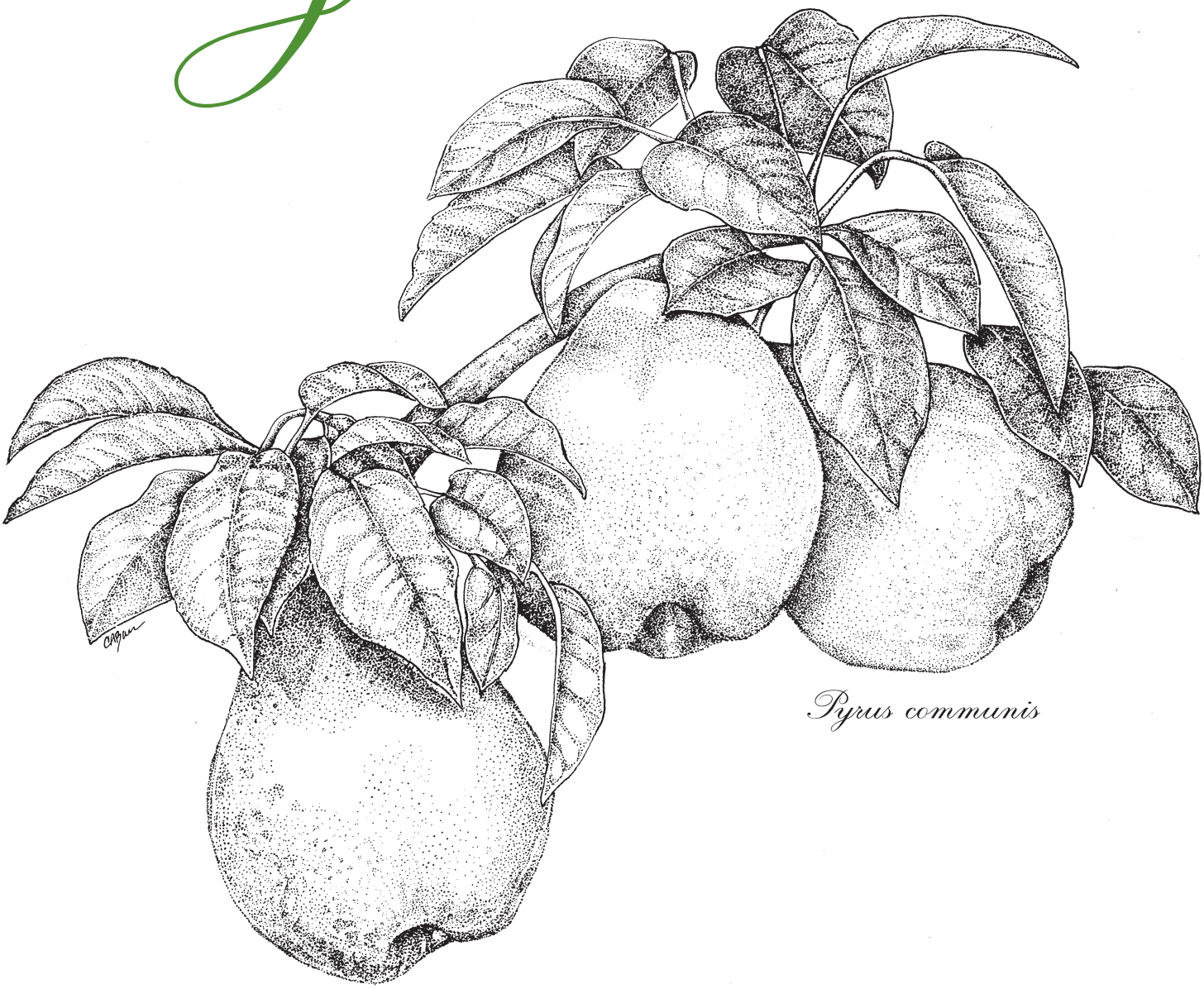
A2072

# Growing Pears in Wisconsin



*Pyrus communis*

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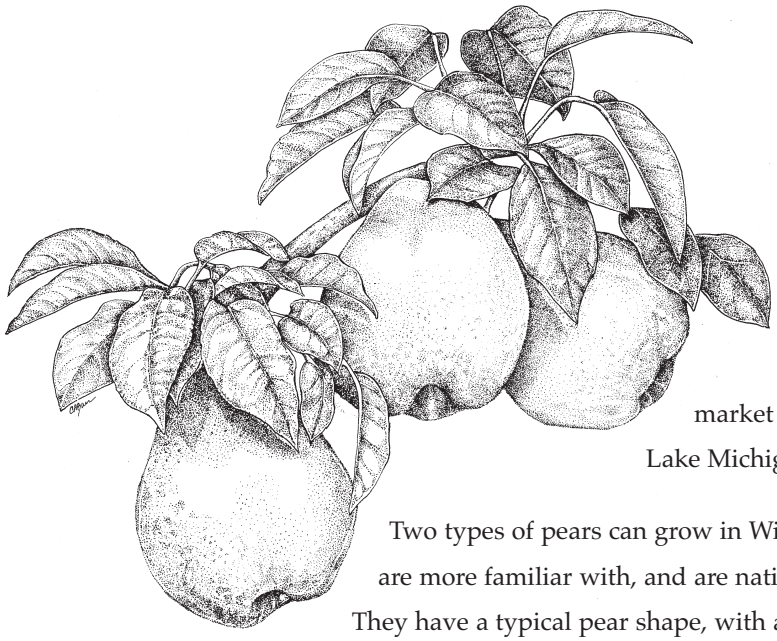


Pears are among the easiest tree fruits to grow. They will reward the attentive gardener with delectable, high-quality fruit for eating fresh or processing. You can grow pears successfully, for home or local market production, in southern Wisconsin and along Lake Michigan.

Two types of pears can grow in Wisconsin. "European" pears are the pears we are more familiar with, and are native to southern Europe and the Middle East. They have a typical pear shape, with a long neck and a swollen base. "Asian" pears are native to China and Japan. These fruit are shaped like apples but have the grittiness of pears and a delicate pear flavor. Asian pear trees look like European pear trees but are not as hardy. See the "Asian Pears" section for more information.

Before purchasing and planting pear trees, consider whether you have the space, time, and skill to grow and care for them. This bulletin will help you decide by outlining the basics of pear production. For more information, contact your county Extension office.

## The Pear Tree

Cultivated pear trees consist of two components: the rootstock, which is the below ground part of the tree, and the scion, which is the aboveground portion that produces fruit (figure 1). These two parts are joined together by grafting, and both are equally important.

Pear flowers and fruit always emerge at the ends of branches. If a fruiting branch continues to grow, it is from a side shoot. Pear trees frequently produce fruit on shorter side branches called spurs.

Pears have two types of buds, vegetative and mixed. Vegetative buds produce only leaves and shoots, while mixed buds produce both leafy shoots and flowers. The first to open is the "king flower," and it blossoms at the base of a cluster of flower buds. The remaining flowers open later from the base to the tip of the cluster. The king flower produces the largest fruit.

Pear trees are self-unfruitful. That is, pollen produced by a flower from one cultivar (cultivated variety) cannot pollinize flowers from the same cultivar. Pollen must come from flowers of a different cultivar. Insects, usually honeybees, carry pollen from one tree to another.

The trunk and branches of a pear tree may be trained and manipulated to provide sufficient strength to support the load of fruit. Usually one or two main vertical stems (central leaders) are permitted to grow. From these, numerous side branches, or "scaffolds," arise. These scaffold

limbs should have wide angles of attachment with the trunk for maximum strength.

The root system of pear trees tends to be shallow and well-branched. The roots have roughly the same horizontal spread as the branches. Most of the active roots are found in the top 18 inches of soil where there is adequate moisture, oxygen, and nutrients. Roots do not tolerate wet or poorly aerated soils. Under these conditions winter injury is more likely.

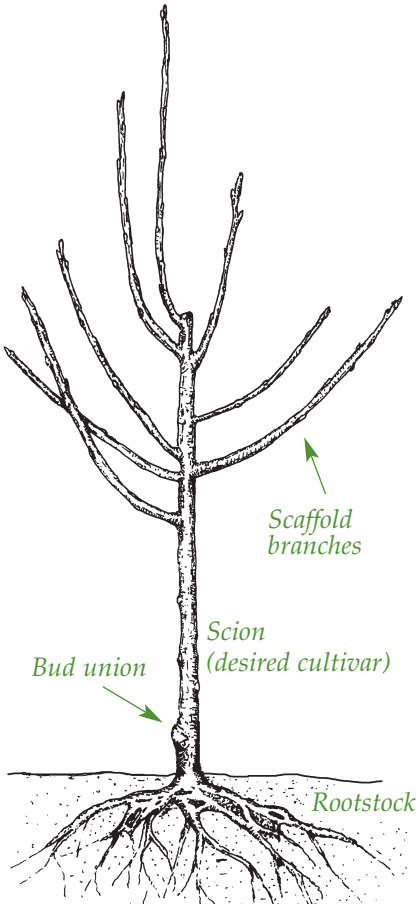



*FIGURE 1.* Important parts of a young pear tree. The bud union shows where the rootstock and the scion were joined by grafting.

## SITE SELECTION AND PREPARATION

Once a fruit tree is planted it's not easy to move it to a better location. So, you should plant your tree in a well-prepared, suitable site. Begin site selection and soil preparation the year before planting. Planning ahead allows time to control perennial weeds, adjust the soil pH, and amend the soil with nutrients.

The first consideration when selecting a site is how much space each tree will require. No reliable dwarfing rootstocks are available for pear trees, so they will grow to be quite large. Each pear tree requires 140–200 square feet of space when mature.

Pear trees are best planted on gentle slopes, where cold air can settle into adjacent lower areas. The bottoms of valleys are "frost pockets" and may be several degrees colder than nearby hillsides. Hilltops are undesirable as they may be very windy, which makes training difficult and can increase the incidence and severity of fire blight. Pears do best in fertile, sandy loam soils, though they will grow in all but the rockiest or heaviest clay soils. The soil must have good internal water drainage, as pear trees will not grow with "wet feet." The soil should be slightly acidic to neutral, with a pH of 6–7. Pear trees will require full sun at least ¾ of the day. Shady locations are not suitable.

Once you select a site, begin soil preparation. Control perennial weeds either by tillage or with the use of non-residual herbicides. Take a soil test of the location to a depth of 6 inches, and follow the soil test recommendations. If the soil is too acidic, add lime. If the soil is too alkaline, add sulfur. Add organic matter such as manure, leaves, or compost to improve soil tilth, aeration, and water-holding capacity. In orchards, plant a green manure crop such as sudangrass or sorghum to add organic matter. Plow or till organic matter into the soil before planting trees.

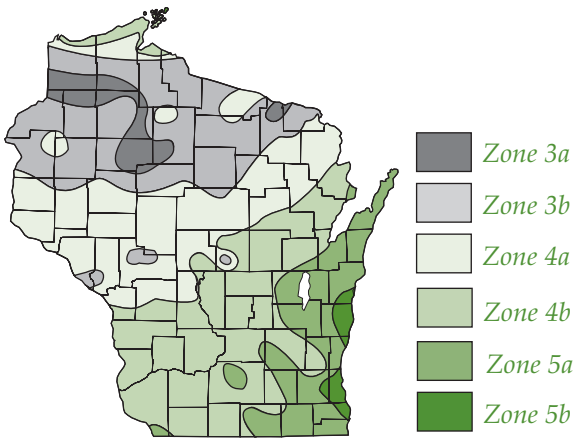
## Cultivar selection

Many pear cultivars will grow well in Wisconsin. When choosing a cultivar consider intended use (fresh eating, baking, processing) and the desired flavor, color, and texture preferences. In addition to these preferences, the cultivar must be hardy in your area. Pears can be grown successfully in USDA hardiness zone 5 and on favorable sites in zone 4b (figure 2). The time required between bloom and harvest must also be sufficiently short for the fruit to mature. In general, fruit should mature by mid-October to be grown successfully in Wisconsin. Another factor to consider is disease resistance. Some pear cultivars are resistant to fire blight, the most serious disease problem of pears in Wisconsin.

Don't let nostalgia for old cultivars influence your choice. New cultivars frequently have improved flavor, texture, and storability compared to older cultivars. Find more information on cultivar selection in Extension publications *Home Fruit Cultivars for Northern Wisconsin* (A2488) and *Home Fruit Cultivars for Southern Wisconsin* (A2582).

Pear trees are self-unfruitful. This means there must be a second pear cultivar planted close by to provide pollen for fertilization and fruit set. Many ornamental flowering pears can be adequate pollen sources for culinary pears. You should ensure that the two cultivars bloom at the same time so they can pollinize each other. Seckel and Bartlett are not pollen compatible, so plant a third cultivar near them. In many suburban residential areas, people have planted enough pears to provide adequate pollen without growing two trees. However, to be sure, plant two trees of different cultivars. Pollinizer trees should be within 200 yards of each other.

*Figure 2.* USDA plant hardiness zones.




## Rootstock selection

As mentioned earlier, pear trees available at commercial nurseries consist of two parts: a rootstock (the below ground portion) and a scion (the aboveground tree). The scion determines the cultivar of the tree. Such trees are made by grafting or budding a desirable scion to a rootstock with other desirable characteristics. More information about pear rootstocks is available in Extension publication *Rootstocks for Fruit Trees in Wisconsin* (A3561).

Good pear rootstocks should be resistant to fire blight, be cold hardy, control tree size, and be graft compatible with a wide range of cultivars. So far, no pear rootstock with all these characteristics has been found. Most trees are grafted to Bartlett seedlings. This is the standard pear rootstock and the best choice for Wisconsin. However, these rootstocks produce a large tree, 25–30 feet tall.

Two other groups of rootstocks are suitable for trial in Wisconsin and may produce slightly smaller trees. These are *Pyrus betulaefolia* seedlings and the Old Home x Farmingdale (OH x F) crosses, numbers 51, 97, and 333. OH x F 51 is dwarfing, 97 is vigorous, and 333 is semi-dwarfing. We have too little experience with these rootstocks to recommend them without reservation. *Pyrus calleryana* seedlings and quince rootstocks are not cold hardy and should not be used in Wisconsin. Unfortunately, many nurseries advertising dwarf pears have grafted trees to quince seedling rootstocks that are not winter hardy in Wisconsin.

## *Asian pears*

Asian pears differ from their European cousins in shape, flavor, and winter hardiness. They are found year-round in upscale produce markets and are becoming more familiar to Americans. Most Asian pears are round like apples. Some, however, have a more typical pear shape. Their flesh is crisp, gritty, very sweet, and juicy with a delicate pear flavor and aroma. They do not have the buttery flesh of European pears. Their skin is frequently russetted, but the presence of russetting does not indicate pest problems or poor management. It is genetically programmed.

Most Asian pears are not as hardy as European pears. You should plant them only in favorable sites in USDA hardiness zone 5 (figure 2). This limits their planting to southeastern Wisconsin. Some cultivars ripen too late to mature during Wisconsin's short summers. Many other cultivars flower too early and would be damaged by spring frosts.

Since most of the nurseries that propagate Asian pears are in the warmer climates of the West Coast, the hardiness of rootstocks is a problem.

Domestic seedling (*Pyrus communis*), OH x F, and *Pyrus betulaefolia* are reasonable rootstock choices. Don't buy Asian pears on *Pyrus calleryana* rootstocks. They are not hardy in Wisconsin.

Preferred cultivars are Hosui, New Century (Shinseiki), and Twentieth Century (Nijiseiki). Hosui produces a large, high-quality fruit that ripens early and will store for about 1 month. It flowers early, so it may be susceptible to early spring frosts. New Century produces a medium-sized fruit of good quality with a smooth skin. The fruit ripens in August and will keep for 2–3 months. Twentieth Century produces medium-sized fruit of excellent quality. It matures mid-season. Twentieth Century should be able to cross-pollinate with European pears. Unfortunately, all three cultivars are susceptible to fire blight.

Asian pears can be trained and pruned following the instructions in the "Training and Pruning" section. Since most are very susceptible to fire blight, they should be pruned only in the dormant season. Asian pears tend to overproduce and will likely need to be thinned to produce flavorful fruit of a decent size. About 2–3 weeks after bloom, shake the branches to dislodge any fruit that has stopped developing. Clip off (don't pull or twist) all but one fruit per cluster and leave clusters at least 6 inches apart.

Harvest the fruit when you see the skin color change. Russet-skinned pears change from green to brown, and smooth-skinned cultivars change from green to yellowish green. Not all the pears on a tree ripen at the same time, so multiple harvests will be necessary. Unlike European pears, the fruit will ripen on the tree, and—after washing—can be eaten immediately.

## Purchasing trees

It is best to purchase pear trees directly from a reputable nursery or garden center. Good nurseries will have trees that are true to their cultivar names and free of known diseases. Nevertheless, some advanced hobbyists and commercial growers may want to propagate their own trees. This is risky. While budding and grafting procedures for pears are straightforward, actually performing the operation takes skill and practice. The typical success rate for amateurs is less than 25%. Good nurseries discard weak plants, while hobbyists often attempt to salvage every tree, leading to poor-quality trees. Also, buds can harbor the fire blight bacterium and serve as a source of the disease.

## Planting

Pear trees must be planted correctly for best results. Trees transplant best in the spring after severely cold weather has passed and the soil has dried and warmed. Planting bare root fruit trees in fall is not recommended in Wisconsin. Potted fruit trees may be planted any time of the year if given proper care. The procedures for planting bare root and potted trees are similar.

**Bare root.** If trees arrive from the nursery before they can be planted in your area, keep them in a cool place, but don't allow them to freeze. Open the container and make sure the roots are still moist. If not, add a small amount of water to moisten the roots, but don't saturate them. You may soak the tree roots in a bucket of water for 2–4 hours before planting to moisten the roots.

**Potted.** Potted trees may be kept for 2–3 weeks in the container. Potted trees need regular watering, but don't overwater them. The soil should dry slightly between waterings. Remove the tree from the pot before planting and spread the roots. If the roots circle the inside of the container, make several vertical cuts through the roots and spread them away from the trunk.

When you are ready to plant the tree, dig a hole large enough to accommodate the roots without cutting or bending them. If one root is very long, you can shorten it, but in general don't prune the roots. The hole should be deep enough so the entire root system will be in the ground. Don't add fertilizer or fresh manure to the hole. Fill the hole with soil and gently pack it in with your foot to ensure good contact with the roots. Water the tree immediately.

Pear trees with domestic seedling rootstocks (the most common type) should be planted with the graft union at or slightly below the soil surface. Pear trees on *Pyrus betulaefolia* or OH x F 51 or 333 rootstocks should be planted with the graft union 2–3 inches above the soil surface. In the latter case the scion must not be in contact with the soil or it may root and lose the dwarfing influence of the rootstock.

Young trees should be staked at planting. Suitable staking materials include ¾-inch metal electrical conduit, pressure-treated 2 x 2 lumber or 2- to 3-inch round, wooden stakes. Drive the stake into the ground 3–4 inches from the tree and use tape (masking, PVC, or electrical) or fabric strips to securely fasten the tree to the stake. Do not use wire, rope, or other materials that will not allow the tree to expand as it grows. You will need to periodically replace the tape or other fastening materials. Leave the stake in place until the trunk is no longer pliable (5–6 years).

## Irrigation

Young trees benefit from regular watering. During the first year, a pear tree should receive 3–5 gallons of water weekly. If rain is insufficient, you must provide water. As trees get older their roots explore a larger volume of soil and irrigation becomes less critical. Don't wait for leaves to wilt or show other signs of water shortage before watering. On the other hand, overwatering can be equally detrimental. Overwatering fills air spaces in the soil and keeps oxygen from reaching the roots. Wet soils also have a greater potential for root rots. Measured watering throughout the season from planting to leaf fall will be most beneficial. Don't ignore the trees after harvesting the fruit—sufficient water is still important.

## *Pruning at planting*

Newly planted trees may need to be pruned. The exact pruning to be done depends on the shape you desire for the tree. Prune unbranched "whip" trees to 30–40 inches tall (figure 3). Pruning encourages strong lateral branches to form just below the cut. You control the height of the lowest branches by the height of your cut. These branches will form the basic framework of the tree. More information about pruning is provided in the "Training and Pruning" section.

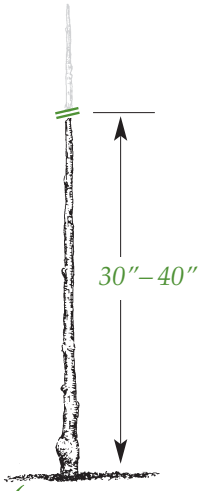



*FIGURE 3.* Prune to encourage branching.

## *MINERAL NUTRITION*

Like all plants, pear trees require certain mineral elements for growth. Have your garden soil tested the year before planting pear trees and incorporate the recommended nutrients based on the soil analysis. Micronutrients such as zinc, boron, and copper are required only in small amounts and are usually not needed in Wisconsin.

A few weeks after planting pear trees, you can make a light application of a fertilizer containing nitrogen. Apply 1 ounce of actual nitrogen to each tree per year of tree age, but do not exceed ½ pound (8 ounces) of actual nitrogen per tree, per year. A 3-year-old tree, for example, should receive 3 ounces of actual nitrogen. To calculate how much fertilizer to apply, divide the nitrogen needed by the percentage of nitrogen in the fertilizer. To find out how much ammonium sulfate—which is 21% nitrogen—to apply to this tree, you would divide 3 ounces by 0.21. The total application would be 14 ounces of ammonium sulfate fertilizer. Be sure to include in your calculation any fertilizer applied to lawns under trees.

You can apply nutrients as granules, liquids, or manures. Granular fertilizer is usually the least expensive method. Apply the fertilizer evenly within the drip line of the tree (the ground area under the tree's branches). Incorporate granular fertilizer into the soil by cultivating, raking, or watering within 24 hours of application. Liquids can be applied with a hose-end applicator or watering can. Dilute the fertilizer according to the manufacturer's specifications. Manures are typically low in mineral content. Allow manures to age before applying, then incorporate them shallowly into the soil, if possible.

After the planting year apply half the nitrogen fertilizer in mid-May and half in mid-June. Do not apply fertilizer after August 1.

You may need to adjust the standard nitrogen application based on the tree's growth. Shoots on young pear trees typically grow 15–20 inches per year, while shoots on fruit-bearing trees grow 8–15 inches annually. If growth is less than normal, apply 25% more fertilizer. If growth is more than normal, don't apply any nitrogen for a year. Avoid overfertilization, as this can increase a tree's susceptibility to fire blight.

## *WEED MANAGEMENT*

Management of the ground around the trunk of the tree affects tree performance. Do not allow grass or other vegetation to grow within 18 inches of the trunk of the tree. A vegetation-free area of 2–3 feet is even better. Grass and other vegetation compete with trees for water and nutrients. Grass growing up to the tree trunk also makes it difficult to mow without damaging the trunk.

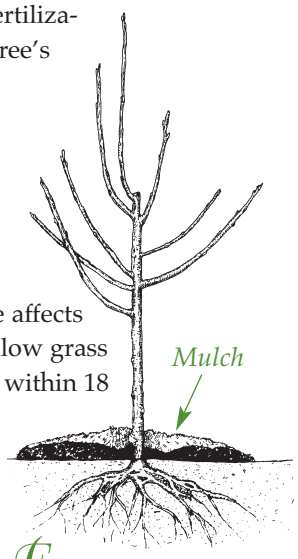



*FIGURE 4.* Place organic mulch in a donut shape around the base. Avoid heaping it against the trunk as this can contribute to fungal rots and attract rodents.

You can prevent weed growth around tree trunks by cultivating, mulching, or applying herbicides. If you cultivate, protect tree roots by digging no deeper than 2 inches into the soil surface. Both organic and inorganic mulches will prevent weed growth while retaining soil moisture. Apply 3–4 inches of an organic mulch such as shredded bark, bark chips, or wood chips. Avoid heaping mulch around tree trunks. This can lead to fungal rots on the trunk and attract rodents that gnaw on the bark. Apply mulches in a "donut" fashion around the trunk (figure 4).

Herbicides containing glyphosate, such as Roundup or Kleenup, are the easiest to use to prevent weed growth around tree trunks. For young trees, wrap the trunk with aluminum foil or plastic wrap to shield it from the herbicide. Apply herbicides according to label directions and avoid getting any spray on the trunk or leaves (or you!). Spray only when winds are calm.

## Training and Pruning

Annual training and pruning is essential to the production of high-quality pears and to the maintenance of healthy trees. Proper training and pruning allows light throughout the tree canopy, which is required for high-quality fruit. Since pruning promotes vegetative growth, it may delay fruiting as the tree expends resources on vegetation.

Prune pears only while the trees are dormant in late spring (March and early April). Do not prune during the summer, as fresh wounds can be entry points for fire blight bacteria (see the "Diseases" section). Do not prune after August 15, as this can invigorate trees, delaying dormancy and predisposing them to winter injury.

Each year remove all dead or broken branches, as well as suckers, water sprouts, and branches forming narrow crotch angles that cannot be spread. Cut the weakest of branches that cross or grow closely parallel. Remove downward-growing branches and spurs. Thin out dense areas, particularly in the top of the tree. For doing this, thinning cuts (removing an entire branch to its point of origin) are better than heading cuts (removing a portion of a branch).

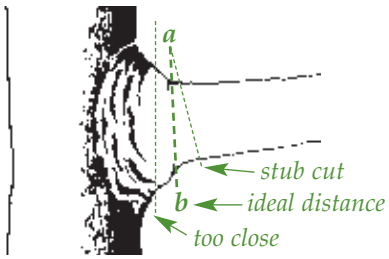



*Figure 5.* Prune branches just beyond the collar, as along line a–b. These cuts will heal most quickly.

Use tools specifically made for pruning, such as hand shears or long-handled loppers. Keep them sharp and clean. Don't use hedge shears—manual or electric—because they make jagged cuts. Do not leave stubs when pruning. Make cuts close to the trunk, but just beyond the collar of the branch (figure 5). These cuts will heal most quickly. Do not use pruning wound paints or coatings as they keep the wound moist, allowing diseases and insects to invade the tree. Instead, allow the wood to dry naturally. The tree will produce growth that eventually closes up the pruning wound.

### Training young trees

Training a tree properly when it is young will save hours of work later. The objective in training young trees is to develop a strong structure that will support fruit production. Also, upper branches of the tree should not shade lower branches.

Pears are usually trained to one of three systems: central leader, multiple leader, or open center. You can also train pears to a trellis, espalier, or other flat surface.

## *Central leader*

The central leader system will produce a single vertical trunk with side branches growing in whorls around it. This training style allows for good light distribution throughout the tree.

**First year spring.** For the first dormant pruning, select four or five strong branches to form the tree's first tier of scaffold limbs. Scaffold limbs are lateral branches that emerge from the trunk and form the framework of the tree. The lowest scaffold should be 30–40 inches from the ground. Select branches that have wide crotch angles (60° from vertical) and that are not growing directly across from nor above one another. To train branches to grow out rather than up, use a notched stick as a wedge (figure 6), or pull the limb down using strong twine, light rope, or a weight.

**Second year spring.** By this time the central leader should be tall enough to have a second tier of scaffolds. If branches have grown starting 25–30 inches above the top scaffold of the lower tier, leave them. If not, cut the leader 25–30 inches above the top scaffold to induce branching for the second tier of scaffolds. This gap between tiers will allow light to penetrate into the canopy. Push the scaffolds down with spreaders as described above. Don't shorten the lateral branches unless they are very weak.

**Third year spring.** Remove any branches that are growing downwards or are crossing. Keep the central leader taller than the second-tier branches by shortening or bending the branches.

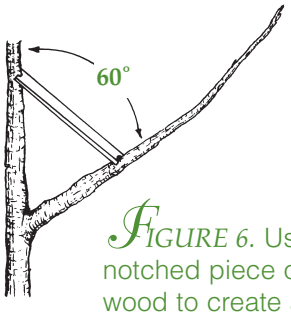
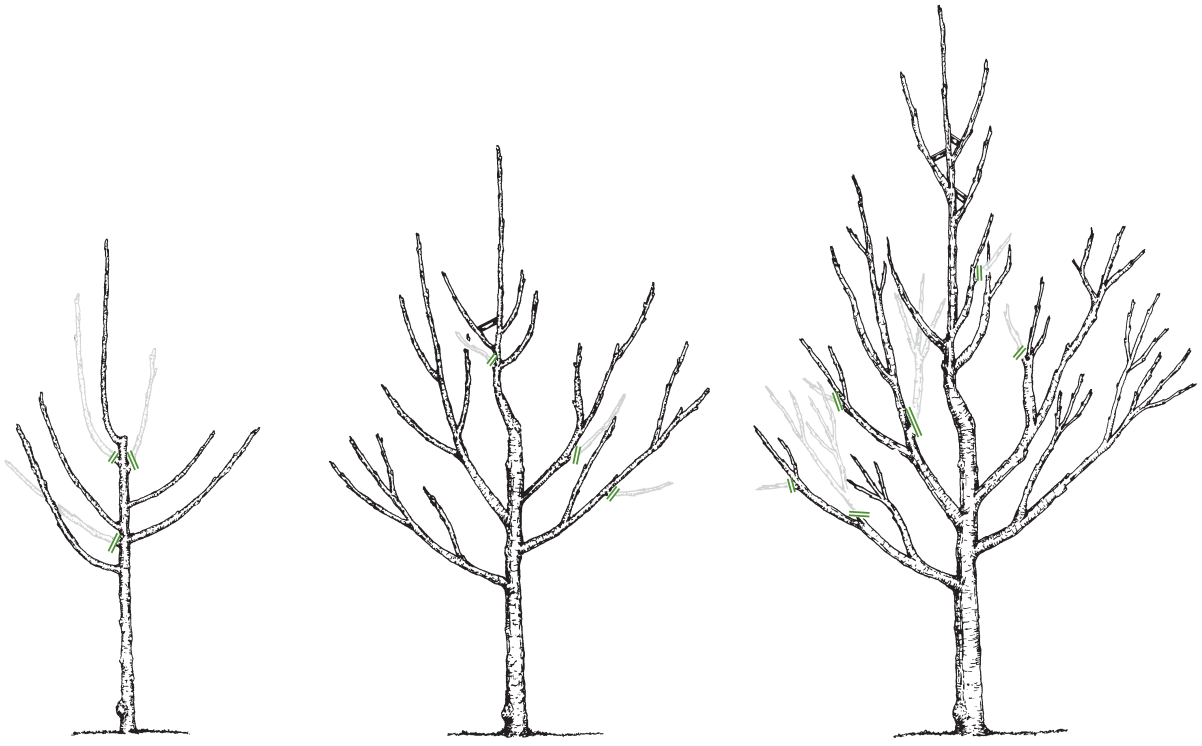



*FIGURE 6.* Use a notched piece of wood to create a wide crotch angle.

### *CENTRAL LEADER SYSTEM*



**First year spring** **Second year spring** **Third year spring**

## *Multiple leader*

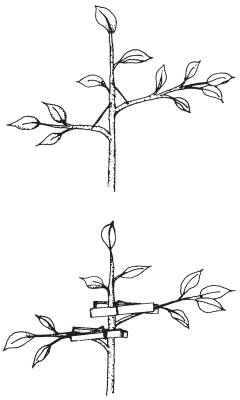
The multiple leader pruning system is similar in concept to the central leader system. Multiple leader trees produce three or four vertical trunks with tiers of lateral branches that bear the fruit. This system allows easy pruning, prevents shading, and leaves a substantial portion of the tree healthy if fire blight strikes one trunk. During the summer of planting allow the top three or four branches to grow vigorously upright. These branches will become the leaders.

**First year spring.** In the first dormant season, remove one-third of the length of each leader to promote branching. Spread three or four branches to form a lower tier of scaffolds.

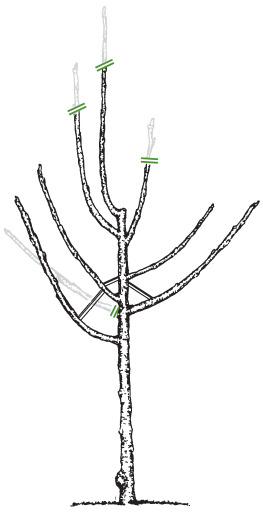
**Second year spring.** Remove any branches that are growing from the leaders toward the center of the canopy. Also remove branches that are within 15 inches of the lower tier's top scaffold. Remove branches growing downwards.

**Third year spring.** Remove any branches that are growing from the leaders toward the center of the canopy. The scaffold limbs of the second tier should be shorter than those of the first tier. Keep the leaders taller than the side branches by shortening the side branches or bending them, using string to tie the branches back. Keep the multiple leaders at roughly the same height and vigor. Remove some branches in the canopy center to allow light to penetrate throughout the tree.

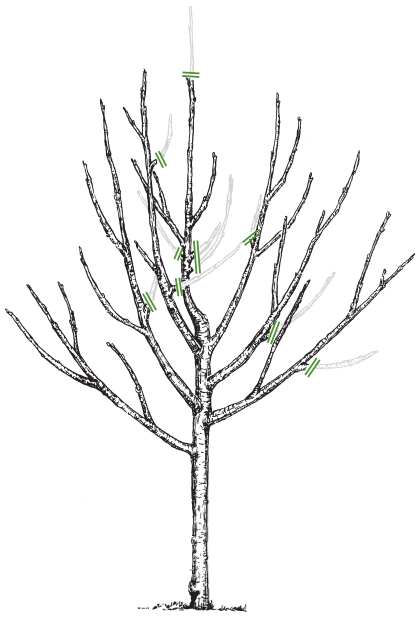
*FIGURE 7.* Use clothespins or toothpicks to spread the branches when they are no longer than 6 inches. Wedge toothpicks between the trunk and branches. Attach spring-type clothespins to the trunk and position them against branches.



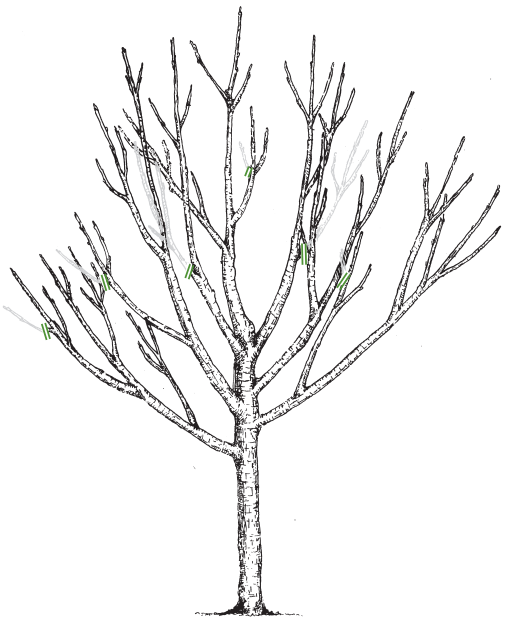
## *MULTIPLE LEADER SYSTEM*



**First year spring**



**Second year spring**



**Third year spring**

## *Open center*

This system will produce a vase-shaped tree with good light distribution in the canopy, but its structure may be weaker than that of central leader or multiple leader trees. During the first year of growth, train young branches to develop strong, wide crotches by spreading them with clothespins or toothpicks when the branches are no more than 6 inches long (figure 7).

**First year spring.** Cut the central leader out of the tree just above the uppermost scaffold limb. This will cause the lateral limbs to become dominant. Remove about one-fourth of the extension growth of these branches by cutting just above a strong, outward-facing bud to encourage further branching.

**Second year spring.** Remove any branches growing toward the center of the tree. Also remove any weak downward growing branches. Unless few lateral branches have been formed, don't cut the tips of branches.

**Third year spring.** Continue with maintenance pruning to prevent shading, to keep the canopy open, and to maintain tree size.

## *Pruning bearing trees*

When pruning older trees the goal is to maintain continuous production of high-quality fruit. Annual pruning is required. Limit pruning of mature trees to removing weak, unproductive branches, reducing tree height, and renewing fruiting wood. Don't let the upper branches grow so long that they shade the lower ones. If necessary, cut limbs back into 2-year-old wood. But don't prune pear trees too vigorously. Pruning is invigorating and will produce much succulent growth that is susceptible to fire blight. Make thinning cuts instead of heading cuts.

### *Open center system*

**First year spring** **Second year spring** **Third year spring**

## *Pruning overgrown trees*

Pruning old, overgrown trees to restore production of high-quality fruit is difficult if not impossible. Neglected old trees will never produce as much high-quality fruit as young trees, but the following techniques may improve production somewhat. To lower the height of a tree, completely remove one or two of the tallest limbs. Make the cut where the limb joins the trunk. Such heavy pruning will stimulate the tree to produce more vegetative growth. Remove water sprouts that grow near these cuts each year. The canopy interior of older trees may also need to be thinned out to allow light and spray to penetrate. Spread heavy pruning over 2 or 3 years.

# *Harvest*

Pears will not ripen on the tree. They must be harvested when mature but not completely ripe and allowed to ripen off the tree. The following signs indicate pears are ready for harvest:

- The dark, leaf-green color of the skin turns a lighter green or yellowish green.
- The lenticels (spots on the skin) change from white to brown.
- The pebbly surface of the fruit becomes smooth, taking on a waxy feel.
- The fruit stem separates from the spur or twig with an upward twist of the fruit.
- As measured by a pressure tester with a 5⁄16 inch tip, the fruit flesh firmness decreases to 18–20 pounds.

Seed color is not a good indicator of maturity. If the flesh of the fruit is brown or looks watery, the fruit is overripe and probably not palatable.

## *Harvest technique*

Harvest pears once the above maturity indicators are evident. Hold the pear in the palm of your hand and twist it slightly while pulling. Don't squeeze the fruit as this will leave bruises. Avoid pulling spurs or branches from the tree—these contain fruit buds for the next year's crop. If pears won't come off the tree without spurs or branches, they are not ready for harvest. In this case, wait a few days before harvesting. Place the fruit gently into a picking bag or basket. Empty the container carefully into boxes to prevent bruising.

## *Storage*

Once harvested, many pear cultivars will keep for several months if refrigerated properly. Discard any bruised, blemished, or diseased fruit. Store only the best fruit. Cool pears quickly and keep them below 40°F for short-term storage (up to about 5 weeks). For longer storage, temperatures of 32°–34°F and 85% humidity or above are required. Don't allow the fruit to freeze. Keeping fruit in plastic bags with small holes in the bags will help avoid water loss and shriveling. Check the fruit occasionally and remove soft or damaged fruit. Pears easily pick up odors from other foods and molds. Don't store them with onions or other vegetables.

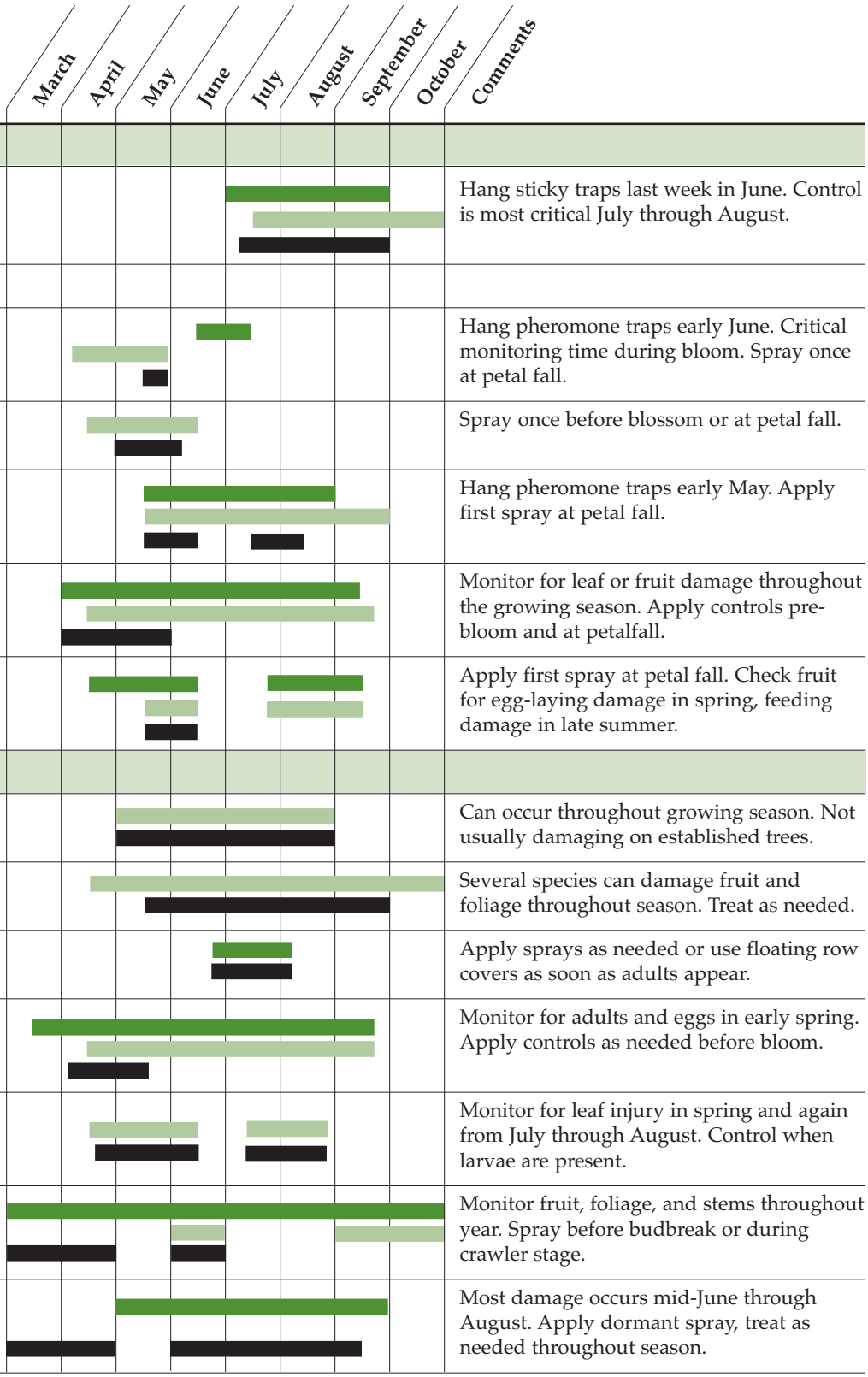
Before using pears, take them from storage and allow them to ripen at room temperature for 3–4 days. During this time the flesh should soften and the skin will turn golden yellow. To test ripeness, hold the pear in the palm of your hand and press your thumb firmly against the stem end. If the flesh yields, the pear is ripe.

# *Insect pests*

There are many types of insects and mites that attack pear foliage or fruit in Wisconsin. Many of the same insects also attack apple, but there are some additional pests as well. Pears are typically not as severely injured as apples and the insects often do not occur at damaging levels every year or in every location. Although usually there will be some insect activity, sometimes a high percentage of quality pears can be produced without insecticide applications. If insects are a problem, the first important step in control is proper identification of the pest. Your county Extension office can assist you in correctly identifying pest problems.

**Table 1.** Approximate dates for monitoring and controlling insect pests. Dates will vary depending on weather and location in state. Do not apply insecticides during blossom period.

*Monitor adult insects* *Monitor larvae and/or damage* *Control periods*




| | |
|---|---|
| ***Fruit-damaging insects*** | |
| **Apple maggot** | Hang sticky traps last week in June. Control is most critical July through August. |
| **Caterpillars** | |
| Fruittree leafroller | Hang pheromone traps early June. Critical monitoring time during bloom. Spray once at petal fall. |
| Green fruitworm | Spray once before blossom or at petal fall. |
| **Codling moth** | Hang pheromone traps early May. Apply first spray at petal fall. |
| **Eriophyid mites** | Monitor for leaf or fruit damage throughout the growing season. Apply controls pre-bloom and at petalfall. |
| **Plum curculio** | Apply first spray at petal fall. Check fruit for egg-laying damage in spring, feeding damage in late summer. |
| ***Plant-damaging insects*** | |
| **Aphids** | Can occur throughout growing season. Not usually damaging on established trees. |
| **Caterpillars** | Several species can damage fruit and foliage throughout season. Treat as needed. |
| **Japanese beetle** | Apply sprays as needed or use floating row covers as soon as adults appear. |
| **Pear psylla** | Monitor for adults and eggs in early spring. Apply controls as needed before bloom. |
| **Pear slug** | Monitor for leaf injury in spring and again from July through August. Control when larvae are present. |
| **Scale insects** | Monitor fruit, foliage, and stems throughout year. Spray before budbreak or during crawler stage. |
| **Spider mites** | Most damage occurs mid-June through August. Apply dormant spray, treat as needed throughout season. |

There are two approaches to pear insect management: a preventive approach where insecticides are applied routinely regardless of actual insect damage, and a curative approach where controls are applied only when pests are present and capable of causing significant damage.

The preventive approach is used by growers who are unable to do routine pest monitoring or who are uncomfortable trying to identify pests and damage. A minimal preventive program uses three to four insecticide sprays per year, timed at petal fall, 2 weeks after the first spray, mid-July, and early August. This spray program usually protects a substantial proportion of fruit. Where the best possible fruit quality is desired, or where insect numbers are high, a more thorough insecticide program may be necessary, with applications at 10- to 14-day intervals starting at petal fall and extending through August.

The best approach to insect pest management is the curative approach. This involves learning to recognize common pests and the types of injury caused, monitoring pest activity routinely (weekly throughout the growing season), and applying insecticides only when necessary. The chart (table 1) will help you determine when to monitor for the most serious insect pests. It summarizes when insects are likely to be present, and the best times to apply controls. Use the chart together with the detailed insect information to know when controls are appropriate. Several methods can be used to monitor insect activity, including sticky traps, pheromone traps, and visual inspection. Not all methods work on all insects. Specific monitoring information is given for each pest.

Pheromone traps are sticky traps with a synthesized attractant that mimics the natural odor or pheromone produced by female moths for attracting males for mating. The traps catch males and help identify when mating occurs. Traps can be purchased at better garden centers and through mail-order catalogs. For best results, follow manufacturer's directions.

Do not use insecticides during the blossom period. Pears are pollinated by honey bees and other insects. Broad-spectrum insecticides applied during flowering will kill these beneficial insects and interfere with pollination.

The following descriptions are of the most serious pear insects in Wisconsin. More thorough and inclusive descriptions can be found in Extension publication *Common Tree Fruit Pests* (NCR63). For additional information on specific pests and pesticides, see also the list of publications at the end of this book.

## *Fruit-damaging insects*

The most serious insect pests of pears are those that directly damage the fruit. These include apple maggot (railroad worm), various types of caterpillars such as leafrollers, fruitworms and codling moth, and plum curculio.

### Apple maggot (railroad worm)


The adult apple maggot is a type of fly that lays eggs in fruit. The larvae tunnel throughout the fruit, causing it to deteriorate and drop. Apple maggot is a summer pest, causing injury from early July until harvest. If uncontrolled, it is the most serious insect pest of apples in Wisconsin; it will also attack pears, but usually not as severely.

**Type of damage.** The adult apple maggot fly lays eggs under the skin of fruit. Several eggs may be laid in a single fruit. The fruit decomposes around the site of the sting, causing a small, darkened depression. The eggs hatch into tiny, transparent larvae that tunnel through the fruit, leaving slender, brown trails. Fruit start to deteriorate and eventually fall from the tree. Apple maggots also attack cherry and plum, as well as native hawthorn.

**Description.** The apple maggot fly is about two-thirds the size of a common house fly. Its body and wings are marked with black and white bands and spots. The larvae are headless, legless cream-colored maggots about ⅓-inch long when

*Wing-banding pattern.*

*Apple maggot*

*Black cherry fruit fly*

*Cherry fruit fly*

fully grown. Young larvae are very tiny and virtually transparent, making them difficult to find within fruit, even with the aid of a microscope.

**Monitoring.** Hang sticky traps during the last week in June and continue trapping until the first frost. There are two types of apple maggot traps: yellow sticky boards and red sticky spheres. Yellow traps are less efficient, but they pick up insects before they start to lay eggs. The red sphere trap is efficient for monitoring reproductively mature flies. An "apple volatile" lure, available for hanging with the red sphere, greatly increases the attractancy of this type of trap.

Apple maggot traps are not as selective as pheromone traps; many different types of insects can be caught on apple maggot traps. For this reason, it is important to be able to recognize the apple maggot fly and differentiate it from other, similar insects. Two types of cherry fruit flies occur in Wisconsin and are easily mistaken for the apple maggot fly. They can be distinguished based on differences in wing pattern (see illustration).

Check fruit for damage beginning mid-July and continuing until harvest. Infested fruit can be detected by the shrunken, discolored dimples. When cut into, the normally white flesh will be crossed with the pale brown trails of the young maggots.

**Prevention and control.** Use, destroy, or bury infested fruit as soon as they fall from the tree. Do not compost these fruit because larvae may survive.

Apple maggots can be controlled by trapping. Use the round red spheres along with the commercial apple volatile bait. Research shows that one trap per 100 fruit will catch most flies and will minimize fruit injury. In larger plantings, place a ring of traps around the planting by hanging traps every 50 feet on the outside of the perimeter trees.

Apple maggots can be controlled with insecticides. In lightly infested areas, spray in early July and repeat once or twice at 2- to 3-week intervals. Reduce the time between sprays in heavily infested areas. Sprays can be timed by using traps to monitor for adult fly activity; spray when the first flies are caught, and again after subsequent catches, but no more frequently than every 2 weeks.

## Caterpillars—leafrollers, fruitworms, and others


The larvae (caterpillars or "worms") of several types of moths feed on pear foliage and fruit. Leafrollers (especially fruittree leafrollers) and green fruitworms are the most common, but others include inchworms, cankerworms, and webworms. Most of these are early-season pests, causing damage shortly after the blossom period; a few cause damage in midsummer.

**Type of damage.** The larvae feed on both leaves and fruit. Young larvae feed on leaves during the blossom period, causing minimal damage to the tree. Leafrollers use silken webbing to roll leaves or tie two or more leaves together, creating a refuge in which they live and feed. Leaves are often tied around clusters of young developing fruit, and the larvae feed on the fruit surface, causing superficial smooth or corky brown scars. Such damage caused early in fruit development heals naturally, and, although the fruit is scarred, the flesh is usable and does not rot. In contrast, green fruitworms do not tie leaves together and they feed deeper into the young fruit. Feeding damage from green fruitworms may cause the fruit to abort and drop from the tree. More mature fruit in summer are not able to heal feeding wounds, and usually fall from the tree and rot. Leafrollers, green fruitworms, and similar

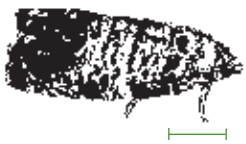
caterpillars do not tunnel into fruit, but feed only from the surface. These pests also feed on many types of broadleaf trees and shrubs, often in wooded areas adjacent to where pears or other fruit trees are planted.

**Description.** Leafroller larvae are pale yellow to pale brown, and have a yellowish, brown, or black head, depending on species. They grow from ⅛-inch long at hatching to about ¾-inch long. Green fruitworms are much larger and more robust, growing to over 1-inch long. They are green and may have small white spots or pale lines that run the length of the body.

**Monitoring.** Check during the blossom period for signs of larval feeding, which may appear as tattered leaves or leaves with holes chewed in them. Also check for leaves that appear stuck together; carefully separate these to determine if leafroller larvae can be found. Pheromone traps are available for fruittree leafrollers. These will help determine flight periods and therefore when eggs are being laid. Trap for fruittree leafroller adults from mid-June through mid-July.

**Prevention and control.** Insect populations vary from year to year, in part depending on numbers in nearby forests, wood lots, or abandoned fruit trees. In some years they may be essentially nonexistent; in other years severe defoliation or fruit injury may occur if the trees are not protected. Insecticide sprays applied at petal fall (the very end of bloom, when 75% of the flowers have fallen) will control most types of caterpillars. Traditional insecticides may be used. Also, microbial insecticides containing the active ingredient *Bacillus thuringiensis* will usually provide satisfactory control as long as they are applied when the larvae are very young.

## Codling moth




Codling moth larvae are caterpillars that feed entirely within the fruit. This is one of the insect pests that cause "wormy" fruit. Codling moth is not native to North America; its original home is Asia. It now occurs throughout the world, and is a serious pest of pears and apples.

**Type of damage.** Tiny codling moth larvae bore into the fruit and tunnel to the core. They feed on the developing seeds and adjacent tissues. Their feeding leaves black residues and rots the center of the fruit. One or more noticeable tunnels lead directly to the outside, and insect waste (frass) can pile up on the skin of the fruit. Damaged fruit fall from the tree and decompose. If harvested, damaged fruit rot rapidly, even if refrigerated.

**Description.** Codling moth larvae are less than ⅛-inch long at hatching, eventually growing to over ½ inch. Older larvae have a brown or black head and a body that is creamy white to slightly pinkish in color. Larvae have three pairs of conspicuous legs near the head and a series of fleshy legs along the body. Adult codling moths have wings with slender bands of alternating gray and tan; the tips of the front wings are shiny golden-brown. The wings are held tent-like over the body.

**Monitoring.** Pheromone traps are available for codling moth. Hang traps at the beginning of bloom and maintain them through mid-August. Replace the lures in early July in preparation for the second flight of adult moths. Check traps weekly.

Damage by larvae is easily observed because of the piles of frass on the outside of the fruit. For positive confirmation, cut open a suspect pear and check for feeding injury and rot in the core.

**Prevention and control.** If possible, eliminate wild hosts (apple, pear, hawthorn) growing within 100 yards of cultivated pear and apple trees. Remove windfall fruit, which are usually insect infested. If these fruit are not used, bury at least 2 feet deep. Larvae can complete development if fruit are merely composted. Spraying once at petal fall and again about 10 days later gives the most control. If numerous wild host plants grow nearby, pear trees will need an additional one to two sprays to control the summer generation. Time the sprays based on noticeable

increases in pheromone trap catches, usually from mid-July to early August. Microbial insecticides containing *Bacillus thuringiensis* are not particularly effective against this insect.

## Eriophyid mites

Eriophyid mites are a family of mites related to spider mites, but are even tinier. There are two species which feed on pear, pearleaf blister mite and pear rust mite. Both cause damage to foliage and fruit; the fruit damage is by far the more important.

**Type of damage.** Pear rust mite feeding causes leaves to turn brown or bronze. Severe injury does not usually occur on young trees, but when it does it can stunt growth. Of greater importance is the feeding on the fruit surface. This can cause severe russetting, leaving the fruit surface rough and brown. Damage to fruit usually starts at either the blossom end or stem end, but can eventually involve the entire fruit surface.

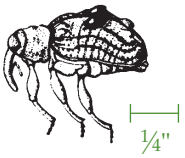
Pearleaf blister mites cause small (⅛ inch) blisters or galls on the leaf surface. Originally green, the blisters eventually turn reddish on the upper leaf surface and dark brown on the lower surface. The majority of the mites feed within the blisters, but some can be found on the leaf surface. The mites also feed on the fruit surface, causing large brown spots and even distorted fruit.

**Description.** Eriophyid mites are very tiny, only about 1/100 inch. Therefore, they are very difficult to see, even with a magnifying lens. Pear rust mite is somewhat wedge-shaped, whereas pearleaf blister mite is more elongate.

**Monitoring.** Check buds in early spring for mite activity; use a 10–20x magnifying glass, or better, a low power microscope. Good illumination will be helpful. Check leaves in spring for early signs of the development of galls caused by pearleaf blister mite.

**Prevention and control.** Low numbers of eriophyid mites do not create significant injury; they also provide alternate food for important spider mite predators. However, if populations increase to damaging levels they should be treated with an approved insecticide or miticide at prebloom and again at petalfall.

## Plum curculio




Plum curculio is a native species of weevil, a type of beetle. As its name suggests, its preferred host is plum, but it also attacks other stone fruits as well as pear and apple. Plum curculio is common throughout Wisconsin and is one of the most damaging apple insects; it is somewhat less of a problem on pear.

**Type of damage.** Plum curculios damage pears in three ways: egg laying, larvae feeding within the fruit, and adults feeding at the fruit surface. The adult female scars the fruit surface at egg laying by cutting small crescent-shaped flaps in the skin of young fruit. This damage occurs when the fruit are smaller than 1½ inches in diameter. As the fruit grows, it becomes very misshapen, with lumps and dimples. Many eggs and young larvae do not survive in the hard tissue of young pears. If they do, the larvae tunnel through the fruit, causing considerable deterioration and eventual fruit drop. Adults feed on the fruit surface, causing small, shallow irregular holes. The surrounding areas decay and rot.

**Description.** Adult weevils are less than ¼-inch long and are gray-brown to dark brown. The plum curculio has three pairs of bumps on the back, and a long curved snout on the front of the head. The larvae are pale and grub-like, with a distinct pale brown head but no legs. Fully grown larvae are about ¼-inch long.

**Monitoring.** Monitor for adult weevils from mid-April through mid-June and again from late July through mid-September. To monitor, spread a white sheet beneath a tree, then sharply tap the branches with a padded stick. Adults will fall to the sheet, pretending to be dead. Check fruit for 4 weeks beginning shortly after petal fall; look for the characteristic crescent-shaped scars.

**Prevention and control.** Collect and bury windfalls as soon as they fall. As the weevils can easily tunnel through soil, bury fruit at least 2–3 feet deep. If possible, remove vegetation from fence rows and eliminate other sites where beetles may overwinter. Chickens readily feed on migrating beetles and may provide some benefit. Do not allow chickens to forage in areas treated with pesticides or where there may be pesticide drift or runoff. Appropriate insecticides applied at petal fall and 10–14 days later will provide excellent control.

## *Plant-damaging insects*

Feeding by insects and mites on foliage or branches can hurt host trees various ways. It weakens trees so that they grow poorly; it reduces bloom and fruit set; and it results in the production of small, low-quality fruit.

### Aphids


⅛"

Several types of aphids feed on pear foliage and young stems throughout the growing season. Often feeding damage causes newly developing leaves to twist and curl. Aphids are generally of minor consequence to pear trees. They are usually under good natural control by native natural enemies. If they are too abundant, they can be controlled with approved insecticides.

### Caterpillars

Various caterpillar species are important defoliators of pear trees. Some feed on fruit as well as leaves. Eastern tent caterpillar and fall webworm are common problems. Both caterpillars are relatively large and hairy. Eastern tent caterpillars spin densely webbed "tents" in early spring, soon after the first leaves have formed. The larvae first feed in groups, outside of their tents, and several colonies can completely defoliate a tree. They return to their tents when not feeding. Fall webworms produce large loose tents which surround the colonies of feeding larvae; there are two generations, spring and late summer. For a discussion of control, see the previous section on caterpillars in "Fruit-Damaging Insects."

### Japanese beetle


⅓"

The Japanese beetle is a relatively recent invader of Wisconsin. It is most serious in the southern part of the state, but extends into central Wisconsin, and will likely continue to be an increasing problem.

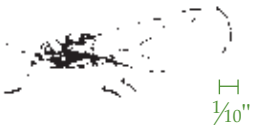
**Type of damage.** They feed on many types of trees and shrubs. The pear is a secondary host plant and may not be as seriously damaged as other fruit trees. Beetles prefer pear foliage and usually will not feed directly on the fruit. Populations can build to very large numbers, resulting in substantial defoliation of the trees.

**Description.** The ⅓ inch beetles are reddish brown and metallic green, with a series of white tufts of hair around the edge of the wing covers. The larvae are white grubs that feed on plant roots and organic matter in the soil, especially under turfgrass.

**Monitoring.** Japanese beetles are strong fliers and can invade from considerable distances from outside the immediate garden area. Watch for them from late June through early August. Modest defoliation (10–15%) will not affect mature fruit trees or yield, but higher levels of damage will stress trees and reduce crop yield and quality. Substantial defoliation to young trees will delay their establishment.

**Prevention and control.** Many insecticides registered for use on pears will kill Japanese beetle adults, but others may soon fly in from adjacent untreated areas. Japanese beetle traps are available and can catch thousands of beetles, but, because they can attract more beetles than they catch, research has shown that the use of traps can actually increase damage to small gardens. If you use traps, they should be placed at least 50 feet away from plants you wish to protect. If you have just a few small fruit trees, you may find success using the woven fabric "floating row covers" that are available to protect garden plants from flying insects.

## Pear psylla




Pear psylla is a sap-sucking insect that is not native to North America, but was introduced from Europe probably in the 1830s. It now occurs in pear-producing regions throughout the country. Pear psylla does not attack apple or other tree fruits.

**Type of damage.** There are two types of damage. Fruit russet occurs when the liquid excrement of large numbers of nymphs and adults accumulate on the fruit surface. The more important damage is "psylla shock." This refers to a combination of symptoms caused by salivary toxins that the psylla inject into the tree during feeding. At high numbers this can result in leaf or fruit drop, poor fruit quality or size, and poor fruit set the following year. Stem die-back can also occur, and the tree can be killed if it is subject to several years of heavy infestation.

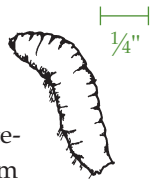
**Description.** The adults look like tiny cicadas, about 1/10 inch in length. They have membranous wings which are held roof-like over the back of the abdomen. They overwinter as adults and have three generations per year. The winter form tends to be darker colored than the summer form. The immature wingless nymphs are very broad, almost oval, and flattened.

**Monitoring.** Adults overwinter under loose bark scales on the tree. They emerge on warm days before bud-break in early spring and lay tiny cylindrical, yellow eggs at the base of dormant buds. They can be monitored early on cool mornings by placing a tray or shallow box, preferably white, under the ends of branches and lightly tapping the branches with a padded stick. The adult psylla will fall into the tray. The winged adults are also attracted to yellow sticky traps, such as apple maggot traps. Otherwise, a keen eye and careful observation will reveal the presence of the overwintered adults and the tiny yellow eggs. The same methods can be used to monitor summer generations.

**Prevention and control.** Although biological control is important in Europe, there are few successful beneficial natural enemies here in the United States. When populations build to damaging levels, insecticides are the most reliable form of control. The best timing is to apply sprays prior to blossoming to kill the overwintering adults before they lay eggs. Pear psylla has developed resistance to common insecticides in many areas. Insecticidal soap has some benefit, primarily in home orchards, but multiple applications may be necessary. Commercial growers have access to newer products that provide relatively good control. Pear psylla sprays should be applied only when populations warrant, to avoid the development of insecticide resistance.

Psylla prefer to feed on vigorous growth; they are less successful on harder growth or older stems or leaves. Therefore, trees should not be over-fertilized. Also, because heavily pruned trees produce lots of vegetative growth, trees should be pruned lightly each year. Water sprouts in the center of the tree also provide ideal food for psylla. Remove water sprouts in midsummer after the rest of the tree growth has hardened.

## Pear slug




Pear slug is not a true slug, but the larval stage of a flying insect also known as the pear sawfly. The larvae secrete a slimy material over their body surface that makes them resemble a small slug. In addition to pear, they feed on the leaves of cherry and plum.

**Type of damage.** Pear slugs are small insects that feed by chewing on the leaf surface, causing brown patches. As the larvae get larger, they feed through the leaf but leave the veins intact, causing a lace-like appearance referred to as skeletonizing. When populations are large, there can be considerable defoliation of trees during either the spring or summer generation of the insect.

**Description.** The larvae grow to a maximum size of about 1/4 inch. They are first dark greenish brown but become more pale colored as they grow. The slimy, slug-like appearance distinguishes them from all other pear pests.

The adult is a small black and yellow insect, a little larger than a house fly, but with four wings instead of two.

**Monitoring.** Inspect the foliage for the slug-like larvae and feeding injury in spring after the trees have leafed out well. Inspect again in July and August for the second generation.

**Prevention and control.** Beneficial natural enemies often provide good control of pear slugs. Also, spring and summer insecticide applications for other pests will provide control. If pear slugs are a problem, they are easily controlled with approved insecticides.

## Scale insects

Scales are tiny insects that feed by sucking sap from branches, leaves, or fruit. During most of their lives, scale insects are motionless and covered by a hard waxy coating. The shape and size of the coating varies with species. Two scale insects occasionally occur on Wisconsin pear trees, San Jose scale and oystershell scale.

**Type of damage.** Young scale crawlers can settle on fruit. Their feeding creates small (⅛–¼ inch in diameter) red halos on green or yellow fruit. In addition to fruit injury, heavy infestations can stress trees and result in die-back of stems and branches.


1/16"

**Description.** San Jose scale is very tiny, only about 1/16 inch when fully grown. Its covering is circular, in the shape of a flattened cone. It overwinters as a partially grown scale on the tree; females mature and produce young, called crawlers, by mid-June. Crawlers seek appropriate places to settle and start to feed. A second generation occurs in summer. Because of their tiny size and brown color, San Jose scales are difficult to see on branches or trunk, and they are usually first noticed when they start to infest fruit. By this time, the tree is usually heavily infested.


1/8"

Oystershell scale is less common than San Jose scale, but causes similar damage. It is slightly larger and elongate, in the shape of a mussel shell. It overwinters in the egg stage under the scale covering of the mother. Eggs hatch 2–3 weeks after pear blossom and crawlers move about until they find an appropriate place to settle on the stems or branches of the tree; occasionally they will settle on young fruit. The scales grow slowly throughout the year, and there is only one generation per year.

**Monitoring.** Because of their small size, scale insects are often overlooked unless they are abundant. If the characteristic fruit damage is seen, carefully examine the tree trunk and branches for scale colonies.

**Prevention and control.** Lime sulfur sprays or superior oil applied during dormancy controls both types of scale. Crawlers can be controlled with one to two applications of a conventional insecticide, timed 2–4 weeks after petal fall.

## Spider mites


*Size of a period.*
1/50"

Spider mites are very tiny creatures that are more closely related to scorpions, spiders, and ticks than they are to insects. There are many different types of spider mites, all of which are plant feeders. Two types, European red mite and twospotted spider mite, commonly attack pear.

**Type of damage.** Mites suck sap and nutrients from leaves. Their feeding damages leaf surfaces, causes moisture loss, and reduces the plant's capacity to produce energy for growth and fruiting. Damaged leaves first become slightly yellow, then take on a purplish or bronze coloration.

**Description.** Both species of spider mite are very tiny, only about 1/50-inch long when fully grown. Twospotted spider mites are pale yellow, with a large dark spot on either side of the body. These mites produce very fine silken webbing along the leaf edges and veins, which becomes quite noticeable when population numbers are high. European red mites are dark reddish brown and do not produce silken webbing. Both types of mites have many generations each year and can build to very high levels. They reproduce

more rapidly in warm, dry weather and can average more than 100 per leaf.

**Monitoring.** Because of their very small size, it is helpful to have a 10–15x magnifying glass when checking for mites. If you see leaf discoloration and suspect mites, check 10 randomly selected leaves from each tree. Most mites will be on the lower leaf surfaces. When smashed between thumb and forefinger, or against a piece of white paper, mites will leave a small brownish stain. In early spring, check stems near buds for eggs of European red mites.

**Prevention and control.** Natural controls are important in regulating spider mites. Heavy rains wash many from leaves, especially on smaller or well-pruned trees. Many beneficial predators occur naturally; these include tiny predatory mites as well as lady beetles, lacewings, and other insects that feed on mites.

A dormant superior oil spray applied at the time of "tight cluster" (as the flower buds first become noticeable) will kill overwintering eggs of European red mite. However, this treatment is ineffective against twospotted spider mites, which do not overwinter on the tree. Insecticidal soap and certain types of conventional insecticides will suppress mites during the growing season, but may not provide complete control. If numbers are high, two applications 5–7 days apart may be needed.

## Diseases

Many disease-causing pathogens (fungi, bacteria, viruses, and nematodes) attack pear trees. Diseases can damage fruit directly, or they can injure the tree by invading the leaves, branches, roots, or trunk. Damage to the tree reduces productivity and increases susceptibility to winter injury or attack by other pests. In order to produce high-quality fruit consistently, you must manage diseases. For additional information on specific diseases, see the list of publications at the end of this book.

### *Fire blight*

Fire blight, caused by the bacterium *Erwinia amylovora*, is the most serious disease of pears in Wisconsin. Fire blight precludes commercial production of pears in this part of the country. Most pear cultivars, including Bartlett, Bosc, Clapp's Favorite, d'Anjou, Flemish Beauty, and LeConte are highly susceptible to fire blight. Likewise, pear and quince rootstocks are susceptible, and if infected, the trees die.

**Symptoms.** Infected flowers appear water-soaked or greasy and then turn brown and dry. Infected leaves are wilted and dark brown or black as though scorched by fire. Dead leaves remain on the tree throughout the summer. Young infected branch tips frequently bend over, giving a "shepherd's crook" appearance. A milky ooze containing the fire blight bacterium is sometimes seen on the surfaces of infected stems. After a few days the ooze turns brown and hardens. Branch cankers vary in size and are frequently sunken and cracked. Internally infected tissue becomes discolored with reddish-brown streaks.

Fire blight is spread by splashing rain, wind, hail, insects, and pruning tools. The pathogen is sometimes carried on nursery stock without visible symptoms. Temperatures above 65°F and relative humidity above 65% favor disease development. After infecting blossoms, the bacteria move into the blossom spurs and then into supporting branches. The pathogen can also move internally to roots; rootstock infections are lethal. This movement into woody tissues allows cankers to form. The bacteria overwinter in these cankers and kill the sections of branches beyond the cankers.

**Prevention and control.** Because fire blight infections are systemic, the disease is difficult to control once established in a tree or orchard. The most effective control measure is prevention. No cultivars or rootstocks are immune, but several are relatively resistant. These include Harrow Delight, Harrow Sweet, Magness, and Moonglow. Examine nursery stock for symp-

toms. Do not overfertilize with nitrogen as this promotes succulent growth which is highly susceptible to fire blight.

If infections are few enough so that it is practical to remove them all, prune them out by cutting at least 12 inches below the lowest visible symptoms. Disinfect pruning tools by submerging them in a mixture of 1 part household bleach plus 9 parts water for at least 30 seconds. If infections are so numerous that it is impractical to remove them all, then wait until late winter or spring pruning to remove them.

Sucking insects such as aphids, leafhoppers, and pear psylla create wounds through which bacteria may enter, and some of these insects may spread the pathogen. Thus, insects should be controlled, but do not apply insecticides when fruit trees are in bloom as this could kill pollinators.

Antibiotics do not provide consistent control of fire blight and are not recommended for hobbyists and other non-commercial growers. Copper-containing compounds such as Bordeaux mixture may help reduce the amount of bacteria on canker margins in the spring. However, copper can be toxic to leaves and fruit and should not be used after leaves are about ¼-inch long. Because the fire blight pathogen is a bacterium, fungicides offer no control.

## *Pear scab*

Pear scab, a disease similar to apple scab, is caused by the fungus *Venturia pirina*. The disease damages leaves, twigs, and fruit. Pear scab is less common than apple scab, but once established the disease can be severe. The pear scab fungus will not infect apple, and the apple scab fungus will not infect pear.

**Symptoms.** Lesions on fruit and twigs are initially olive-colored and velvety but later turn black and corky. Lesions can be pared from the fruit, leaving the remaining portion unaffected and edible. Leaf lesions are somewhat inconspicuous but are most apparent on the undersides of leaves.

Trees are susceptible to scab from the time leaves emerge in the spring through harvest. The scab fungus overwinters in leaves on the ground. Rain or heavy dew triggers the release of spores starting at about the time when new leaves are emerging. Maximum spore release occurs between bloom and petal fall. Infection and disease development is favored by leaf wetness and mild temperatures (55°–75°F). From primary infections, more spores are produced which cause secondary infections. Preventing primary infections is the key to controlling pear scab.

**Prevention and control.** No cultivars are resistant to pear scab. Nevertheless, pear scab is usually not a serious problem and can be managed by sanitation and fungicides applied early in the season. Leaves should be raked in the fall or in the spring before buds begin to swell. Compost, burn, or bury the leaves to kill the fungus. If fungicides are used, they should be applied when leaves are ¼–½ inch long, and one or two more times until about a week past petal fall.

## *Sooty blotch and flyspeck*

Sooty blotch and flyspeck are separate fungal diseases that often occur together on apple and pear fruit during late summer. Both diseases are favored by extended periods of warm, humid weather and are usually not serious problems in Wisconsin. However, in organic orchards or home gardens where fungicides are not used, the diseases occur more frequently.

**Symptoms.** Sooty blotch appears as irregularly shaped olive-green to dull black smudge-like blemishes on fruit. Flyspeck appears as clusters of distinct, black, shiny, pinpoint-sized dots. Neither disease will cause a serious rot, and affected fruit can be eaten safely.

The fungi that cause sooty blotch and flyspeck overwinter on twigs of apple, pear, and many different woody plants commonly found in hedgerows and wood lots. Spores or fragments of the fungi that cause sooty blotch are spread by splashing rain from reservoirs onto developing fruit about 2–3 weeks after petal fall. Spores of

the flyspeck fungus are released during rainy periods, become airborne, and are carried to fruit. Because the infections are confined to the peel of the fruit, disease development is highly sensitive to environmental conditions at the fruit surface. Optimal temperatures for spore germination are 60°–80°F. Both diseases develop only when relative humidity is very high (greater than 90% for sooty blotch; greater than 95% for flyspeck).

**Prevention and control.** Cultural practices that promote air circulation and drying, such as fruit thinning and pruning, will reduce the relative humidity at the fruit surface and should reduce the incidence and severity of sooty blotch and flyspeck. Choose planting sites that have good air movement and that are not adjacent to wood lots. Destruction of nearby hosts, especially raspberry and blackberry, is not always practical but will reduce the inoculum available to infect pear fruits. Remove prunings from the vicinity or destroy them by burning, burying, or mulching and composting. Some fungicides are effective against these diseases, but are not necessary in most years in Wisconsin.

## *Canker diseases*

Several different fungi can cause cankers on branches and trunks. If severe, canker diseases can disfigure or kill trees. Canker pathogens often infect through wounds created by improper pruning, broken limbs, and "southwest" injury. Southwest injury occurs when trunks expand after exposure to intense sunlight on winter days, and then quickly contract as the temperature falls at sunset. Trees that are further weakened during the growing season by environmental stresses such as drought or disease and insect pests are especially susceptible to canker development.

**Prevention and control.** Train trees properly so they are structurally strong and less prone to mechanical damage. Prune properly so wounds heal quickly. (See the section on training and pruning.) Irrigating during dry periods will bolster the tree's defense mechanisms and reduce canker development. Do not apply nitrogen after August 1 as this will delay winter hardiness. Applying white latex paint to the southwest side of trunks will help reflect sunlight during winter and minimize cracking due to rapid expansion and contraction.

# *Problem solving*

## *Why pear trees fail to bear fruit*

There are many reasons why pear trees fail to bear fruit—spring frosts, poor pollination, age of trees, too much pruning, and too little training. This section describes the most common problems and how to avoid them.

**Cold injury.** Perhaps the most common reason trees lack fruit is spring frost. Temperatures at or below 28°F during bloom will kill flowers. When flowers are damaged by spring frosts no fruit can form. Extremely cold winter temperatures may also kill flower buds. This is a serious problem for cultivars with marginal hardiness (d'Anjou and Bosc, for example) and for most cultivars grown in northern Wisconsin. You can avoid these problems by choosing good sites and by planting recommended cultivars.

**Pollination problems.** Poor pollination during flowering may also lead to few or no fruit. Bees or other insects are required for pollinating pear flowers. If the weather is cold, cloudy, windy, or rainy, bees do not forage well. When they don't transfer pollen, no fruit results. Since pears are self-unfruitful, pollen for each flower must come from another pear cultivar that blooms at the same time. A lack of compatible pollen may also lead to no fruit. It is important that pollinizer trees be within 200 yards of your pear trees.

If you have only one pear tree and no pollinizer trees nearby, you can provide pollen by cutting branches from a tree of a different pear cultivar and placing them in a bucket of water near your pear tree.

**Tree age.** Pear trees must pass from a juvenile to a mature stage before they will produce fruit. Trees on dwarfing rootstocks will bear fruit 3–4

years after planting; on seedling rootstocks, pear trees will bear fruit 6–7 years after planting.

**Heavy pruning.** Too much pruning, particularly heading cuts into 1-year-old wood, will cause trees to produce a lot of strong vegetative growth. When trees are vegetatively invigorated they will produce few fruit buds and fruit. Prune trees only as needed to train the tree to the desired shape and to allow light into the canopy. Don't prune trees with hedge shears or similar tools, because this encourages multiple branches to grow. See the "Training and Pruning" section for more information.

**Poor training.** Trees that have not been trained properly, especially those with strongly vertical limbs, will produce few, if any, fruit. Bend branches on these trees so they extend out at a 30° angle (60° from vertical). Hold them in that position with a notched stick or weight, or tie the limb down with strong twine or light rope. Bending branches toward horizontal will increase their fruitfulness.

**Too much fertilizer.** Trees that receive too much nitrogen fertilizer produce excessive vegetative growth. This growth comes at the expense of fruit production.

## *Poor fruit quality*

In some instances pear trees produce fruit, but the pears are of poor quality and small. Several problems may lead to this condition.

**Fruit from rootstock.** Most pear trees are "two-piece trees" composed of a rootstock and a scion. If the scion is killed but the rootstock continues to grow, the rootstock can generate a tree that will produce fruit. This fruit is usually inferior in size, taste, and quality. Occasionally nurseries fail to remove a tree when the scion's budding or grafting was unsuccessful. These trees will also produce poor fruit. If a pear tree is girdled or dies back to ground level, it is better to replace the tree than to risk having the rootstock produce fruit.

**Neglected plantings.** Fruit quality suffers when trees are not properly trained, pruned and fertilized, or if diseases and insects are not managed. Trees may be defoliated prematurely, leading to low vigor and poor fruit quality. In other cases diseases or insects may attack the fruit itself, rendering it inedible.

**Poor growing conditions.** Trees planted in unsuitable sites will produce poor-quality fruit. Strong shade prevents trees from manufacturing sufficient carbohydrates to produce quality fruit. Windy sites may promote the growth of wood rather than fruit. Carefully consider site selection before planting. The section "Site Selection and Preparation" offers advice on this.

**Fruit russetting.** It is common for pears to have some russetting—that is, corky, brownish patches—on the skin. Russetting does not reduce fruit quality but may make pears unattractive. Russetting has at least three causes. Some cultivars, such as Bosc, are normally russetted. Russetting may also be caused by cool, moist conditions early in the growing season and may be exacerbated by some pesticides. Finally, powdery mildew disease can cause patches of russetting on fruit. Little can be done to prevent russetting, and since it does not reduce fruit quality, you should try to ignore it.

**Improper harvest.** Pears will not ripen on the tree and should be harvested at the mature green stage. After harvesting them, store pears in a cool, dry place to allow ripening to occur. Remove pears from cold storage and leave them at room temperature for a few days before serving them. The flesh will soften and the skin will turn golden yellow. If fruit are allowed to stay on the tree too long, the flesh around the core will turn brown, making the fruit inedible.

**Inferior cultivars.** Inferior cultivars produce inferior fruit. Also, volunteer seedlings will likely produce poor fruit. For the best chance of success, plant cultivars recommended in Extension publications *Home Fruit Cultivars for Northern Wisconsin* (A2488) and *Home Fruit Cultivars for Southern Wisconsin* (A2582).

## *Why plantings fail*

Plant death is usually caused by a number of interacting factors rather than a single identifiable cause. One injury may provide sufficient stress to allow other problems to kill the tree. Several common reasons for tree death are described below.

**Winter cold injury.** Although most pears are cold hardy in southern Wisconsin, extremely cold weather will damage the scion, the rootstock, or both. Some cultivars, such as d'Anjou and Bosc, are not reliably hardy anywhere in Wisconsin. Winter-injured trees often leaf out in the spring and may even flower. But the leaves are typically small and narrow; if damage is severe, the tree may die within 4–6 weeks. Damage to the layer beneath the bark—the cambium—will cause it to be reddish brown; healthy tissue is cream-colored. Even modest winter injury may weaken trees, making them more susceptible to other problems.

Winter injury can be avoided by selecting appropriate sites and by planting only recommended, hardy cultivars. Also, avoid fertilizing pear trees after August 1, and pruning after August 15. Control insect and disease pests to assure the trees go into winter in good health.

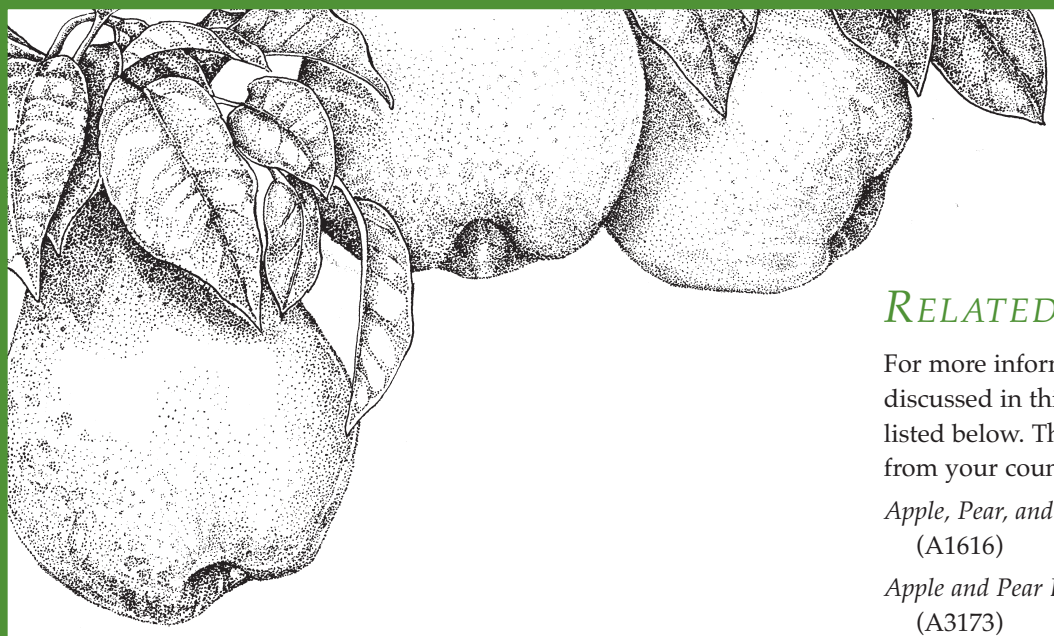
**Too much water.** Pear trees will not tolerate "wet feet." Wet soil conditions lasting more than 2–3 days during the growing season will likely damage the roots. Water fills the pores in the soil, depriving the roots of oxygen. Once the roots are weakened, if water is still present, collar rot often moves in and kills the tree. Poor soil drainage is common in soils with a high clay content and in low areas. Avoid these problems by choosing sites with good soil drainage.

**Too little water.** Drought is also difficult for pear trees, particularly young ones. When water is scarce, roots cannot supply enough water to replace that lost by the leaves through transpiration. Sandy soils hold little water and are particularly drought-prone. Drought stress is easily solved by regular watering. Young trees should receive 3–5 gallons of water per week. Irrigation also benefits mature trees during dry weather.

**Physical damage.** The lower bark of pear tree trunks can be damaged by small animals feeding in the winter and by lawnmowers and string trimmers. If a large portion of the bark has been removed, the tree will weaken but may survive. If a complete ring of bark is removed so that the tree is girdled, death will occur shortly after growth begins in the spring. To prevent physical damage, keep the area around the trunk free of grass and weeds. Don't pile mulch up against the trunk. This will prevent rodents and rabbits from nesting and will make the trees less attractive as a food source. Keep vegetation around the planting mowed short, particularly in fall. You can also wrap tree trunks with wire trunk-guards made from an 18-inch square of ¼- or ½-inch mesh hardware cloth. For more information about rodent control, see Extension publication *Meadow Mouse Control* (A2148).

Deer will also feed on pear trees. They tend to eat the tips of shoots in late winter or early spring. When deer browse trees heavily it is more difficult to train and prune trees correctly. Deer may also rub against young trees, scraping off the bark and killing the tree. If deer pressure is low, repellents can reduce or eliminate injury. Inexpensive repellents include human hair hung in fabric-net bags in each tree. Small, hotel-size bars of soap can also be effective repellents. Leave the wrapper on the bar, poke a hole through the soap and hang it on the tree with a short piece of wire. All repellents last only a few weeks to a few months and need to be replenished often. If deer pressure is heavy, only fencing will keep them away from trees. For more information on preventing deer damage see Extension publication *Controlling Deer Damage in Wisconsin* (G3083).

**Insect and disease pests.** Severe insect and disease infestations can weaken trees, making them more prone to winter injury. While these problems seldom kill trees outright, they contribute to death. Fire blight is an exception in that it can quickly kill susceptible pear trees given proper weather conditions. Manage insect and disease pests using the practices described earlier.



## Related publications

For more information on many of the subjects discussed in this publication, see the resources listed below. These publications are available from your county Extension office.

*Apple, Pear, and Other Trees Disorder: Fire Blight* (A1616)

*Apple and Pear Disorder: Sooty Blotch and Flyspeck* (A3173)

*Controlling Deer Damage in Wisconsin* (G3083)

*Diseases of Tree Fruits in the East* (NCR045)

*Fruit Crop Pollination* (A3742)

*Home Fruit Cultivars for Northern Wisconsin* (A2488)

*Home Fruit Cultivars for Southern Wisconsin* (A2582)

*Meadow Mouse Control* (A2148)

*Rootstocks for Fruit Trees in Wisconsin* (A3561)

*Sampling Lawn and Garden Soils for Soil Testing* (A2166)

*Tree Fruits: Insect and Disease Management for Backyard Fruit Growers in the Midwest* (AIDEA3)

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