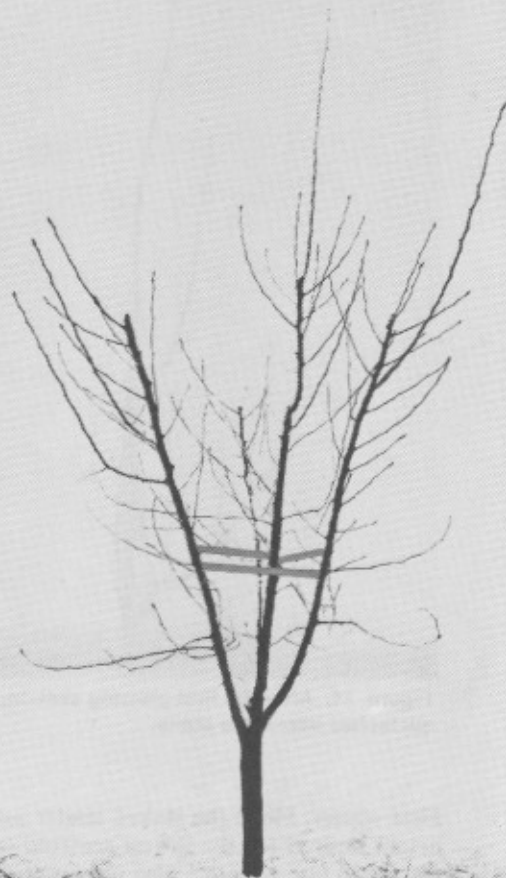


Figure 22. This pear tree developed an upright, narrow shape that cannot be corrected solely by pruning. An open center can be developed by the use of spreader boards. Spreader boards can be made by notching the ends of lath or by inserting finish nails into the ends of 3/4- to 1-inch square sticks. These boards are placed between limbs to spread them. *Be careful not to spread limbs too far apart—they will split at the crotch.* To further reduce splitting of crotches, spread only during the growing season.



### Modified Central Leader or Delayed Open Center

The modified central leader system is used mainly on the higher headed nut trees, such as pecan and walnut. With this system, 4 to 6 primary scaffolds are developed from the main trunk before the open center is allowed to develop.

Training is done in the following way:

**Pruning at planting.** Walnut and pecan trees are severely headed to four to five buds above the graft union (Figure 23). In windy areas a support stake, at least 2x2 inches that extends about 6 feet above the ground, is set next to the tree. During the first summer one shoot is encouraged to dominate by lightly pinching back the other shoots and loosely tying the main shoot to the stake. This shoot (leader) will become the tree trunk.



Figure 23. After the walnut tree (left) was planted, it was headed back to four to five buds above the graft union (center) and was staked (right) to support the new growth which will occur during the first growing season.

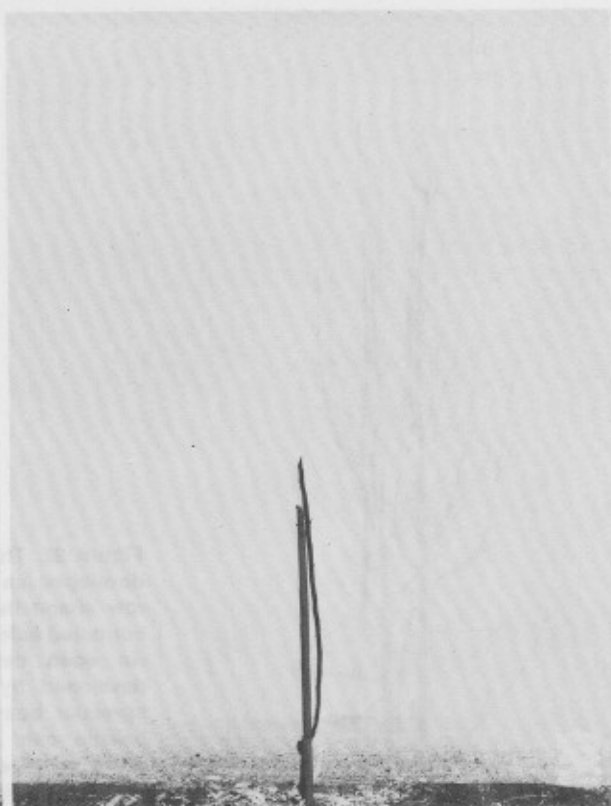
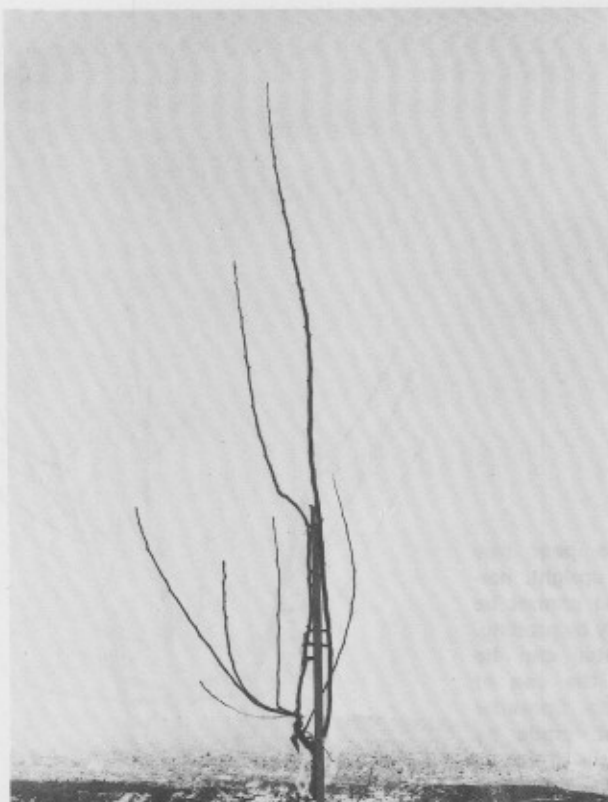


Figure 24. After the first growing season, all lateral branches were removed and the central leader was headed about six inches above the stake.

**First winter.** Head the staked leader just above the height desired for the lowest scaffold (about 6 feet for pecan and walnut). The uppermost bud continues as the leader for the development of additional scaffolds. Try to leave at least three buds above the stake to avoid interference by the stake (Figure 24). Necked buds (Figure 25) near the top of the leader should be rubbed off, since these will produce narrow angled, poorly attached primary limbs.

If the leader did not reach the minimum height desired for the lowest scaffold, it should be cut back to round, mature wood and continue to be trained up the stake during the second season. Remove all lateral shoots, since they tend to be poorly attached and may eventually break at the crotch.

In the *second growing season* continue to keep the leader tied to the stake if present. Pinch back vigorous shoots along the trunk and rootstock which arise below the lowest desired primary scaffold.



Figure 25. Necked buds (arrow) on walnut are undesirable for scaffold limbs. Secondary buds (below necked buds) will form limbs with strong, wide-angled crotches.

During the *second* dormant pruning select primary scaffold branches by starting with one 5 to 7 feet above the ground that ideally faces the prevailing summer winds. Select additional scaffolds, if present, upward along the leader at intervals of several inches or more, forming a spiral pattern around the trunk (Figure 26). Do not select flat limbs or ones with narrow, weak crotches, such as those arising from necked buds. Completely remove lateral branches just below the lowest scaffold and cut others located lower on the trunk to short stubs. Growth

from these stubs, which may need occasional pinching back, will provide shade for sunburn protection and will help to increase trunk growth. Head back vigorous limbs selected for scaffolds by removing one-fourth to one-half of their length, depending on fruiting potential of the variety (the more fruitful the variety, the more it is headed back). Hartley and other strictly terminal bearing varieties require no heading of scaffold limbs. The leader must be left longest to avoid being choked out by lower branches.



Figure 26. After the second growing season for this walnut tree, three lateral branches were selected and headed back and the central leader headed but left the longest to encourage its dominance. All other branches were removed. In windy locations a stake would continue to be used.



In *subsequent* years continue to select primary scaffold branches from the leader until four to six are present (Figure 27). Then allow the leader to become the topmost scaffold. Continue to head

back scaffolds on very fruitful varieties each winter. Completely remove stubs along the trunk when it is about 4 to 6 inches in diameter at the base.

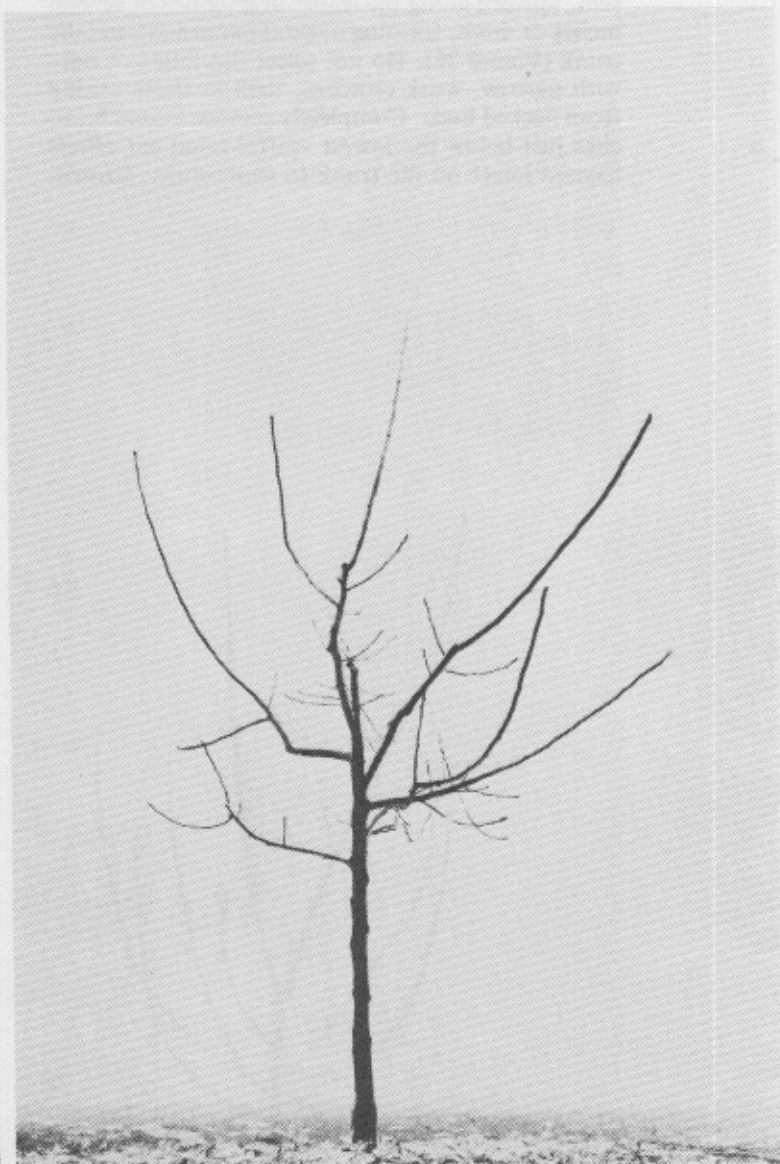
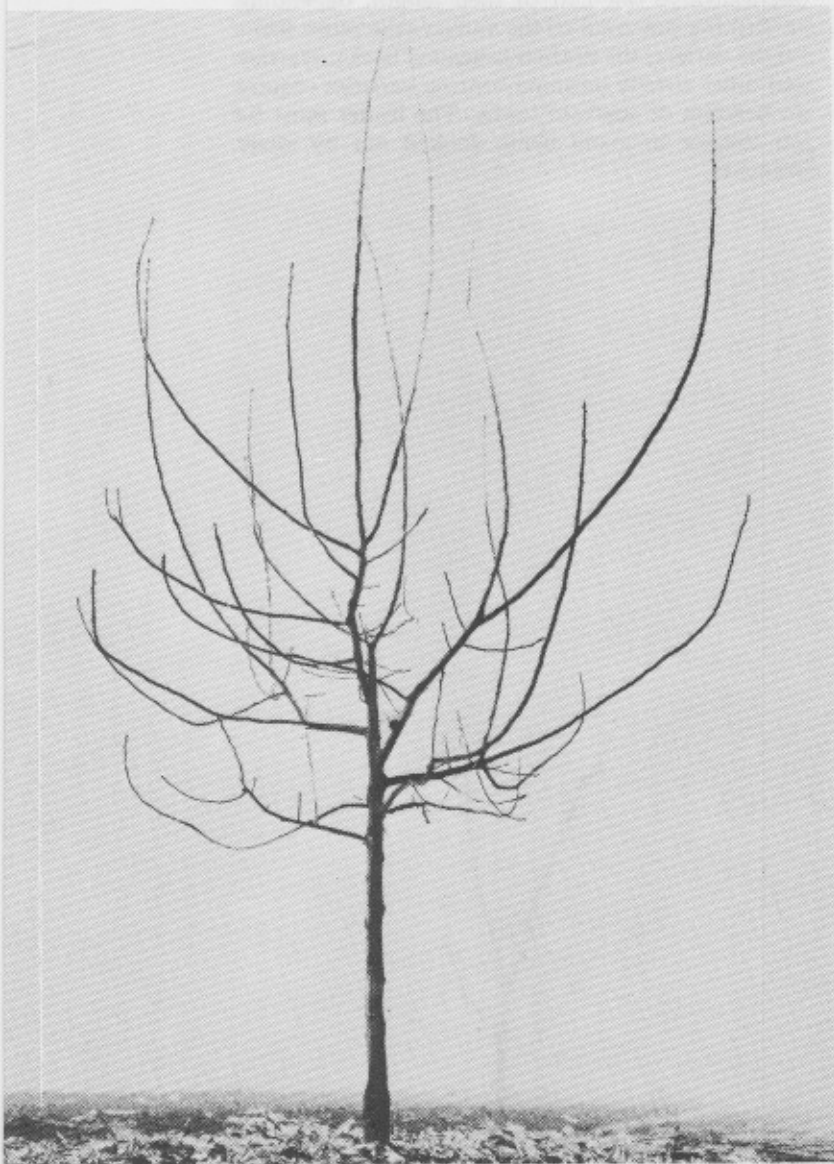


Figure 27. After the third growing season an additional two or three lateral branches were selected on this walnut tree. The central leader may be allowed to bend outward and become the topmost scaffold or maintained for an additional year to develop more lateral branching.

### The Central Leader System

The central leader system is often used in high density or "hedgerow" plantings. Training apple trees to this system is accomplished as follows:

**Pruning at planting.** Head back the newly planted tree to a height of 24 to 32 inches. Handle lateral branches as described for open center trained trees. During the following spring and summer, check the trees at 4- to 6-week intervals to make sure the uppermost limb (central leader) is dominant. Pinch back any strongly competing limbs and remove any narrow-angled (almost vertical) limbs.

**First dormant pruning.** Select three to five *wide-angled* lateral scaffold branches along the leader (leaving 18 to 24 inches between the lowest scaffold and the ground). These branches should be distributed as evenly as possible around the tree and

spaced vertically along the leader 2 to 4 inches apart. Remove other large limbs and all upright branches (except the central leader). Head the central leader and scaffold branches to promote branching and maintain vigor (Figure 28). If the tree has good vigor leave some small, flat-angled shoot growth for fruiting wood.

**Pruning during subsequent summers.** Remove any upright shoots from scaffold limbs and vigorous, narrow-angled branches that compete with the central leader. Thin out branched terminals on each scaffold to a single limb. As scaffold limbs approach their desired length (depending on tree spacing and area to be occupied by limb), and while they can still be easily bent (approximately  $\frac{1}{2}$  to 1 inch in diameter at their base), they can be spread to a 45-degree angle with the central leader using spreader boards. Spreading should be done during the growing season to reduce limb breakage.

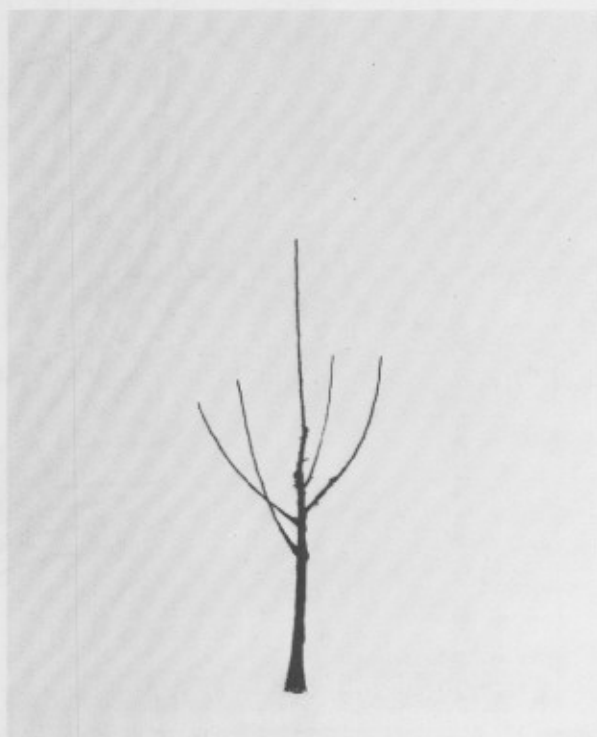
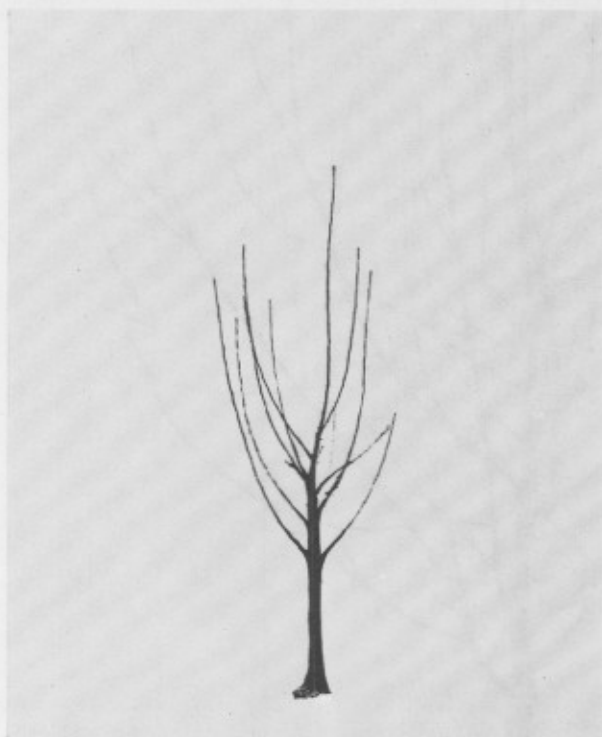


Figure 28. Apple trees are often trained to the central leader system. The first year's branches of this apple tree were thinned out to four scaffold limbs and the central leader was maintained. All scaffold limbs and the central leader were headed back with approximately one-third of last season's growth removed.

**Pruning during subsequent dormant seasons.** Continue to head back the central leader and main scaffold limbs, removing approximately one-third of last season's growth. Remove narrow-angled branches and any upright branches from scaffolds (the central leader should be the only upright limb in the tree). Two to three feet above the first group of scaffolds a second set of scaffold branches is formed from wide-angled limbs arising from the central leader (Figure 29). A third group of scaffolds may be formed at an additional 2 to 3 feet higher in

subsequent years, depending on tree vigor (Figure 30). During subsequent growing seasons these higher groups of limbs are also spread to about 45 degrees. Always leave at least 2 feet between scaffolds directly over each other. Each higher group of scaffolds should be shorter in length than those below it, giving the tree a pyramid or cone shape. Fruiting wood is developed on the scaffold branches and is thinned out to maintain tree vigor and yet encourage fruiting. Branched terminals are thinned to a single limb.

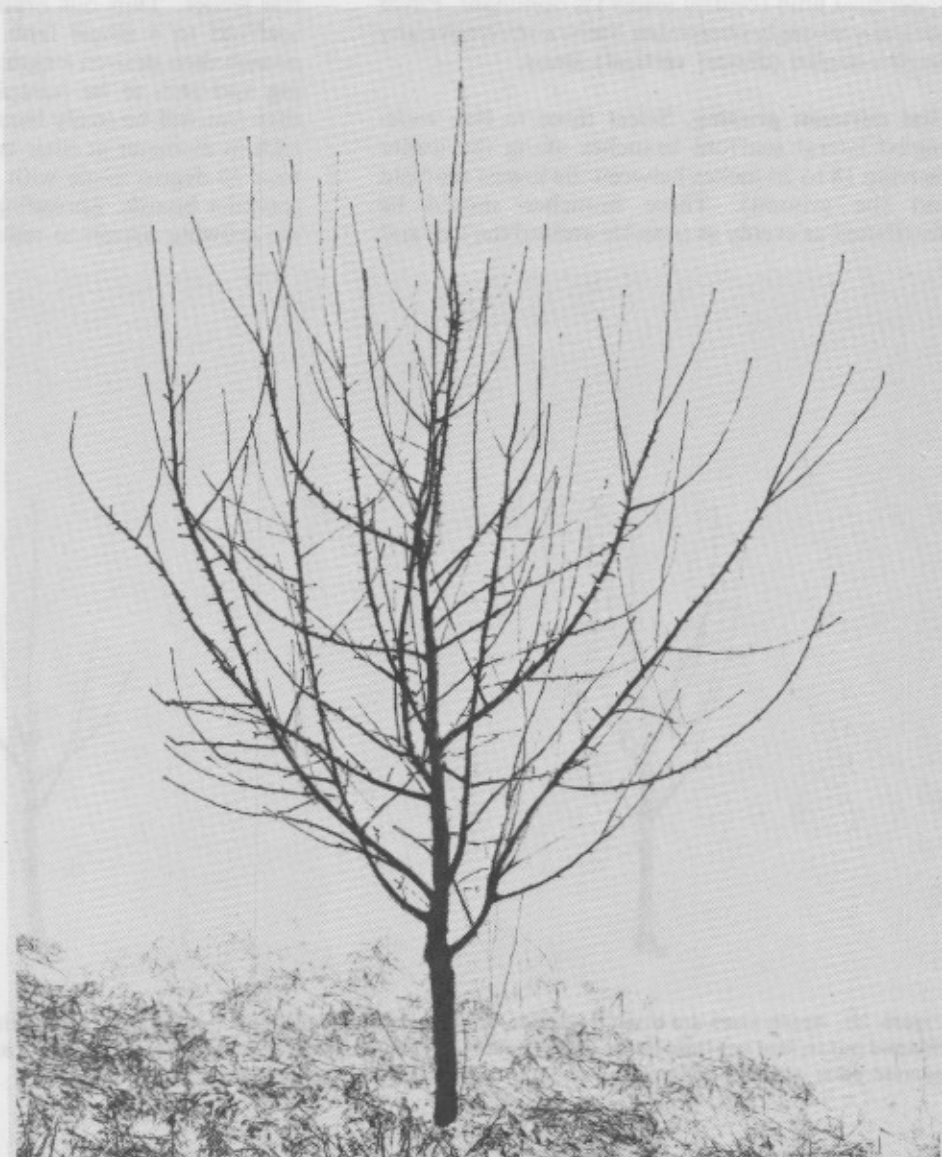
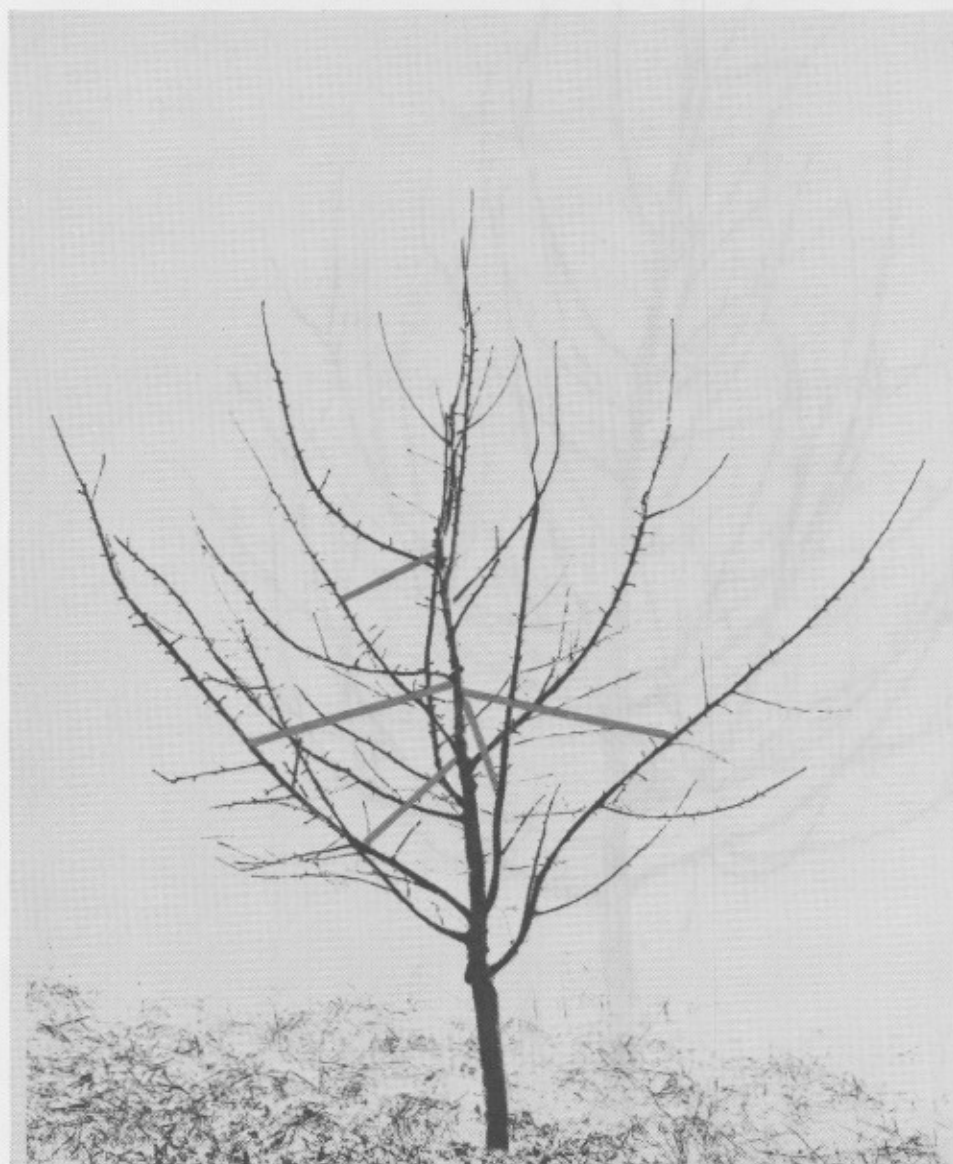


Figure 29. The upright and interfering branches of this 4-year-old apple tree have been continually thinned out and





the central leader maintained. Spreader boards are often used to achieve wider angles of lateral branches.



Figure 30. This apple tree illustrates continuation of the process shown in Figures 28 and 29. It can be maintained at a





particular height by annually heading the central leader at that level or by cutting it back to a shorter lateral.

### Other Training Systems

**Peach and nectarine trees.** These have been planted in hedgerow orchards where two training methods have been successful. One is a dual leader system where two scaffolds are trained upward from the

trunk at a fairly upright angle to form a "Y" shape (Figure 31.) The leaders are kept in line with the tree row and are not allowed to branch further. Fruiting laterals arise directly from the main scaffolds. In a second method, the single leader spindle



Figure 31. A dual leader or "Y"-shaped peach tree is pictured after pruning.

system, the trunk is allowed to continue growth straight up as a dominant leader. Flat-angled (horizontal) secondary branches are distributed upward along the leader in a spiral pattern (Figure 32). Lower branches are slightly longer than those im-

mediately above them, giving a Christmas tree shape. Fruit wood arises from the flat-angled limbs and the central leader. Both methods require summer pruning every year to allow sunlight infiltration and maintenance of fruit wood.



Figure 32. A single leader, spindle system-trained peach tree is seen here after pruning.



**Dwarf trees.** Genetic dwarf peach and nectarine trees are currently receiving considerable attention as possible candidates for high density, high yielding orchards where ladders are not required. These trees are very compact with short internodes (distances between buds). Final tree size is usually 6 feet high by 6 feet wide. At planting these trees are usually branched and the branches should be thinned out to allow a few to dominate as structural limbs. During the first few years thinning out of crowded limbs should be continued to allow development of a reasonably good tree structure (Figure 33). After the tree reaches full size, annual light thinning out of small branches is recommended to provide space for fruit production (Figure 34).

**Olive.** At planting only suckers or badly placed limbs are removed. Training involves the selection of three well spaced lateral branches along the trunk from 18 to 30 inches above the ground. This selection takes place during the first summer and the process of removing suckers, watersprouts and undesirable branches continues through subsequent developmental years with just enough trimming to develop a good structural system. Excessive cutting delays the age at which olive trees come into bearing.

During the first few years, little or no wood should be removed from the upper portion of the tree.

After trees come into bearing (at 3 to 5 years old) other pruning is required to develop a secondary scaffold system. This consists of about three permanent branches arising from each of the three primary scaffolds spaced around the tree so as to form a strong supporting framework for the fruiting top and side branches. It is best to develop this secondary scaffold system and to thin out unwanted branches over a period of several years. Heavy thinning out of branches in any one year causes trees to become so strongly vegetative that they stop bearing until fruiting wood again develops.



Figure 33. During the first few years, the pruning of genetic dwarf peach and nectarine trees consists of thinning out crowded branches to allow development of a reasonably good tree structure.



Figure 34. After the dwarf tree has reached full size, annual light thinning of small branches is recommended to provide space for fruit production without scarring from limbs rubbing against the fruit.