneberry are also attacked. The area of attack differs from that of the peach tree borer in that the lesser peach tree borer prefers to attack the upper trunk and scaffold limbs of its host. When found near the base of the tree, it often is in wounds made by the peach tree borer. Gummosis also occurs where the borer enters the tree. Damage is done by the borers burrowing in the cambium.

These pests overwinter in their burrows as partly grown larvae ranging from ¼ to 1 inch in length. They renew their boring activity in spring. The larger borers complete their development by late April and the smaller ones by late June. The larvae closely resemble those of peach tree borer, but identification in the field can be made on the basis of where they occur on the tree. They pupate in cocoons near the burrow exit, which is covered by a thin silk web. The cocoon is not dirt and gum covered, as is the cocoon of the peach tree borer. Shortly before emergence, the pupae push out of their cocoons and partly out of the burrows. First emergence occurs during May. The moths are blue-black with pale yellow marks on the abdomen. On warm days they are very active and dart about rapidly. The female lays her brown eggs in cracked or scuffed bark, usually around crotches or tree wounds caused by cankers, tool injury, sunscald, or winter injury. Eggs hatch in about 10 days, and the larvae bore to the cambium.

San Jose Scale

San Jose scale (Figure 18) attacks the limbs, leaves, and fruit of many tree fruits, especially peaches. The first signs of damage usually noticed are small bright red rings that occur around each insect on the fruit. If the San Jose scale problem is not controlled, it can cause death of limbs or even the whole tree.

The scales themselves are stationary, inconspicuously small, gray to black, 1/16-inch in diameter, flat, and circular. They have a raised nipple at the center surrounded by a dull yellow ring. The male scales are oblong—oval and smaller than female scales. Scales overwinter in a partly developed stage and reach maturity about bloom time. Mature females do not lay eggs, but give birth directly to the crawler stage. The crawlers are yellow and mite-like.

Figure 18. San Jose scale on peach.

They move only a short distance on their own but may be carried to other trees on the feet of birds. Within a few hours after leaving the parent scale, the crawler inserts its mouthparts into the host and ceases its wandering. Its skin is soon shed and it becomes a typical small-sized scale. Two generations occur per year. Orchards may be continually re-infested from reservoir populations on forest and shade trees. Dormant oil spray is effective in reducing scale insect populations.

Catfacing

A fruit injury characterized by sunken areas more or less conical in shape with corky tissue at the bottom is called *catfacing* (Figure 19). Catfacing is caused by feeding injury by plant bugs from the Miridiidae family. Apple, plum and quince are often catfaced, but peach is particularly susceptible. Any type of injury to developing fruit that stunts the filling out of the fruit around the point of injury may result in catfacing. When the initial injury occurs on young fruit, the resulting "catface" will be more severe than on fruit that is more fully formed.

Figure 19. Catfacing injury on peach.

Plant Bugs

The tarnished plant bug (Figure 20) and stink bug (Figure 21) are often pests of peach, especially if the orchard is near leguminous crops. The tarnished plant bugs are ¼-inch long; flattened; oval; mottled with brown, tan, and yellow; and have black markings. The green stink bug is solid green, shield-shaped, and 1 to 1¼ inch long. Both bugs overwinter as adults, and when they resume activity in spring, they attack buds and blossoms. By laying eggs in growing shoots they also cause twig blighting that resembles oriental fruit moth injury.

Figure 20. Tarnished plant bug.

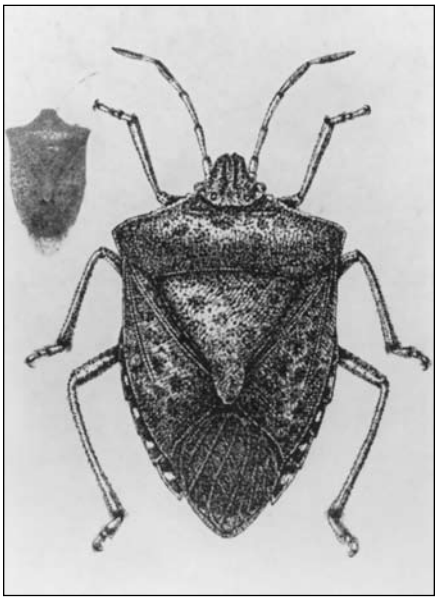
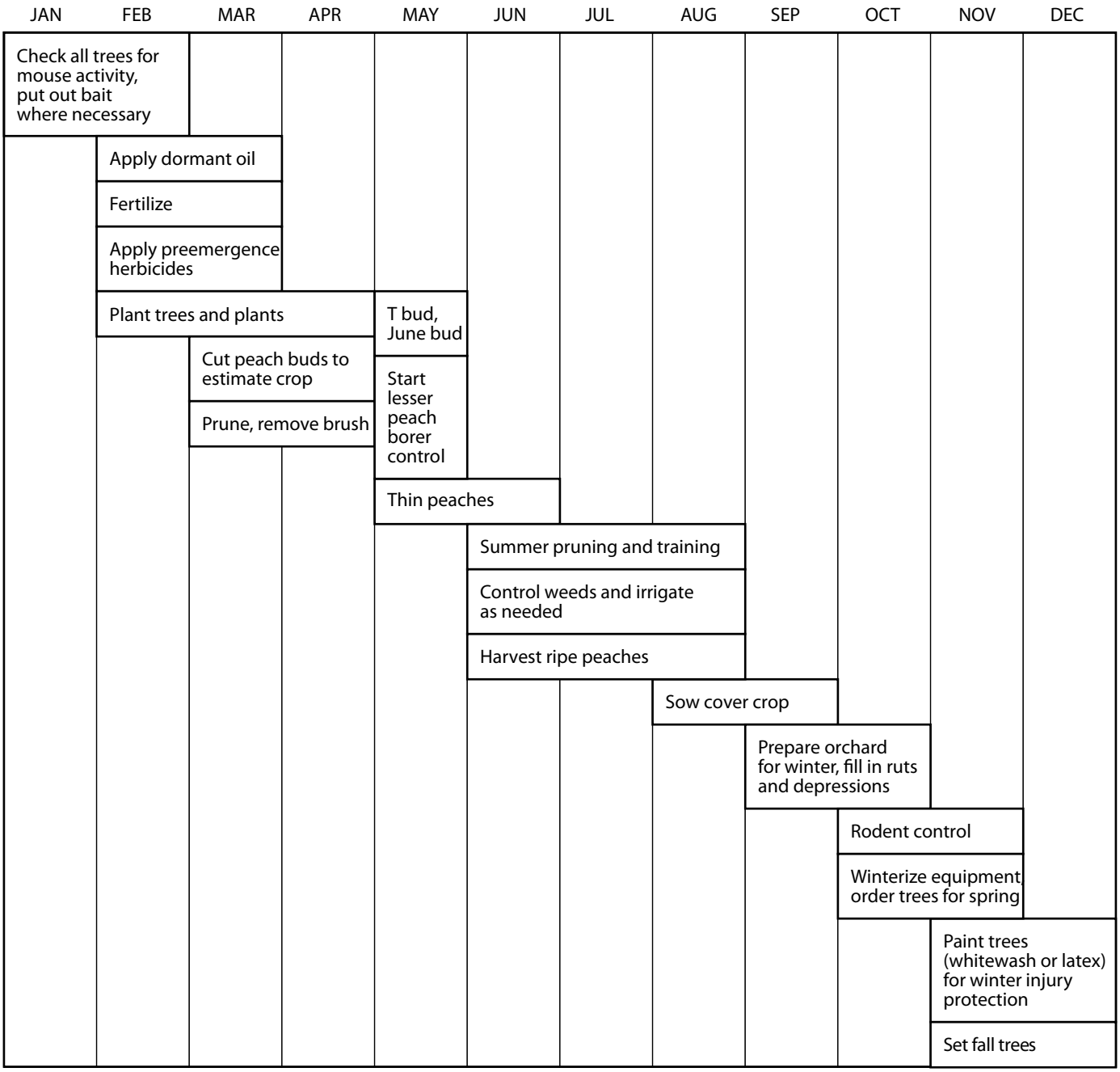


Figure 21. Stink bug.

Peach Calendar



Issued 5-2007