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Pruning Fruit Trees

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Pruning, maintenance techniques, and timing for fruit trees are different than for other trees in the landscape. Applying good cultural practices and pruning techniques can help to improve the potential for high-quality fruit. Pruning is often neglected either due to a lack of pruning skills and knowledge or fear that improper pruning can lead to injury or death of a fruit tree.

Pruning Objectives:

- Obtain maximum light exposure for both leaves and fruit
- Provide uniform distribution of fruiting wood along the scaffold branches
- Control size and health of the tree
- Reduce limb breakage
- Produce high-quality fruit of desired size
- Increase air flow in the tree to improve production and reduce potential for disease
- Ensure a healthy root system by root pruning at planting, if necessary

A major requirement for the backyard gardener is creating a small tree open enough to allow effective spraying with home equipment and easy gathering of fruit. Pruning, combined with selection of fruit trees on dwarfing rootstocks, helps accomplish this requirement. Although pruning is essential in development and maintenance of fruit trees, excessive pruning in young fruit trees will delay fruiting.

Normal maintenance pruning throughout the life of the tree is done during dormancy, from January through March. However, pruning may be needed when a new tree is planted (*Figure 1*). Additionally, summer pruning is done with some vigorous fruit tree cultivars to balance tree growth and fruit production.

Figure 1. Damaged roots should be pruned before a tree is planted.

Pruning at Planting

Pruning of tree roots, branches, and trunks may be necessary at planting for several reasons. First, damaged roots are cut back to sound tissue. Root damage creates an opening for disease entry, while clean pruning cuts minimize wound sites. Roots too long to fit in the planting hole are also pruned back to sound tissue. Bending roots to make them fit the planting hole usually results in circling roots; the better course of action for long roots is to simply dig the planting hole wider to accommodate them.

History of Fruit Production in Nebraska

Currently, Nebraska is famous for its bountiful production of grain and livestock, but in the late 1800s and early 1900s Nebraska was a nationally recognized fruit-producing state. Nebraska's move toward fruit production began in the mid-1850s as pioneers crossed the Missouri River at Brownville on the Brownville Ferry. Many settlers homesteaded near the crossing in Nemaha County in southeast Nebraska.

Publications from the Nebraska Horticultural Society, which began publishing its yearly proceedings in the 1850s, tell us that during this period Judge J.W. Hall of Brownville planted the first apple tree in what was to be the state of Nebraska. The variety was unknown, but reportedly the tree bore yellow fruit claimed to be as sweet as honey and exhibited amazing vigor, resulting in production 17 months after planting. The vigor and fruit quality were attributed to the rich soil of the region, and a fruit production industry was born.

A full complement of both tree and small fruits was produced throughout Nebraska in both commercial and smaller plantings. The majority of commercial production took place in eastern Nebraska with the greatest concentration found in the southeast area of the state. Commercial orchards with hundreds of acres were planted. Most homesteads had groves of fruit trees to supply their needs. Apples, peaches, plums, apricots, pears, and tart cherries were planted throughout the region. Small fruits such as raspberries, blackberries, gooseberries, and grapes also were produced.

The face of Nebraska's fruit industry began to change with Prohibition, the Great Depression, and, most notably, the Armistice Day freeze on Nov. 11, 1940. During the late 1930s into 1940, Nebraska experienced a prolonged drought. The growing season of 1940 was very warm and dry, and the first freeze normally experienced in October never came. Light rain began to fall, nourishing the fall-canopied trees, the rain fell heavier, and the fruit trees pulled in the moisture. Temperatures dropped overnight from the 60s to below zero, causing the trunks of the trees to rupture as the water inside them froze. Hundreds of acres of commercial orchards, as well as countless smaller plantings of fruit crops, were destroyed. Between cleanup costs and the economic times, few trees were replaced and orchards were converted to row crops.

Now, Nebraskans are showing renewed interest in planting a few fruit trees in their yards or on acreages. Many remember the day when their grandparents grew the fruit that they ate directly off the tree or canned for later use.

(Acreage eNews—December 2013—Fruit Trees Offer Backyard Bounty By Vaughn Hammond, former Nebraska Extension Specialty Crops Educator)

Prune selected branches (if not pre-pruned at the nursery) back to about half their length and remove branches that form narrow angles less than 45 degrees with the trunk or those less than 6 inches from other branches. Refer to the 45 degree angle branches in *Figure 2*. Inspect containerized trees for circling roots and root prune to eliminate them. Circling roots will not establish beyond the planting hole, restricting tree growth and eventually damaging other healthy roots.

Critical Pruning Window of Opportunity

Variable weather from year to year in Nebraska alters when a fruit tree is truly dormant and ready to be pruned. Most pruning is done during the dormant season when no leaves are on the tree. The ideal dormant pruning window is January through March.

Cultivated varieties susceptible to winter injury are pruned in late spring before growth begins, rather than in January or February. Do not prune any fruit tree before January or winter injury may occur. Aside from dormant pruning, summer pruning can be done after vegetative growth is several inches long to restrict growth, optimizing light penetration and airflow, and minimizing shading. To minimize the potential for winter injury, summer pruning should not be done after the end of August. Suckers (shoots that grow from the base of the tree), water sprouts (shoots that arise from latent buds on the trunk or scaffold branches), and diseased or damaged wood can be removed anytime during the year.

Dormant pruning is an invigorating process as carbohydrates stored in the tree's trunk and root system have a smaller top portion of the tree to support. In the spring, the tree will respond by producing many new shoots, which may be especially useful when rejuvenating neglected trees. Excessive dormant pruning may cause the tree to produce many water sprouts, diverting energy from fruit growth and development. Therefore, it is best to limit dormant pruning to cuts that remove damaged, diseased, and dead wood and those that develop the tree's desired shape. Summer pruning, on the other hand, reduces tree vigor, resulting in a reduction

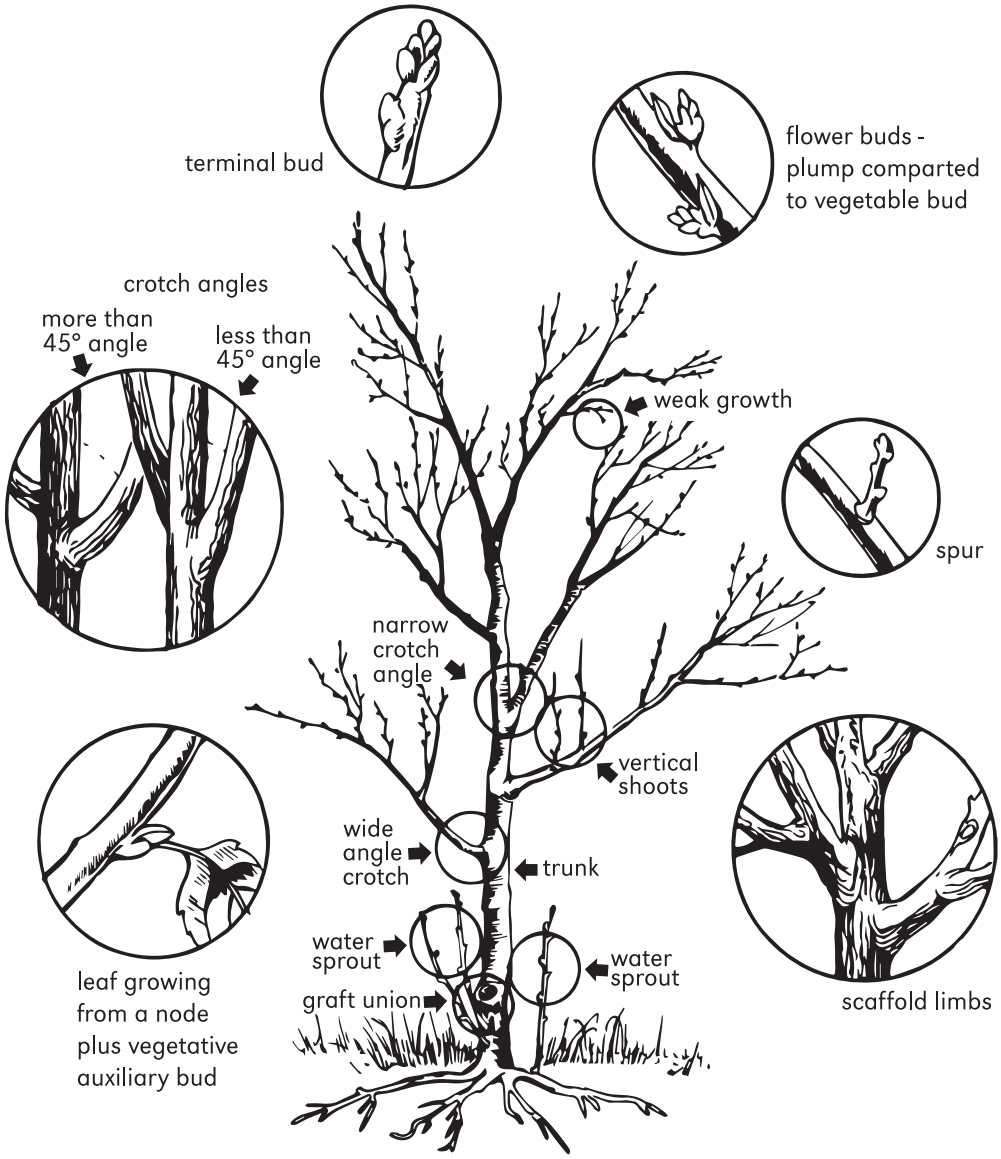

Figure 2. Parts of a fruit tree.

in tree growth. This dwarfing effect can be used to the orchardist's advantage to balance the growth of overly vigorous trees with fruit growth and development. Summer pruning is usually done from June through August, though the greatest benefits are achieved when summer pruning is completed in early summer, when fruit are still small.

Pruning Unbranched Trees or Whips

The trunk and branches of a new fruit tree may require pruning immediately after planting. Unbranched trees, called "whips," are pruned to initiate secondary branch growth at a proper height for later harvest. Prune the whip back to a healthy bud at the following height, based on tree type:

- Standard trees, 44 inches
- Semi-dwarf trees, 36–40 inches
- Dwarf trees, 29–30 inches

Pruning Branched Trees at Time of Planting

Bare root trees can be shipped to the nursery or orchardist pruned or not. If trees were pre-pruned, no additional pruning is needed until the dormant season following planting. If trees were not pruned at the production nursery, prune selected branches back to about half their length and remove branches that form narrow angles less than 45 degrees with

Figure 3. Examples of hand pruning equipment: (a) scissors-cut hand shears, (b) lopping shears, and (c) curved pruning saw. Photos: Oregon State University.

the trunk or those less than 6 inches from other branches.

Once the basic training structure of a young tree is developed, pruning should be restricted to minimal maintenance cuts to remove water sprouts and damaged wood until fruit production begins. At that point, maintenance pruning takes over.

Pruning Equipment

Hand pruning equipment:

- Scissors-cut hand shears
- Lopping shears
- Curved pruning saw or bow saw

Three tools are essential for pruning: hand shears for cuts up to one-half inch in diameter; lopping shears for cuts up to 1 inch in diameter; and a curved saw or swivel-blade orchard pruning saw for larger cuts (*Figure 3*) to avoid ragged cuts that can slow healing and reduce plant vigor. To disinfect tools between cuts, use either a 70 percent denatured alcohol solution or household bleach at one part bleach to nine parts water. Use a sponge or spray bottle to apply these solutions to your tools between pruning cuts.

Types of Pruning Cuts

There are basically two stages in the life of a tree that require radically different approaches to pruning. Pruning during the period of structural development establishes the basic framework of the tree and is referred to as **training**. How many years of training depends on the tree's classification as a dwarf, semi-dwarf, or standard:

- Dwarf—two to three years
- Semi-dwarf—three to four years
- Standard—five to eight years, depending on variety

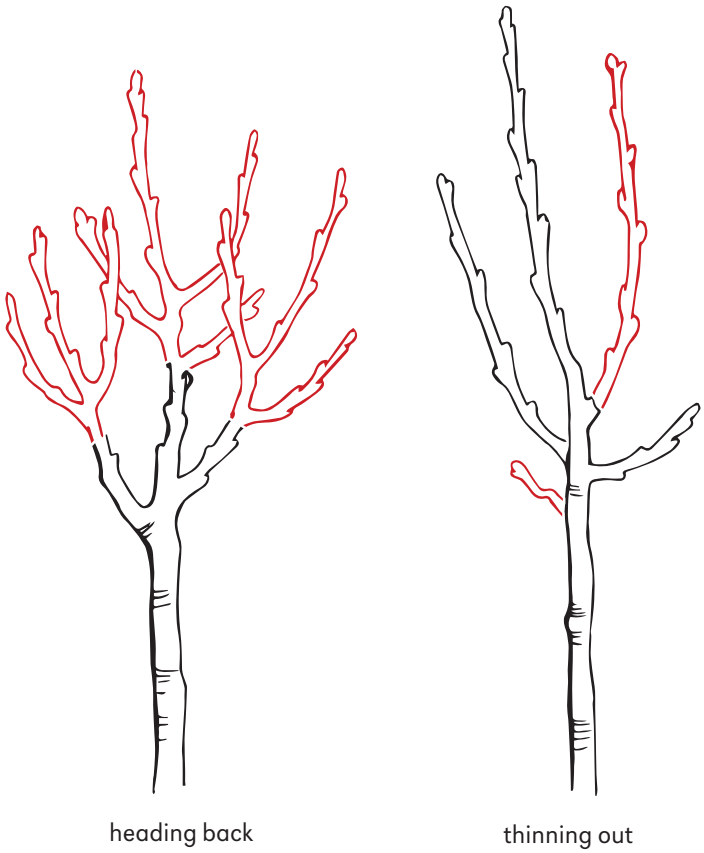

Figure 4. Basic pruning cuts.

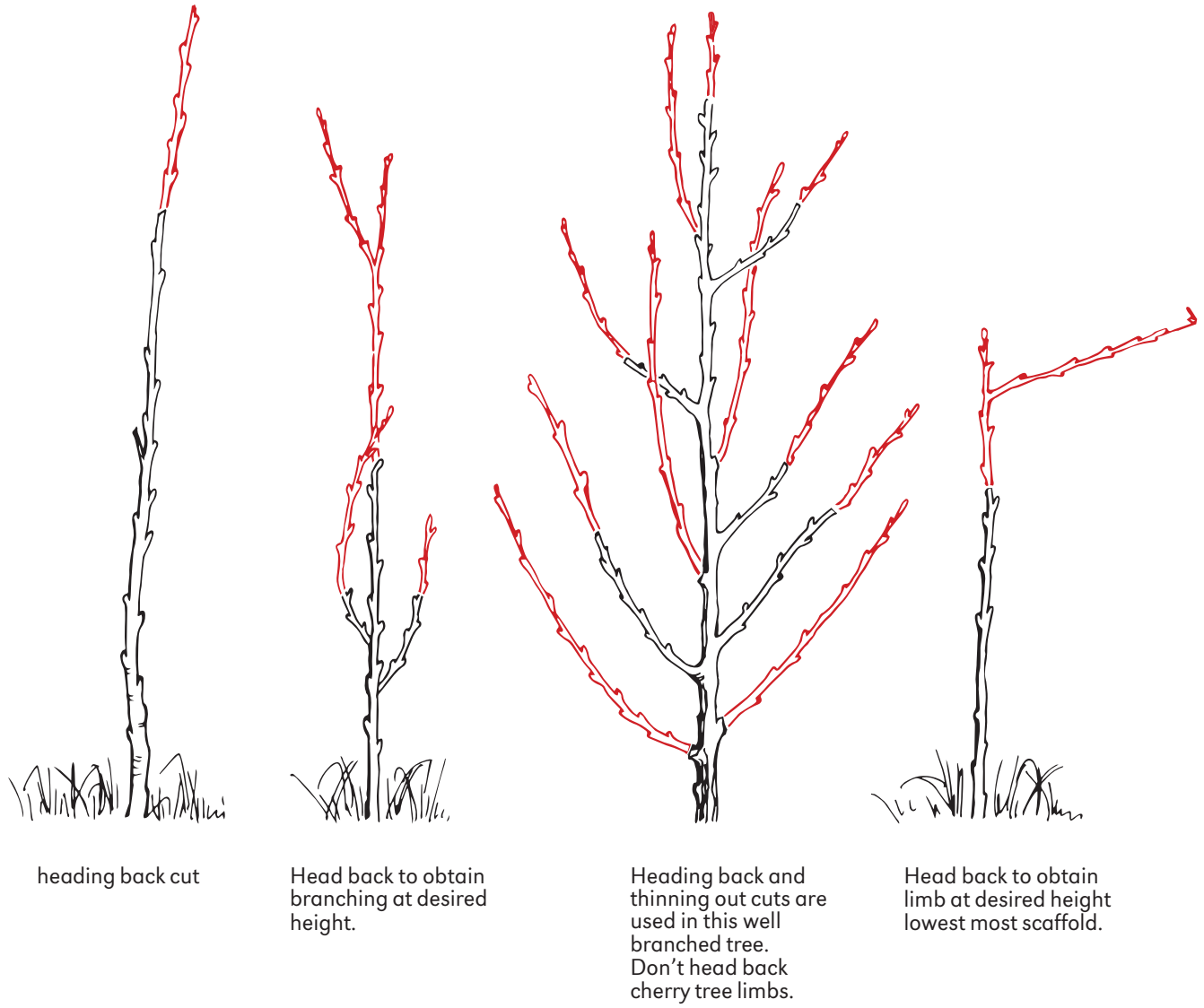

Figure 5. Pruning branched trees at planting.

Pruning that is done after training is complete and fruiting occurs is called **renewal** or **maintenance** pruning. The primary purpose of this pruning is to maintain tree size, shape, and vigor. Renewal pruning is achieved through thinning and heading back, which encourages growth of new fruiting shoots. Maintenance pruning involves removing suckers and damaged or diseased branches.

When thinning out, entire shoots or branches are removed back to a lateral branch, scaffold branch, or the main trunk (*Figures 4 and 5*). Since the entire shoot or branch is removed, no lateral growth from that shoot or branch is possible. Utilize heading back to slow growth and discourage competition with the leader, to overcome unequal growth of two scaffold branches, to direct branches, or to encourage lateral growth. Heading back cuts are made in 1- or 2-year-old wood. Cuts in 2-year-old wood usually result in good lateral growth but relatively little extension growth. For vigorous cultivars like Red Delicious, cut into 2-year-old wood. Make thinning cuts to remove undesirable growth such as upright branches that compete with the leader, branches that cross, and branches that will be structurally weak because of narrow crotch angles.

Historically, it was recommended that pruning wounds be covered with pruning sealants. This practice is no longer recommended. Incomplete applications and seals over pruning cuts can trap moisture and bacteria, increasing disease and damage to the tree. Research has shown that use of these compounds does not enhance the healing process and may actually impede it.

Training Systems

Several training systems are used in tree fruit production. Each system has advantages and disadvantages depending

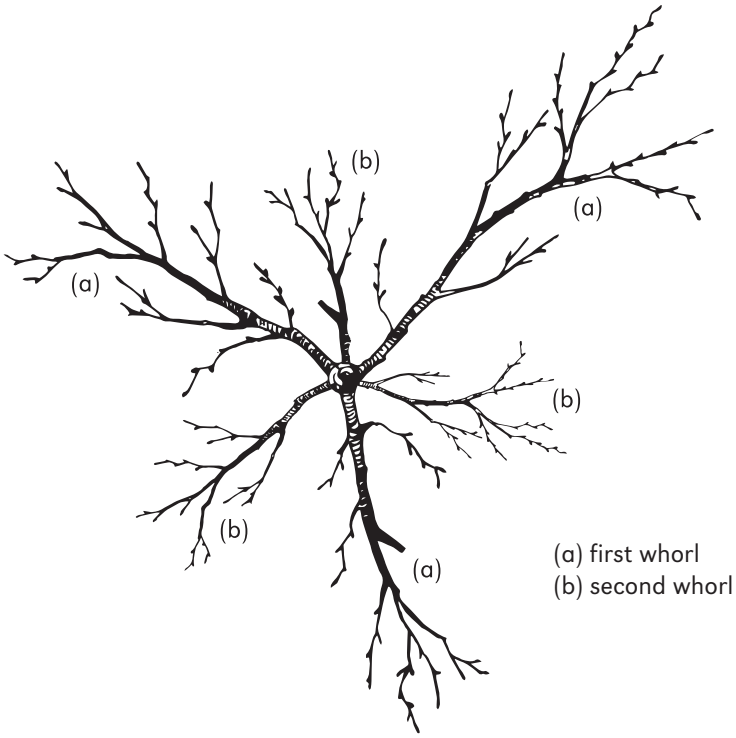

Figure 6. Desired distribution of scaffolds.

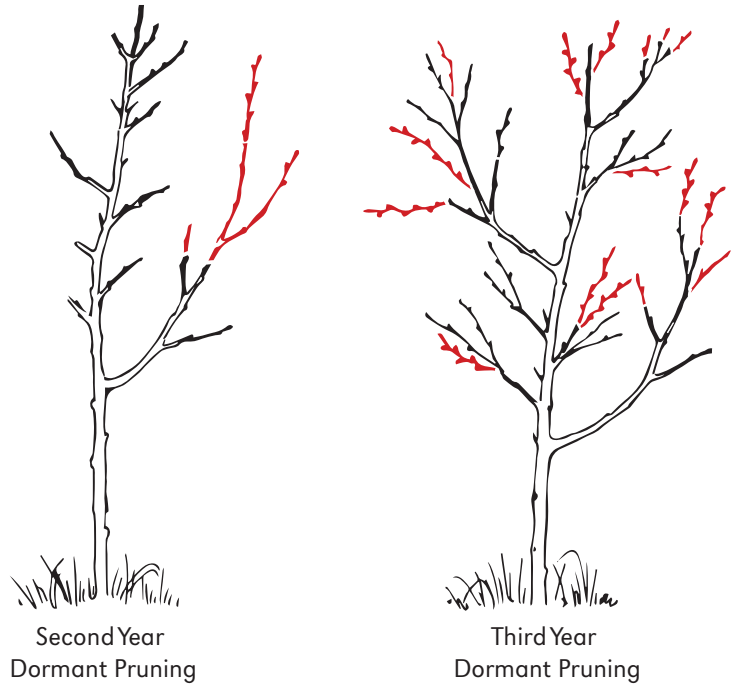

Figure 7. Second and third year dormant pruning.

on site, purpose, and cultivar. Trees are pruned differently in each system. Some systems, such as the central leader, modified central leader, or vase-shape, are adapted for freestanding trees while other systems are used with trellised or supported trees. The modified central leader is the most versatile and easy-to-learn training system.

Modified Leader System

Any fruit tree, regardless of rootstock, can be trained using the modified leader system. Development of the modified leader system in a young tree begins with dormant season pruning in its second year of growth, one year after planting.

Modified Leader Pruning System

1. Retain scaffold branches (up to four) that are spaced 6 to 10 inches apart vertically (*Figure 6*) and with broad branch-trunk angles (45 degrees or more). Branches located in desirable locations that are less than 45 degrees may be widened through the use of spreaders or weights. Please refer to the section on spreading, on page 10.
2. The lowest scaffold branch should be 20 to 24 inches aboveground. If possible, the lowest scaffold branch should point to the southwest so that it shades the trunk to reduce freezing and trunk cracking.
3. Save one strong, upright growing branch at the top of the central axis. This serves as the leader.
4. Maintain dominance of the leader. The leader should be two times longer (taller) than the longest side lateral branch. Begin to spread lateral branches based on each specific fruit tree species. For example, pear trees should have a multiple leader system to compensate for future lost leaders.

Third Year Dormant Pruning

1. Retain two or three additional scaffold branches the second year of tree life. Promote two or three new scaffold branches the third year (*Figure 7*). In the fourth year, promote an additional two or three scaffold branches.
2. Maintain dominance of the leader by shortening long side branches, if necessary. Scaffold branches should not be longer than the leader. Some of the scaffold branches will have rebranched by the third year, and two or three of these secondary laterals should be retained on each branch. Treat each of the scaffold branches as a young tree. Do not allow laterals of the scaffold branch to com-

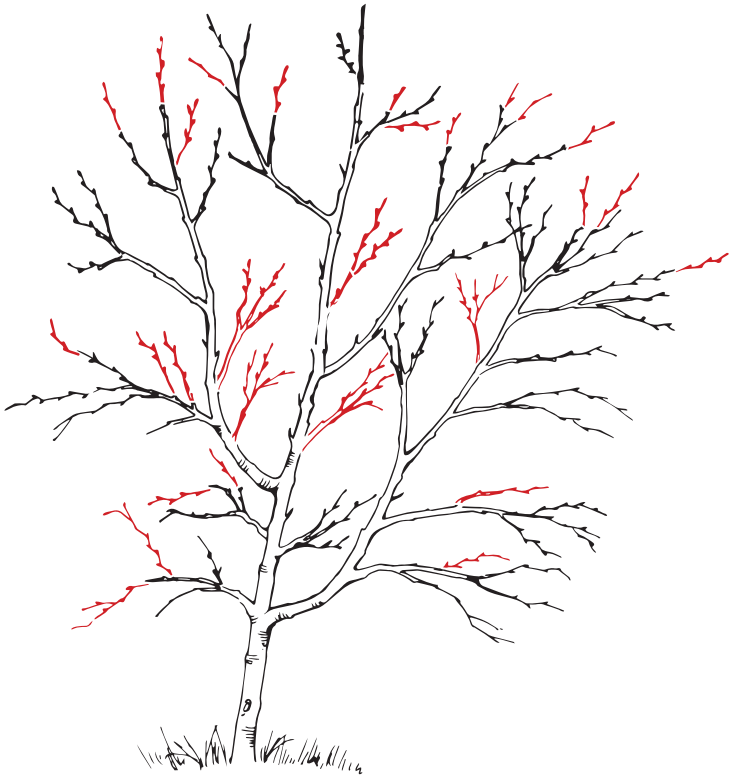

Figure 8. Training to a modified leader is complete. Note: Don't remove the leader until the tree begins to bear fruit.

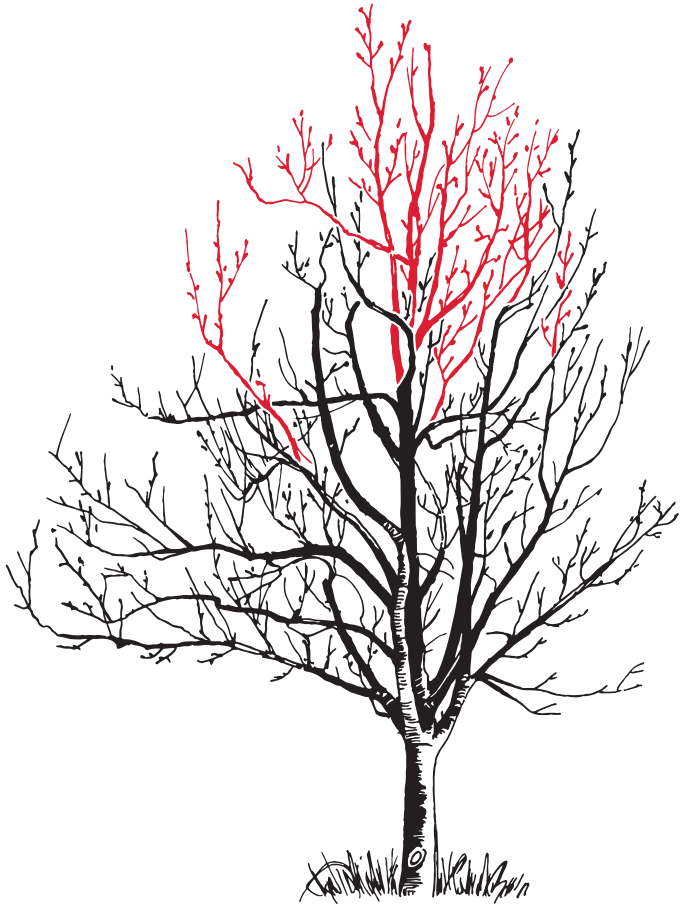

Figure 9. Lowering the height of a neglected tree.

pete with the leader of that branch. Don't prune short fruiting branches known as spurs.

Fourth or Fifth Year Dormant Pruning

1. Continue to maintain the shape of the tree. By this point of development, there should be six scaffold branches (*Figure 8*).
2. Prune to reduce shading of the lower branches.
3. Continue to promote leader dominance by cutting back aggressively growing lateral branches. Cut back lower branches to maintain balance with the upper portion of the tree.
4. In the case of damage to scaffold branches over time, promote new replacement scaffold branches in their place.
5. Once the tree is of bearing age, the leader can be cut back to a well-placed lateral. This practice helps maintain tree height and increases air movement and sunlight penetration.
6. If height reduction of the tree is desired, it is appropriate at this time to prune the leader back to the height of a well-placed outward growing scaffold branch (*Figure 9*).

Pruning Bearing Fruit Trees

1. Annual dormant pruning is necessary to maintain tree shape and size. It should be unnecessary to remove larger branches if the tree has been properly trained, except in the case of damage.
2. For cultivars that bear biennially (produce large crops in alternate years), prune heavily in the spring before the large crop season to balance vegetative growth and fruit production.
3. Remove dead, diseased, or damaged branches each year.
4. Remove water sprouts and suckers. See page 2.
5. Eliminate crossing or closely parallel limbs. Retain the stronger of the two limbs.

Figure 10. Light is needed to develop fruiting wood in any part of the tree. It may take several years to remove large branches on an excessively overgrown tree.

6. Remove limbs growing toward the center of the tree.
7. Remove excess branching to increase light penetration.
8. Use pruning tools made for the purpose and keep them sharp and clean.
9. Disinfect pruning tools in-between cuts.

Pruning Neglected Trees

The four primary objectives in pruning neglected trees are:

- Remove no more than one-third of the tree each year; more than that would promote excessive vegetative growth at the expense of fruit production.
- Reduce tree height.
- Promote air circulation and light penetration by thinning out branches.
- Remove dead, damaged, or diseased branches.

It may take three or more years to bring the tree back into correct condition. It is important to note that no more than one-third of the tree's canopy should be removed in one year. Thin the outer areas of the tree first to improve light penetration in the canopy. Light is needed to develop fruiting wood in any part of the tree (*Figure 10*.)

Step-by-step procedure for pruning a neglected tree:

1. If the tree has become too tall, up to 5 feet of height can be removed each year, as long as no more than one-third of the tree height is removed, to achieve the appropriate height (*see Figure 9*).
2. Remove dead, damaged, or diseased branches.
3. Remove vertically growing shoots or broken branches.
4. Remove excessively large branches. This may need to be accomplished over several years. Up to three large branches can be removed in one year as long as no more than one-third of the tree's canopy is removed. Remove first the branches with narrow branch angles with the trunk that form weak crotches.
5. Prune upper branches to shorter lengths than those lower on the tree. Cut back lateral branches that are too long to bring the tree back to the desired balance.

(*See Figure 11*.) While complete renovation of neglected trees can take up to three years of rather severe pruning, peach, plum, and cherry trees can often be pruned back and thinned out in a single year. Follow annual dormant pruning practices once the tree has been renovated.

Fruit Thinning

Fruit thinning is often a necessary task if larger fruit is desired. A tree left un-thinned may result in many small-sized fruit and increased stress on the tree structurally or physiologically. Excessive fruit loads may affect next year's crop, creating inconsistent production levels from year to year.

Many fruit trees drop fruit to compensate for adverse growing conditions. Fruit thinning counteracts this naturally occurring fruit drop and allows you to control placement of developing fruit for optimum size and quality.

Chemical means of thinning tend to be inconsistent. Manual, hand thinning of fruit results in more consistent-sized fruit with better placement on the tree.

- Many fruit tree blossoms are borne in clusters. For apples, up to five or six blossoms per cluster is common. For best results, reduce the number of fruit borne to one or two apples per blossom cluster. The most desirable spacing is one fruit per 6 inches of shoot.
- Peach trees are notorious for producing excessive amounts of fruit. The fruit resulting from 10 percent of the flowers being pollinated constitutes a full fruit load. Peach thinning begins when the fruit reaches marble size, and can be done until mid-May. The optimal spacing is no less than 6 to 8 inches between fruit.

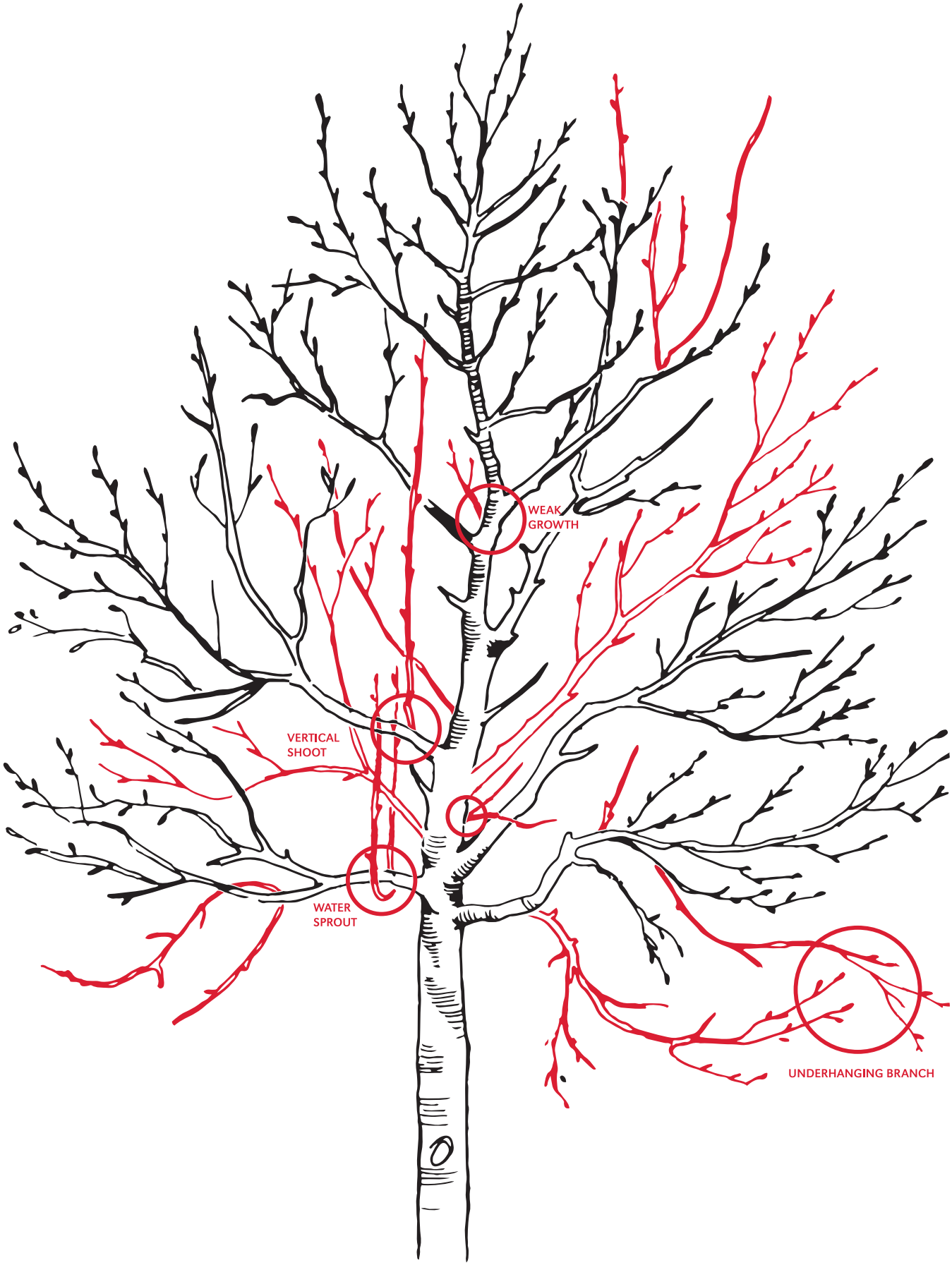

Figure 11. Thinning out undesired growth from a bearing or neglected fruit tree.

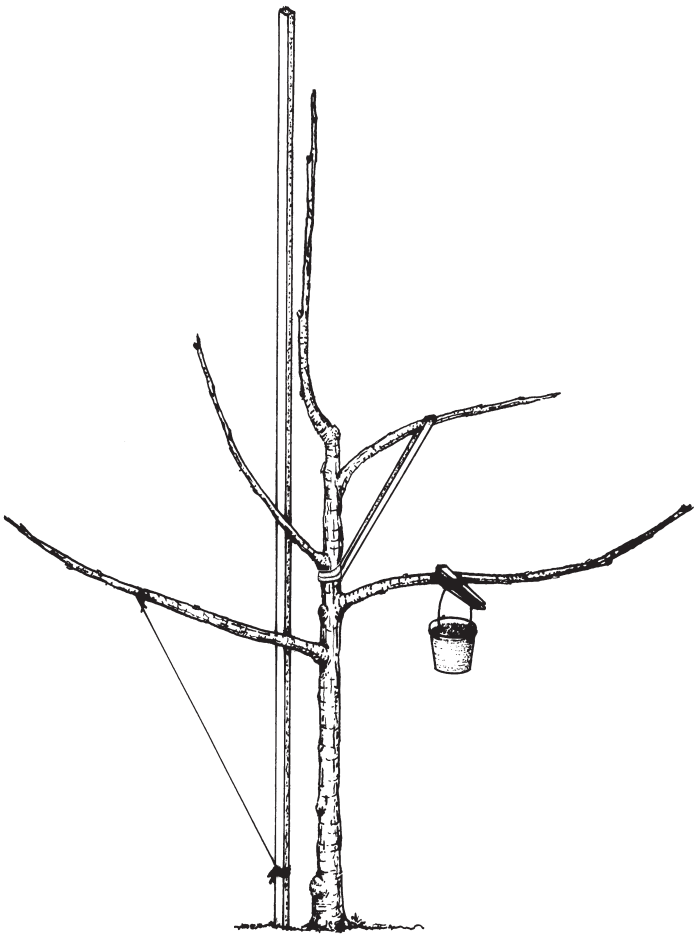

Figure 12. Various methods of tying and weighting branches.

- Plum trees also have the ability to produce very large crops. If the fruit is not thinned, branches could break. The recommended spacing is one fruit every 2 to 3 inches.
- Tart cherries tend to produce consistent yields of nice-sized fruit year to year without thinning.

Branch Spreading

Spreading scaffold branches of young fruit trees creates stronger branch/trunk unions, which helps promote quicker fruiting and creates optimum limb positioning in the canopy. Spreading involves bending upright, growing branches to a nearly horizontal position. The permanent spreading of branches may take several years.

Spreading is preferably started the first year of tree growth and continues throughout the development of the tree. Several techniques can be used for spreading branches. Young, thin branches can be pulled into place simply by attaching a clothespin; a clothespin's weight will pull the branch down into position. Older, larger branches can be moved into position by using a cable and a stake (*Figure 12*). Manufactured spreaders, which are available in varying lengths, also are used to force branches into position.

Permanent positioning of the branch should be achieved after two or three years. Spreading larger branches safely may require incremental positioning over a period of time to avoid breaking the limb.

General Pruning Guide

Each different type of fruit tree has its own pruning requirement. Each variety or cultivar within a fruit tree species may have specific pruning requirements to meet its specific needs.

Different types of fruit trees (pears, peaches, plums, apricots, and cherries) differ sufficiently from apples in growth habit to require somewhat different approaches in pruning, training, and stimulation of fruit production.

Pears

Most pears form narrow-angled crotches. To obtain a spreading growth habit, prune back selected scaffold branches to an outward growing lateral or bud. Avoid heavy pruning, which induces development of water sprouts and overly vigorous terminal growth, both of which make trees subject to fire blight. To address the fire blight concern, susceptible varieties should be trained to a multi-leader system. Multiple leaders are promoted to compensate for any leaders that may be lost to fire blight or other disease in the future.

Peaches

Unlike apple and pears, peaches bear fruit on 1-year-old wood. One-year-old wood is easy to recognize as it is usually red in color. Annual pruning is essential to promote growth of new wood for the following year's crop. To reduce winter injury on peaches, don't prune until danger of severe cold weather has passed (mid-March to early April). To maintain an open, vase-shaped form that promotes air circulation and light penetration, the central leader is removed from peach trees. This pruning practice aids in the reduction of disease incidence and promotes optimal ripening.

Plums

Scaffold branches in plums arise in a very compact area. Care must be taken to allow for adequate space between the

scaffolds to promote an open canopy. Pruning has less impact or influence on fruit size and quality, when compared with apples. Take care not to remove too much wood. This will result in excess water sprout development.

Apricots

Apricots bear fruit on short-lived spurs. Cutting back and thinning out is necessary to promote new spur development. Flowers and fruit are very susceptible to spring frost. When possible, prune after the danger of frost has passed.

Tart Cherries

Tart cherries are produced on spurs that may be productive for 10 or more years. Spreaders can be used to encourage open crotches and stronger branches. Dormant season maintenance pruning requirements include the removal of damaged or downward growing branches and those growing across the interior of the canopy. Also remove rubbing branches and water sprouts. Cherries are capable of producing a very dense canopy. Thinning cuts should be made to increase sunlight penetration and air movement. Failure to open up the interior of the canopy will significantly reduce tree productivity.

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