5

Establishing the Orchard

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Planting a fruit orchard is a long-term investment, usually taking 3 years to bear a commercial crop and then continuing economic production for another 15 to 30 years. Careful planning results in optimum production, high returns, and long tree life.

Site Selection

In selecting a site for an orchard, choose a proven area for the fruit to be grown. Any attempt to grow a new or different fruit crop of high quality and good yields in an area that has not been proved increases the grower's risk.

For growing peaches, plums, and nectarines for the fresh fruit market, establish the orchard where fruit production is concentrated. Because growing these fruits is both highly technical and specialized, a knowledgeable, dependable labor supply is necessary; therefore, develop the orchard where skilled labor is available. Crews experienced in pruning, thinning, and picking are necessary for each variety of fruit grown. Packinghouses must be nearby with capacity to handle large volumes in short periods of time. Cold storage must be available to cool and store fruit between picking and sales. Field personnel from packinghouses, pest control advisors, and other technical consultants, such as farm advisors, are essential assistants to growers producing fruit crops.

Size

Orchards should be large enough for packinghouse crews or labor contractors to utilize crews efficiently for essential operations. To move a crew several miles during a busy season for only a few hours' work is usually not economical; thus, packinghouses may be reluctant to contract for handling crops from small acreages. On the other hand, a large block of trees of the same variety may not be girdled, thinned, or harvested within the short time necessary because of the large numbers of skilled workers required. It is usually best to plant no fewer than 5 acres nor more than 15 to 20 acres of one variety in one block.

Weather

When selecting an orchard site, consider weather and microclimate effects. The site must not be too cold during late winter or early spring when flowers or young fruits can be damaged by frost. However, during the dormant season the site must have a period of cold weather that satisfies the chilling requirement necessary for normal fruit set and growth in the following growing season. Commonly, winter chilling is measured by calculating the number of hours at or below 45°F (7°C) during the dormant season. Most peach and nectarine varieties grown in the San Joaquin Valley require 650 to 850 hours of chilling before February 15 for flower buds to break dormancy and develop normally; leaf buds require slightly more. The chilling requirement for leaf and flower buds of most Japanese plums is 700 to 1,000 hours. Effective cold hours vary, depending on daytime temperatures and fog cover. For example, a period of warm daytime temperatures somewhat offsets the effectiveness of previous chilling. Occasionally, areas in the San Joaquin Valley fall short of the chilling hours required for most standard varieties. In warmer desert areas, peach plantings are restricted to "low chillers" that require less than 400 hours of chilling.

Extreme cold. Damage to tree trunks or branches by extreme winter cold does not occur in California. However, in late winter or early spring, when trees are in bloom or young fruits are developing, frost

damage can and does occur (see chapter 21, **Frost Protection**). At that time, below-freezing temperatures are almost always the result of temperature inversions rather than invective or cold air mass freezes. Low-lying areas are more susceptible to frost under temperature inversions because the densest cold air tends to accumulate there. Since risk of frost damage is greater in low-lying areas, closely investigate temperature conditions before planting an orchard.

Wind. Wind is seldom a risk in orchard plantings in the San Joaquin Valley, but in other California areas fruit scarring can cause losses, along with occasional limb breakage. Fresh shipping peaches, plums, and nectarines must be cosmetically free of scarring to prevent their cullage by packers; thus, avoid planting where winds are strong enough to cause scarring.

Hail. Unlike some areas of the world where summer hailstorms occur, California's fruit-growing areas experience hail only during March and April. Hail can destroy bloom, leaves, and young fruit on trees. Flowers and leaves are sometimes knocked from trees, but the worst damage occurs when young fruit have formed and are exposed. Hailstones, even small, soft ones, can severely pit and scar young fruit. Most hail-scarred fruit must be culled at harvest or in the packinghouse. If hail frequently damages fruit, as it has occasionally in a few local areas in California's Central Valley, the risk may not justify planting more orchards in those particular locations.

Heat. Where total heat units are high, as in the southern San Joaquin Valley or especially in southern California deserts, some varieties will not produce high yields or good quality fruit due to internal heat damage. Heavy producing varieties often do not yield as well in these areas because trees tend to produce excessive vegetative growth at the expense of fruit. Other varieties tend to "shade out" lower fruitwood because of early and rapid production of dense canopies in the upper half.

Water supplies

Because California's fruit-producing regions receive no effective rainfall in the growing season, underground or surface water supplies are needed to produce crops. Mature orchards use between 3 and 5 acre-feet of irrigation water each growing season, depending upon application efficiency. In some areas this water is supplied entirely from pumps that draw water from underground aquifers; other areas utilize surface water from streams, rivers, or canals. Most orchards in the Central Valley use a combination of these two sources. An adequate supply of water, available when needed throughout the growing season, is vital. In spite of its availability, the cost of water can be a factor if, for example, the high power cost of pumping from deep wells makes it uneconomical to grow fruit. Water must be free from excessive or injurious salts, such as sodium, boron, and chlorides. If water quality is in doubt, particularly well water, have it tested for salt by a commercial laboratory before trees are planted.

Along with adequate supplies of good-quality irrigation water is the need for the orchard to have adequate surface and subsurface drainage. Without proper drainage of water through the root system and below, trees will lack aeration, develop root or crown diseases, become weakened and nonproductive, and even die. Water drainage is poor on some soils, in spite of the many corrective measures available, and such soils, therefore, are not suitable for orchard planting.

Past crops, diseases

The crop previously grown on a potential site may influence future productivity. Just as field or vegetable crops may suffer reduced vigor and productiveness when the same crop is planted year after year on the same site, orchards planted on old orchard soil may react similarly. Trees may show spotty and weak growth, especially during the first few years. To overcome these effects, soil fumigation is necessary before planting where orchards or vineyards have recently grown. Soil fumigation also helps to rid soil of nematodes left there from the previous crop. Current nematode-resistant rootstocks available for use with peaches, plums, and nectarines grown in California resist only one nematode (root knot). However, several other species of nematodes may attack these "resistant" rootstocks and suppress growth, especially when trees are young (see chapters 2, **Rootstocks,** and 19, **Nematodes**).

Consider residual soil diseases before planting. If the site has a history of Armillaria (oak root fungus), the new orchard will not escape infection, often even after soil fumigation. Verticillium wilt, particularly following such previous crops as tomato or cotton, may occur for the first few years in the young orchard. In addition, an orchard site with a history of crown rot or crown gall may continue to be diseased into the next tree planting (see chapter 17, **Diseases**).

Slope

The orchard slope and the direction it faces can affect the maturity time of fruit, particularly important in the production of early maturing varieties. An orchard planted on a westward-facing slope or in a location known to produce earlier-maturing fruit is desirable because trees planted on these sites are provided with a microclimate that results in fruit maturing 1 to 4 days ahead of the valley floor. Thus, growers able to pick early and place fruit on the market ahead of other growers frequently receive higher prices.

Soil Preparation

Peach, plum, and nectarine trees grow and produce best on deep sandy loam soils, free of alkali or salinity and with good internal drainage. Adequate growth and production can be obtained from trees grown on a wide range of soils, providing the rootstock has been carefully selected.

Fruit trees cannot tolerate soils with poor internal drainage (whether the result of hardpan, plow pan, or clay layer), which keeps the soil saturated with water for extended periods, particularly during the growing season. Groundwater tables must be well below the root zone for the same reason.

Ripping hardpan, plowpan

An orchard site should be checked well before planting to determine the presence of hardpan, a dense layer of rocklike material located 1 to 5 feet below the surface and varying in thickness from 1 to 12 inches. Hardpan impedes water drainage, resulting in root or crown damage. Where the hardpan layer is located within 4 feet of the surface, the soil should be ripped deep enough to break the layer (fig. 5.1) and allow good drainage after the trees are planted. Hardpan layers do not reform after ripping, so once the soil has been ripped and the hardpan broken, it need not be done again.

Another impediment to drainage is plow pan, a dense, compacted layer of soil found from 6 to 20 inches below the soil surface. It forms when trucks, tractors, and tillage or other orchard equipment are run over the soil many times, especially when the soil is wet. Chiseling 20 inches deep with shanks about 18 to 24 inches apart, when the soil is reasonably dry, will break up plow pan layers. If the soil is deep ripped for hardpan, this operation usually also breaks up the plow pan.

Fig. 5.1. Deep ripping an orchard site to break up a hardpan layer.

Providing drainage

Drain tile, seldom used in California orchards, is sometimes installed to carry off excess water at the base of a hill or where there is an abrupt change in slope. Underground water draining from a hill following winter rains often surfaces where there is a change in slope at the base of the hill. Strategically placed drain tile or other underground drainage systems will keep this perched water table below the root zone and prevent tree damage. If the soil is very heavy (adobe-clay) or sandy, consider the choice of drip or microsprinkler irrigation. This will influence any decision about whether to land level – little or no leveling is needed with this method of irrigation. Make certain that low spots in the orchard have good surface drainage so that winter or spring rains do not accumulate around tree trunks.

Leveling

A furrow- or flood-irrigated orchard must be properly leveled (fig. 5.2). The site's slope or fall should be judged by type of soil and head of water available. Heavy soils should be leveled to only a slight grade. Sandy soils should be leveled to a little steeper grade to make sure the water can be "pushed" to the other end of the orchard. The volume of water available at the head of the run will influence grade. A small head of water requires a steeper slope to run farther before it is absorbed by the soil, especially a sandy soil.

Fig. 5.2. Laser leveling a field in preparation for planting.

If the site was deep ripped before leveling, thoroughly irrigate it before final leveling. Ripper shank marks can settle substantially and disrupt a final level if the soil is not irrigated sometime before the final level or floating takes place.

Flat or dead-level orchard sites are more common now, thanks to laser leveling. Dead-level orchards irrigate easily and uniformly. Water is turned in middles or furrows until it reaches the other end of the field and then is turned off at the source or drained into a return flow system. One disadvantage: Excess rain or surface runoff water has no place to go during the rainy season. Fields with no slope for drainage may stay wet for long periods, resulting in tree damage.

Eradicating weeds

Perennial weeds, such as johnsongrass or bermudagrass, are more easily eradicated before trees are planted. Before planting, frequent discing or harrowing, especially during summer, helps eliminate perennial weeds. Spraying established weeds with a systemic herbicide and discing, following irrigation, helps reduce weeds. Preemergence herbicides, recommended for preplant use and worked into the soil in late fall before planting, help control germinating weed seeds the following spring without harming newly planted trees.

Fumigating

Soil fumigation (fig. 5.3) should be done after ripping and before final leveling, usually in late summer or early fall when soil temperatures are still warm and soil moisture content is low. Its purpose is to control nematodes, help overcome possible adverse effects of the previous crop, and – depending upon the fumigant used – control weeds and some soilborne diseases. Because prefumigation site preparation is critical to a good job, check with the applicator to see just what soil conditions are desired to obtain the best results.

Spacing

Tree and row spacing must be decided upon before any irrigation system is begun. If the orchard is to be furrow or flood irrigated, the distance between valves corresponding to the head of the row must be known. It is much more convenient and less disruptive to orchard operations to install pipelines and valves before planting trees. If the orchard is to be irrigated by a drip or microsprinkler system, the main lines and hose faucets should be in place before planting. Hoses and emitters can be installed later.

At one time, 20 x 20 feet was standard tree and row spacing for most orchard plantings of peaches, plums, and nectarines. Now tree and row spacing commonly varies anywhere from about 16 x 16 feet to 22 x 22 feet on a standard planting and even closer on intensive planting systems. Where rows are planted 16 to 18 feet apart, every fourth middle is sometimes made 20 feet to allow additional room between tree rows for harvesting equipment. Type of soil, irrigation system, variety of tree, pruning system, and growth habits of the tree all influence tree and row spacing. For example, trees do not grow as vigorously or as large on heavy soils; thus, they can be planted closer than trees on deep sandy loam soils. Upright-growing Japanese plum trees can be planted closer together than vigorous spreading varieties. Consider all factors carefully before selecting final tree and row spacings.

Fig. 5.3. Preplant soil fumigation controls nematodes and other harmful organisms.

Planting

To be assured that the preferred variety and rootstock combination is available, order trees from the nursery by May before planting the following winter. May is preferred because "June-bud" trees, the most commonly planted trees in California, are budded then in the nursery. Yearling trees that are fall budded and grown for a full growing season in the nursery are also planted. The most desirable sized trees for planting have trunk diameters ranging from 5/16 to 5/8 inch. Very large or very small trees usually grow more slowly and often require extra care.

Arrangements

Square plantings are most common. Where some doubt exists that trees may eventually grow together and shade lower fruitwood, offset rectangular or triangular plantings may provide an advantage (see chapter 4, **Designing the Orchard**). Trees are slightly farther apart between rows in an offset planting that provides more light infiltration in mature orchards. Hedgerow or intensive planting systems have better light distribution throughout the lower part of the trees, if rows run north and south rather than east and west.

A few plantings are double set in rows where growers wish to take advantage of increased production for the first few years. For example, the initial orchard setting distance is 20-foot rows with trees 10 feet apart in the row. After a few years, interset trees are removed for a permanent 20 x 20-foot setting. Over the life of the orchard there is probably no economic advantage to double-setting trees with standard training because trees grow rapidly and soon interfere with proper training of the permanent trees. The cost of trees is doubled and removal costs add to the expense which may not be regained by early increased production. Some growers are successful with this system because their orchard management and cultural practices such as pruning are very precise.

The planting arrangement for Japanese plums is critical because pollination often dictates row configurations (see chapter 9, **Japanese Plum Pollination**). Plan pollenizer arrangements carefully before planting.

If more than one variety is to be planted in an orchard, strive for operation compatibility. Will the need to irrigate one variety interfere with the harvesting of another planted alongside? Will the need to spray insects or diseases in one variety prevent thinning or harvest crews from entering a neighboring block of trees? Planting compatible varieties side by side as pollenizers or orchard blocks saves time and delays during the busy season.

Because large mature trees often crowd turning avenues, the final planting plan should include adequate space at the ends of rows to turn equipment around and to provide easy access by other vehicles.

Laying out the field, digging holes, and planting the trees are often done by contract. Experienced tree-planting crews are sometimes the best choice for completing the job rapidly and expertly, especially for planting large numbers of trees.

First steps

The first step is to square the field and to mark accurately the spot where each hole is to be dug. Planting wires stretched tightly along the entire tree row, with each hole location marked on the wire, accurately mark tree sites. A stake, plastic straw, or gypsum marker at each planting wire mark later identifies where the hole is to be dug.

If possible, holes should be dug sometime before the beginning of heavy winter rains, particularly for plantings in heavy soils. It is difficult to dig holes in wet, heavy textured soil. On sandy or sandy loam soils, holes may be dug any time before planting. Holes may be dug by hand shovel or with an auger mounted on the back of a tractor. Holes dug in clay or wet loam soils should be dug by shovel to avoid "glazing" or compacting the sides of the hole with a tractor-driven auger.

Planting holes should be just deep and wide enough to accommodate the root system in its natural position. If holes are much deeper than the root system, undesirable tree settling will occur. Because tree damage can occur, it is best not to place commercial fertilizers in the bottom of the hole or to mix them in with soil during back filling.

Nursery trees are dug as soon as possible after they are dormant and before heavy winter rains begin, usually in late November or early December. They may be delivered by nursery van or picked up at the nursery. Trees are tied in bundles of 10, according to caliper size. Bare-root trees should be handled carefully so that the trunk is not damaged or the roots broken. They should be enclosed or covered when being transported to the orchard site to prevent roots from drying.

A shallow trench should be dug in a well-drained area if planting is not begun immediately upon delivery of the trees. Trees should be "healed in" immediately after arriving from the nursery. Bundles of trees are placed in the trench and roots covered with moist soil to prevent their drying out. Trees can be held indefinitely in the healing trench, but for best

growth the following season they should be planted in January or by February 15 before top growth begins. Root growth on young trees begins in early February. For maximum tree growth for the year they should be planted before or as soon as possible after the new white root growth is noticed. Planted later, their first-season growth may be reduced.

Delaying planting

If the site is not ready or if adverse weather has delayed operations, nursery trees can be placed in cold storage to delay their growth until the field is ready for planting. Trees are placed in cold storage when still dormant, preferably before root growth begins. Tree bundles are placed upright in bins, roots covered with moist wood shavings, and put in a commercial cold storage room where temperatures are maintained at 35° to 40°F (2° to 4°C). Air volume should be at a minimum to maintain proper temperature and to prevent drying of the trees. The wood shavings should be inspected frequently and water added if they begin to dry.

If planting is delayed, trees can be held in cold storage until April or May. In late spring plantings, these trees will survive, but the first season's growth will be less than that of earlier plantings.

At planting, tree bundles should be removed from the healing trench or cold storage and delivered to the field, just ahead of the planters. If there is reason to believe that the previous crop left a residue of crown gall that may carry over to the new orchard, trees may be dipped in *Agrobacterium radiobacter* 84 to help prevent this disease (see chapter 17, **Diseases**). Trees should not be allowed to lie on the ground for any length of time ahead of planting or else the roots may dry or be exposed to frost. Any dead or damaged roots should be trimmed. Rather than permitting long roots to curl to fit the hole, trim them slightly so that they will not be permanently twisted or bent. Trees should be set in the hole at the same height or slightly higher than they grew in the nursery as gaged by the soil line on the trunk. Face the flat part of the rootstock scar at the bud union away from the intense afternoon sun to reduce sunburn during the first growing season.

Filling holes

Fill holes with pulverized soil. Avoid clods that may bend roots down and possibly weaken tree anchorage. If the side of the hole is "glazed" or compacted from augering, break the side into the hole to make it easier for water to penetrate and for roots to grow into the surrounding area. Lightly irrigate newly planted trees soon after planting to settle soil around roots and to remove air pockets. Water may be applied more easily to the hole if it is filled with soil to within 2 to 3 inches of the top, leaving a small basin for irrigating. Final filling of the hole can be completed after the water soaks in around the root system. After making a furrow on one or both sides of the row as close to the newly planted trees as possible, lightly irrigate to help settle the fill soil around the roots. If the hose line is in place, use emitters to apply irrigation water. If the emitter is placed at the tree site, apply only 1 to 2 gallons of water per tree to avoid overirrigating. Long soaking irrigations, followed by periods of rain, may damage root systems of newly planted trees.

Pruning

Newly planted trees must be headed (pruned) back carefully to knee height (20 to 24 inches) so that the new shoots that form future scaffold limbs will be properly positioned. Side branches below this point should be clipped back to one or two buds. Small-caliper trees usually have enough buds below knee height to have many shoots when growth begins. Larger-caliper nursery trees may not have enough buds on the trunk below knee height; therefore, leave one to two buds on all side branches so that new shoots will grow and the tree can be properly trained the following year.

Protecting trees

White latex paint (fig. 5.4), or tree wraps, or both should be used on newly planted trees to protect them against damage. The paint (straight out of the can or diluted 1 to 1 with water) provides protection against sunburn and western flat headed borer. Apply paint from ground level to about halfway up the trunk; particularly cover the bud union and rootstock scar where borers usually enter. Apply paint before new shoots start to grow or they will be damaged. Because paint applied to dormant buds will delay or sometimes prevent growth, do not paint the top half of the young tree.

Cardboard tree wraps should reach only about half way up the trunk so that they will not interfere with new shoot growth at the top of the new tree. Tree wraps help prevent both sunburn and chewing damage by rabbits or squirrels as well as protect the trunk in case contact herbicide sprays are applied around the young tree.

Fig. 5.4. White latex paint applied to a newly planted plum tree prevents sunburn damage.

Caring for Young Trees

After the initial irrigation to settle young trees at planting, there should be no need to irrigate again for some time. If trees are planted in late winter or early spring, rainfall should be sufficient to supply their needs until continued warm, dry weather prevails in late spring. By then, trees have enough foliage to require increased water usage and to demand frequent irrigations, increasing in amount as summer continues.

Irrigating

Sandy soils require more frequent irrigations than do loam soils. As the tree grows with more water being transpired on hot summer days, irrigation frequency and amounts of water needed are increased. One small, V-shaped furrow or flat furrow on each side of the tree will supply the tree's needs in the area where roots are expanding. Furrows should be placed far enough away from trees so that the crown is not wet frequently or for long periods of time; but, they should also be placed close enough to the trees so that water will easily "sub" into the root area. Frequent checking with a shovel or soil tube will indicate when the tree has had enough but not too much water.

Avoid irrigating the entire middle between tree rows; it wastes water, because young tree roots are not in that area, and it only serves to stimulate weeds in the middles where they might not otherwise grow if the soil were kept dry.

Drip emitters should be placed near enough to trees to allow irrigation water to "sub" to the root system. Care should be taken not to allow emitters to puddle water at the tree base. Foggers and microsprinklers should be operated similarly. When it becomes necessary to irrigate more often in hot weather, frequent light irrigations are most efficient in supplying water needs of young roots confined to a small area near the base of the tree. Amounts of water required to irrigate trees may be less than 1 gallon a day in spring but up to 5 gallons a day as growth increases and hot weather continues.

Fertilizing

Well supplied with fertilizer in the nursery, young trees usually have enough reserve to push early foliage when planted in the orchard site. It is seldom necessary to apply fertilizer (especially nitrogen) to newly planted trees until after growth has begun in spring or early summer. Sufficient nitrogen should then be made available to allow the tree to grow as rapidly as possible in its first growing season. Some soils may have enough residual nitrogen remaining from a previous crop so that none is needed for the entire season. Others, particularly sandy soils, may have very little available nitrogen and young trees will become nitrogen deficient before the end of spring. Some irrigation water contains nearly enough nitrogen to supply tree needs. (Water can be tested to determine its nitrogen content.)

To assure that trees continue satisfactory growth after they are established, when new growth is 6 to 12 inches long, the standard practice is to place about one-eighth of a pound of actual nitrogen in the furrow bottom close to the tree just before an irrigation. This will supply adequate nitrogen for spring and summer growth. Nitrogen can also be added in water through a drip or microsprinkler system. Care must be taken not to overfertilize, as excessive amounts will cause trees to defoliate.

Protecting trees

First-year trees do not compete well with weeds, which can greatly reduce their growth. Weeds compete for moisture and nutrients and can be eliminated by careful cultivation, hoeing or chemical spraying. Preemergence herbicides eliminate most, if not all, weeds in spring and early summer. As the season progresses and after several irrigations that tend to leach preemergence herbicides, weed seedlings may grow to where they need other controls. Special care should be taken to control perennial weeds, such as johnsongrass, bermudagrass, and bindweed, which are difficult to eliminate once they become well established.

Frequently monitor a new orchard for damaging insects, such as peach twig borer, false chinch bug, and mites, which can seriously reduce tree growth. Rabbits often damage newly planted trees by eating foliage or chewing bark off trunks and should be controlled at the first sign of tree injury. Likewise, control gophers if their presence is noted (usually by fresh mounds) in the orchard and any large birds (frequently crows) that land in the tops of young trees and break new branches, thereby deforming trees and slowing growth (see chapter 20, **Vertebrate Pests**).

Both peach and plum rootstocks often send up sucker growth from near or below the soil line. These should be removed while still small when they can be rubbed or easily clipped close to the trunk. Care should be taken not to cause bark injuries that act as entry sites for such disease organisms as crown gall.

Light summer pruning sometimes helps to shape trees during the first year's growth. When they are small, remove strong growing shoots positioned too low on the trunk to later form into main side branches or standards. Pinch back very upright growing shoots, particularly in plums, when they are about 8 to 12 inches long. This helps promote side branching and tree spreading early in the life of the tree. Only vigorous trees should be summer pruned the first season and then only lightly or pinched back. Weak trees should be allowed to grow and summer pruning should be avoided.

Intercropping

Intercropping (planting annual summer crops such as cotton or vegetables between tree rows) is sometimes practiced in young orchards, although growers are divided about its usefulness. Some young peach, plum, and nectarine orchards thrive despite annual intercrops between rows, but others suffer reduced growth due to competition. Where intercropping is successful, precautions are taken to provide young trees with adequate irrigation, fertilizer, weed control, and insect pest protection. Weed control by cultivation and summer spraying for insect pests may be difficult because the intercrop interferes with access to the trees. Another difficulty is that pesticides may not be registered or otherwise compatible for both trees and intercrop. Growers are also sometimes reluctant to irrigate trees and thus interfere with harvesting of the intercrop, causing the trees to suffer from lack of moisture.

In most cases it is probably best not to intercrop young trees because of the risk of reduced tree growth. However, if potential cash returns from the intercrop are great, the risk may be justified.

Orchard Floor Management

When planning a new orchard, consider the type of orchard floor management system to be used when trees are young and later, when they come into bearing. Although many orchard floor management systems are used for stone fruit in California, only three basic systems – with variations – exist: complete cultivation, bare noncultivation, and partial noncultivation.

Complete cultivation

Under this system, orchards are disced in two directions three to four times during the growing season, primarily for weed control. This also prepares the soil for irrigation, incorporates prunings, and helps orchard sanitation by covering fruit left on the ground after harvest. Where weather permits, the orchard is disced, and furrows or checks are made in late winter; this allows irrigation water to be run for frost protection in the event of subfreezing temperatures during or following bloom. The first cultivation during the growing season is usually delayed until after bloom, since frost hazard is increased in freshly disced, open soil.

As the season progresses, the orchard is disced again to incorporate weeds and smooth ground before thinning. Refurrowing takes place following thinning. Most early maturing varieties will not be disced again until after picking; later maturing varieties may have another discing and furrowing or bordering before picking. Most orchards are disced and smoothed in fall before winter rains begin.

Not many fresh market stone fruit growers continue to use complete cultivation because there are certain disadvantages to this system. Costs of fuel and equipment maintenance are higher than for other

orchard floor management systems. There may be a greater risk of soil erosion on sloping ground. Compacted soils from continuous use of heavy orchard equipment, particularly when the soil is wet, can reduce water penetration. During winter or after irrigations, it is more difficult to carry out timely cultural operations, particularly on heavy soils. Rough, newly cultivated soil contributes to the spring frost hazard. Increased radiant heat loss can cause the orchard to be colder by 1° to 3°F (1°C) at a time when flowers and young fruit are very sensitive to temperatures only slightly below freezing.

Bare noncultivation

A few orchards are under a system of bare or complete noncultivation (fig. 5.5). Since the orchard is not disced, other weed control methods are used to keep the entire orchard floor free of weeds. Pre- or postemergence herbicides, or both, are used for weed control. Generally, the first year is expensive, but during subsequent years the advantages of no discing or furrowing, plus low weed control costs, make this system attractive. There is less soil compaction; thus, water penetration is better than in orchards where tractors and cultivation equipment are frequently used to control weeds and make furrows. Under a bare noncultivation system, soil compaction tends to occur where wheels of trucks, spray rigs, tractors, and bin trailers ride on each side of the middle. After these wheel-compacted strips are formed, a narrow roadway is created to make it easier to drive down the middles for spraying or harvesting following a rain or irrigation. These narrow wheel-compacted areas are not large enough to prevent trees from receiving sufficient water from furrow bottoms or beside the berms. The berm (or tree border) is often used to prevent rainwater or irrigation water from accumulating around the trunk. Broad, flat furrows or flat middles (sometimes slightly crowned to crowd water to the berm edge) are commonly used, along with some drip or microsprinkler irrigation systems.

Sealing of the soil surface and the resulting poor water penetration have been a problem in some noncultivated orchards, the severity depending upon the source of the irrigation water. Allowing shredded pruning brush to remain on the orchard floor frequently helps improve water penetration and easier orchard access.

Partial noncultivation

This system of orchard soil management incorporates the good features of both previously described methods. Permanent, rounded tree berms about 6 inches high and 4 to 5 feet wide are formed in the tree row (fig. 5.6), with weeds controlled by pre- or postemergence herbicides or both. Middles may be

Fig. 5.5. Complete noncultivation system of orchard floor management.

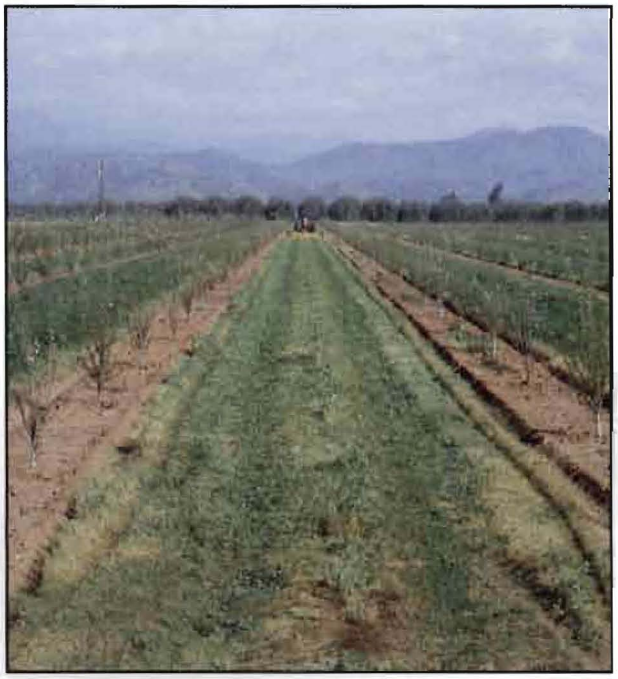

Fig. 5.6. Weed-free berms with native weeds mowed in the middles is a widely practiced orchard floor management system.

maintained by an occasional one-way discing (fig. 5.7) and furrowing. More widely used is a system in which the middles are flat (or slightly elevated in the center to crowd water to berms) and flood irrigated. Drip or microsprinkler irrigation lines are often used, with hoses laid on top of the berm or buried under the berm with risers to the emitters. Weed-free berms allow easier inspection and operation of the emitters. Where middles are flooded, permanent cover crops, such as self-seeding clovers (fig. 5.8), are mowed occasionally and the middles are not disced. Prunings are shredded and allowed to remain on the soil surface. Benefits of this orchard floor management system are better water penetration and lower fuel and equipment costs, along with better winter and post-irrigation access to the orchard for such operations as spraying and harvesting.

Fig. 5.7. Orchard floor management system of weed-free berms and cultivated middles.

Fig. 5.8. Weed-free berms with a cover crop maintained between the rows is another semi-noncultivation system variation.

Additional Reading

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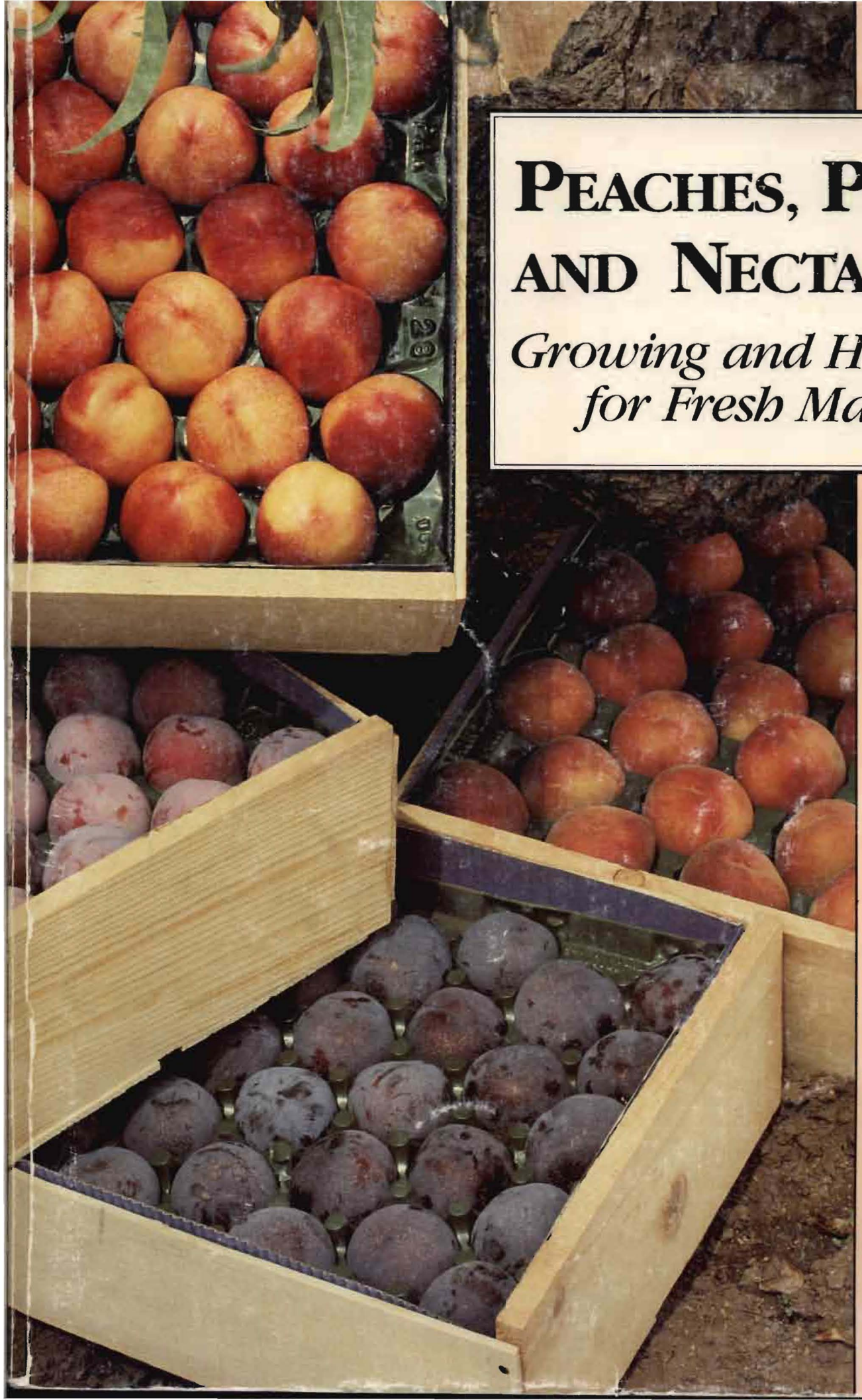

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