

PLANTING AND TRAINING YOUNG TREES

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Training young pistachios is essential to establishing the desired tree shape to facilitate harvest and cultural operations. Pistachios in California are trained to open vases, leaving much of the interior wood for early fruiting. Depending upon rootstock, the trees are low to moderately vigorous and require five to seven years of growth before significant fruiting occurs. California pistachios have been planted on primarily three rootstocks; *P. atlantica*, *P. integerrima* and one inter-specific hybrid, UCB I. *P. integerrima* is the most widely planted due to its *Verticillium dahliae* tolerance and production history. Rootstock trials with UCB I have proven its yield to be superior to *P. integerrima* and more cold tolerant. UCB I is slightly less tolerant of *Verticillium* than *P. integerrima* (Epstein, et al., 2004).

Although applicable to other cultivars, the training and pruning guidelines suggested in this chapter are based upon the 'Kerman' cultivar grown almost exclusively in California.

THE PRINCIPLES OF TREE TRAINING

A discussion of tree training can be lengthy. For the commercial orchardist, there are four main concepts to remember:

1. All pruning, and therefore training, is dwarfing. A pruned tree may have the desired shape, but it will always have less total growth than an unpruned tree.
2. Dormant training (winter) is the most invigorating. Removing portions of a tree at this time results in more food available to the remaining growing points. They therefore grow at a faster rate in the spring and, as individual branches, they usually grow longer. This is an important concept for pistachios since they grow slowly and require dormant pruning to create adequate growth in selected limbs.

3. In-season training (tipping) has the greatest dwarfing effect on trees. This is because portions of the tree are being removed which the tree has expended energy to produce. Commonly called summer pruning, in-season tipping also reduces the amount of foliage, and thus, the amount of growth substances produced by photosynthesis. Therefore growers should not delay in-season tipping when training young trees, because excessive shoot growth and foliage is removed. In-season tipping performed for branching should only remove that amount of shoot growth that can be manually pinched off. Avoid ever having to remove more than six inches (15 centimeters) from any single shoot.
4. Heading cuts (removing only part of a limb) stimulate more vigor (faster growth) than thinning cuts (removing an entire limb at its point of origin). Heading cuts are most often used on young trees to direct growth, force branching and produce long shoots with rapid growth. Thinning cuts are used to control tree shape, remove unwanted limbs and maintain tree vigor at a desired level. Thinning cuts also remove fewer buds so they have less of an invigorating effect on subsequent growth.

THE FIRST SEASON

Planting and budding

Planting of unbudded nursery-grown rootstock seedlings begins in January or February while they are still dormant or in the early leafing stage. Planting dormant trees allows for a much greater margin of error than planting after leafing, but the potential for freezing temperatures exists. Planting continues into May. Early summer plantings have also been successful but are not desirable due to the great potential of heat stress and insufficient growth

for field budding in August. Field budding has proven superior for orchard uniformity and early vigor.

Before leaving the nursery, the one year-old seedlings are topped to approximately 24 inches (61 cm), irrigated, and placed in standard fruit bins for shipment. Since the rootstocks are usually leafing out, it is essential that they be covered during transport to the orchard site. This is often done by “capping” the tree-filled bin with an empty one. Upon arrival and unloading by forklift, provisions must be made to water the seedlings if necessary due to weather conditions or planting delays. Under no circumstances should nursery trees become dry and stressed. The seedling rootballs must be moist to remain intact during transfer to the field and planting. The planting contractor usually provides bin trailers to transport the bins filled with trees to the field.

The rootstocks are typically grown in five mil plastic liners six inches in diameter (15 cm) and 14-16 inches (35-45 cm) deep. The liner is removed by cutting approximately one inch (2.5 cm) of compacted root mass is cut off the bottom of the stock; growers and nurserymen believe this allows more rapid development of new roots with less restriction (Plate 10A). Holes are usually hand-dug and the stock inserted with the top of the root-ball slightly above the soil level; this compensates for settling after watering and reduces the potential for excessive moisture around the “crown” (soil-tree interface) of the seedling (Plate 10B). Prior to backfilling the hole, the liner is pulled up and over the seedling. Tamping of the backfilled soil by foot is done sparingly to avoid damage to the small roots extending from the crown. The bamboo stick supporting the nurserystock is also removed at this time and the resulting small hole is covered with soil to prevent drying of the crown roots (Plate 10C).

It is preferable that tree staking occurs immediately so that all the stress factors associated with planting are consolidated prior to the required postplant irrigation. The trees are staked using six-foot, two-inch (1.6m, 5x5 cm) square grape stakes driven in approximately 18 inches (45 cm). Most California growers place the stake 3 inches (7.5

cm) away on the downwind side of the tree to provide additional support (Plate 10D).

After planting, pre-emergent herbicides, (often Prowl® and Goal®, active ingredient pendimethalin and oxyfluorfen, respectively), are applied in a 6 foot wide (1.8 m) swath (32% of the acre) down the tree row. Hand weeding by contract labor is also done around the base of the trees in the first year.

Prior to budding, the rootstock is allowed to grow with little manipulation. Early in the season, a suckering crew removes any growth from the rootstock that is within 8 inches of the ground to facilitate weed management. Vigorous shoots are tied to the stake to develop straight trunks, reduce wind breakage and facilitate budding. Some growers elect to place 12 inch (31 cm) tall cardboard wraps around the rootstocks to minimize trunk injury from contact herbicides. .

Budding can begin in mid July, providing stock diameter is three-eighths of an inch (1 cm) in diameter and two to three branches exist. However, experience has shown that delaying budding until late July or early August provides higher vigor and more uniform scion development. Spring or dormant chip budding has not been commercially accepted due to poor percent take (60-65%) and the resulting problems it causes in orchard uniformity.

Five to seven days after budding, 50% of the growth above the bud and on other branches is removed. The crew also partially girdles (notches) the rootstock directly above the ‘Kerman’ bud using a 24-tooth hacksaw blade. As soon as a sufficient number of buds begin pushing, the remaining rootstock growth is suppressed by terminal pinching to prevent its competing with growth of the ‘Kerman’ bud. If the bud does not push but appears to be alive, the rootstock is only lightly tipped to prevent excessive loss of leaf area. Test the viability of inactive buds by touching the leaf petiole subtending it. If it resists abscission from light force, the bud is most likely dead.

Pistachios can be successfully budded until late September if the bark still slips. Fall buds are not encouraged to grow due to the risk of loss from sudden cold temperatures. Excess late season growth also predisposes both the rootstock and ‘Kerman’ scion to cold injury

should night temperatures reach about 27 °F (-2.8 °C) for an hour or more. Tender, late season 'Kerman' growth is also susceptible to infection by *Botrytis cinerea* if exposed to wet weather. Fall buds pushing voluntarily should be tied up loosely to prevent contraction of the tape and subsequent mechanical loss during the winter. Fall tying also aides in developing a straight trunk (Peterson, 1985).

Trunk development

Successful July budding of optimally managed, vigorous rootstocks makes it possible to achieve up to six feet of 'Kerman' growth in the first growing season. Once the 'Kerman' bud has grown 4 to 6 inches (10-15cm), training up the stake begins. First, the rootstock above the bud is pulled to the stake and firmly secured using one-inch (2.5 cm), 12-mil plastic tape or some other strong fastener. This reduces the distance between the developing 'Kerman' shoot and the stake. Secondly, a tie is made on the 'Kerman' shoot using green half-inch (1.25 cm), eight-mil plastic tape. The frequency of further ties is dependent upon growth rate, orchard uniformity and wind conditions; it is commonly done every 8 to 10 inches (20-25cm). Well-managed trees can grow one inch **daily**, requiring crews to make field passes every two weeks. Low laterals developing from the trained 'Kerman' shoot are pinched rather than removed to provide the greatest possible leaf area. The remaining rootstock leaves are similarly pinched for the same reason (Plate 10E).

Heading of the 'Kerman' shoot at 42 inches (1.1m) to force primary scaffold branching could be performed after 46-52 inches (1.2-1.3m) of total growth. However, this is usually not done to prevent loss of carbohydrates critically needed for the approaching winter. The remaining growing period is often so short that the laterals fail to acquire sufficient length and girth to be valuable. Limited lateral branching is also common, making it difficult to achieve proper tree shape. Therefore, this is **not** recommended for the novice grower.

The First Dormant Pruning

The first winter pruning consists primarily of removing rootstock growth on successfully budded trees and selected removal of dormant shoots on unbudded trees. 'Kerman' shoots taller than 40 inches are headed at 42 inches (1.1m) to force primary scaffold development. Dormant heading has been consistently observed to force more laterals on pistachios than in-season heading (3-5 versus 2-3). Any remaining rootstock above the 'Kerman' bud is headed 3 to 4 inches (7.5-10 cm) above the bud. This is used to secure the base of the tree to the stake for straightening purposes without placing tension on the still-tender bud union.

Fall budded trees with little or no 'Kerman' growth are suckered, and the rootstock above the bud is also headed at 3 to 4 inches (7.5-10 cm). 'Kerman' buds having grown only a few inches are left until spring when their greater flexibility allows tying without damaging the bud union.

Unbudded trees are assessed for their vigor and pruned accordingly. Poorly growing rootstocks are headed one-third to one-half; seedlings with less than six to eight inches (15-20cm) of growth may require replacement, especially if gophers have been active in the area. Vigorous seedlings the height of the stake or greater have selective thinning cuts performed to the lower third of the tree. The main shoot tied up the stake the previous season can be headed at 36 inches (91.4cm) to force laterals in the spring, which can each be budded. This is referred to as scaffold budding and aids in improving orchard uniformity.

THE SECOND GROWING SEASON

Fall budded trees are trained up the stake and then tipped at 42 inches (1.1m) if they have grown sufficiently by late June to mid-July. Half-inch (1.25 cm), 8-mil plastic tie-tape should be used for training young shoots, not the heavier one-inch tape. The heavier tape contracts during cold nights and strains the bud union. Rootstock growth below the bud and lateral growth from the 'Kerman' shoot is again suppressed by pinching. This allows the

greatest leaf area but the least competition with the growing shoot. Growth close to the ground is typically suckered to reduce possible herbicide damage. This should be performed early to prevent significant loss of leaf area.

Trees whose 'Kerman' bud reached sufficient height the previous season to allow dormant heading at 42 inches will push several laterals near the cut. These become the primary scaffolds. They can grow vigorously and require tying into a vase-shaped position in May or June. Failure to do so results in flat scaffolds and too open a canopy.

Moderately vigorous laterals can also develop along the distance of the trunk. Experience suggests that these are best removed rather than suppressed by pinching, since they can quickly develop size and compete with primary scaffold growth. Single leaves or short spurs along the developing trunk can be left since they aid in trunk diameter growth.

Primary scaffolds are allowed to grow 12 to 14 inches (30.5-35.5cm) before they are pinched to 11 to 13 inches (28-33cm). This usually occurs by early June (Plate 10F). Lateral branching can be improved by also clipping the leaf blade off its petiole at the second node position from the terminal cut. Two lateral shoots are then more likely to grow than just the one nearest the pinched tip.

Young pistachios tend to be of insufficient girth, and primary limbs are often unable to support the weight of new secondary growth. Tying of limbs is, therefore, often practiced during this development stage (Plate 10G). It is generally not advisable to attempt development of secondary and tertiary branching in the same year, because summer pruning occurs too late in the season. Secondary branches would require tipping at 11 to 13 inches (28-33cm) by mid-July to have sufficient vigor to produce tertiary shoots 30 inches (76cm) in length by mid-September. Excessive summer pruning during the second season leaves the tree weak, spindly, and predisposes trees to cold injury in the winter.

Unbudded rootstocks are handled in much the same manner as developing 'Kerman' trees; this facilitates instructions given to field crews. Budding should take place as soon as possible

to avoid the trees becoming too large for a high take.

The Second Dormant Pruning

Trees with secondary branches are thinned to 2-3 branches arising from each primary. In their selection, one should avoid retaining limbs directly opposite one another; it is preferable to have branches spaced 3-4 inches (8-10cm) down the primary. Following selection, each is headed to 11-13 inches (28-33cm) and tied up, if necessary (Plate 10H).

Trees headed in-season to force primary branching are thinned to three or four well-distributed scaffolds; each is then headed to 11-13 inches (28-33cm) and tied to form an upright vase shape. Pruning guidelines for trees at earlier training stages have been previously discussed.

THE THIRD, FOURTH AND FIFTH GROWING SEASONS

Training activities during the third season are very similar to those of previous years. Trees with secondary branching in the winter will produce tertiaries. Tertiary branches should **not** be tipped during the third growing season. This results in tertiary branches growing so long that they often touch the ground. The goal is now to increase total canopy size and limb diameter so that the tree has sufficient structural strength. Training efforts should therefore focus on rootstock sucker removal and trees, which have yet to reach this development stage.

THE THIRD, FOURTH AND FIFTH DORMANT SEASONS

Pruning trees with developed tertiary branches is very similar to those with developed secondaries. Two to three branches per secondary are selected for location and strength and headed to 18-24 inches (46-61cm) (Plate 10I). Some tying of trees is still necessary to insure maintenance of the desired shape. Long shoots with good girth are typically cut in half and some minor limb removal is performed in the center of dense trees. Limbs having grown in a better location than those previously selected can now be incorporated into the branching system.

It is unwise to open the center of the young pistachio canopy early in its development. Removing the centers of trees three to eight years in age reduces their early bearing potential and forces outside shoots to grow excessively long. Vigorous shoots tend to develop and retain flower buds. This is especially important for male 'Peters' trees, for they tend to produce insufficient flower buds for pollen in the early bearing years. Hence, once the basic tree shape has been secured with sound training during the first four years, early bearing is promoted by reducing the number of pruning cuts made per tree. This distributes total growth into greater numbers of short spurs, which have higher fruitfulness. Excessive pruning of the centers also does not prevent shading and fruitwood loss during the early years because light is not limiting in these canopies. Delaying heading cuts on young, vigorous trees until shortly after bud push may also enhance spur development.

Pistachio tree training is very labor intensive and expensive, compared to other nut crops. However, attention paid to this critical production component will pay huge dividends as the orchard matures. Pruning of mature canopies will be much more systematic, less corrective, and require fewer decisions by contract laborers. Harvesting will be more efficient due to increased nut removal and reduced catch frame damage from low limbs. It is a worthy investment.

References

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2. Peterson, B. 1985. New pistachio training technique. In Calif. Pistachio Ann. Rpt. 1985. pp. 127-29.