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Growing

Fruits and Nuts

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PART 3

Fruits and Nuts



Growing Apples, Pears, and Quinces; Pest Control, Air Drainage Important

by Roger D. Way

Growing fruit in the home garden is a good, profitable hobby, but it also can be challenging because of pest control problems. This chapter gives instructions on how to select, plant, and maintain an apple, pear or quince orchard and how to harvest, store and use the fruit.

Home-grown apples are excellent for eating fresh or for apple sauce and baking. Pears can be home canned as halves or eaten fresh. Quinces are used for jelly making or preserves. Fruit trees can do double-duty in producing fruit and also in landscaping.

Climate is more important than soil in determining where apples will grow successfully. Apples do not grow well in central and southern Florida or southern California because winters are not sufficiently cold to satisfy the necessary chilling requirements. Some new varieties with low chilling requirements, such as Anna, will grow farther south than most varieties.

Conversely, severe cold (-45° or colder) will kill most apple trees, making it impractical to grow them in northern North Dakota and in other very cold locations. They do well between Georgia and New Mexico and Maine, Wisconsin and the southern parts of Canada.

Before planting, survey your area and determine what varieties grow best.

Air drainage can be very important to the successful growing of fruit trees. Trees planted on sloping land (5 to 10 percent slope) will sometimes

escape late spring frosts which could kill blossoms. Windswept hill tops or low valleys where frosts settle should be avoided.

Apples grow on a wide range of soil types. An ideal soil is a well drained, fertile, sandy loam at least four feet deep. Good drainage is more important than good fertility. Soils that remain wet late into the spring are not suitable. Apple and pear trees tolerate a wide range of soil acidity. Liming before plowing may not be necessary unless the pH is below 5.5.

There are at least 6,000 apple varieties. They can be classified according to their time of harvest. In the Northeast, the very earliest summer varieties are harvested in mid-July and the latest in late October at the time winter freezes begin.

In their approximate order of harvest, some of the best mid-July to mid-August varieties are: Vista Bella, Julyred, Jersey mac, Viking, Tydeman Early; mid-August to late September: Gravenstein, Paulared, Prima, McIntosh, Cortland, Macoun, Spartan, Jonathan, Rhode Island Greening, Empire; late September to late October spur type Delicious, Priscilla, Jonagold, Golden Delicious, Spigold, Northern Spy, Stayman Winesap, Idared, Red Rome, Mutsu, and Melrose. There are also many old apple varieties still available from nurseries.

Contact your county Extension office for a list of recommended varieties.

Scab-resistant varieties include Prima, Priscilla, Macfree, Nova Easygro, Priam, and Sir Prize. Unfortunately, no insect-resistant varieties are yet available.

Satisfactory pear varieties are Bartlett, Spartlett, Moonglow, Seckel, Clapps Favorite, Aurora, Gorham,

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Magness, Highland and Bosc. Magness and Moonglow have some resistance to fire blight, a severe disease on pears, and are recommended for the South where this disease is a special problem. Orange is the most popular quince variety.

Variety selection can be greatly aided by studying nursery catalogs which give good descriptions of varietal attributes, but often fail to point out their weak features.

Pollination is essential for the setting of flowers to initiate fruit development. Apple varieties cannot be fertilized by their own pollen. However, pollen from almost any other apple variety will cause fruits to set. Therefore, in order to obtain fruit set, you need to provide for cross-pollination by having more than one variety within 100 feet. Bouquets of another variety may be brought in and placed in a pail of water beside the tree.

The pollen source variety has no effect on fruit characteristics of the variety being pollinated.

Some varieties, although they bear heavy crops when pollinated by another pollen-producing variety, do not themselves produce good pollen. Examples are Gravenstein, Rhode Island Greening, Mutsu, and Jonagold. When these are grown, it is necessary to have three varieties in order to provide cross-pollination.

Blooming Times

Varieties differ in their time of blooming. Some early bloomers are Vista Bella, McIntosh, and Idared. Late bloomers follow about a week later. These include Macoun, Rome Beauty, and Golden Delicious. In most years, early and late bloom will overlap and result in good cross-pollination but in some cool springs, the overlap may be insufficient. It may be desirable to plant two early bloomers or two late bloomers.

Pears will not pollinate apples nor vice versa. Pears also need two vari-

eties to cause effective pollination and fruit set. Bartlett and Seckel are cross-incompatible. Most other pear varieties are cross-compatible. Magness and Alexander Lucus do not produce good pollen.

Bees carry pollen from one variety to the other. Bees fly at temperatures above 65° F. In some springs, the temperature during bloom may never rise above 65°. Due to bee inactivity, little cross-pollination will occur. Thus, not much fruit will be set.

Dwarf Trees

Dwarfing rootstocks are a beneficial innovation for the modern home orchardist, as well as for the commercial apple grower. Although dwarf trees are somewhat more expensive to buy, they are easier to prune, spray and harvest. They also begin to bear crops of fruit at a younger age than full-sized trees.

The fruit of Delicious, or any other variety, which is borne on a dwarf tree is just as large and otherwise identical with the fruits of Delicious borne on a full-sized tree. Dwarf rootstocks do not shorten tree life.

Dwarfing in apple and pear trees is caused by specific dwarfing rootstocks onto which common varieties are budded. Tree size at maturity depends on which rootstock is used. True dwarf trees grow to a height of about 10 feet when fully mature at 15 to 20 years of age.

The most dwarfed trees are propagated on Malling 9 or M.27 roots; semi-dwarf on M. 26 (12 feet), M. 7 (15 feet), or M.9/Malling-Merton 106 interstems; semi-vigorous on MM.106 or MM.111; and vigorous (30 feet high) on seedling roots.

An interstem tree, such as M.9/MM.106, is one with strong growing, well-anchored MM.106 roots. By double budding, it has a 6-inch trunk section of the very dwarfing M.9 to produce a semidwarf tree. Finally, the variety is budded on the top.



Pear trees are dwarfed by growing them on quince roots with an interstem of Old Home to overcome the graft incompatibility which exists between Bartlett and quince.

Tree size also is influenced by the inherent varietal vigor, soil fertility, severity of pruning, and several other factors. For example, on a given rootstock, Cortland grows into a larger tree than Golden Delicious or Rome Beauty. Also, nonspur Delicious and McIntosh will grow into bigger trees than spur type Delicious and McIntosh. Spur varieties are mutations which grow into compact trees that are smaller than normal and usually more desirable for the home orchard.

Buying the proper tree from a reliable, local nursery is one of the most critical decisions in the successful growing of fruit in the home orchard. Nursery catalogs contain much information about varieties and planting tips; study them carefully before buying. Medium-sized, 1-year-old trees are preferred to 2- or 3-year-old trees.

Do not attempt to grow fruit trees from seed; they do not come true to variety. Trees from seeds produce very small, poor quality fruits.

Trees with five varieties on one tree can be grown, but they are not recommended because the different varieties will grow unequally, making tree shaping difficult.

Order from the nursery the precise variety/rootstock combination you want. Do not buy a tree which is called "dwarf"; the specific rootstock should be identified.

Spacing between trees in the orchard will depend on such factors as how much land is available, vigor of the variety, rootstock vigor, soil fertility, and drainage.

Photos by Roger Way

Dwarf apple trees provide easy access to the fruit. They also bear fruit much quicker than standard trees.

Apple Tree Spacing in the Home Garden

Varietal vigor	Rootstock	Soil fertility	Tree spacing (feet)	
			Between trees	Between rows
Semi-vigorous (Golden Delicious, Rome Beauty, spur varieties, etc.)	Dwarf (M.9, M.27)	Medium	6	12
		High	8	16
	Semidwarf (M.7, M.26, M.9/MM.106 interstems)	Medium	8	16
		High	10	18
	Semivigorous (MM.106, 111)	Medium	14	22
		High	16	24
Vigorous (Cortland, nonspur Delicious, McIntosh, etc.)	Dwarf	Medium	10	18
		High	12	20
	Semidwarf	Medium	12	20
		High	14	22
	Semivigorous	Medium	18	26
		High	20	28

Planting of fruit trees in the north-eastern United States should be done as early as possible—as soon as the land is dry enough to work in the very early spring. Fall planting is risky because it may result in winter injury to the trees, but in warmer regions, fall planting is practical.

As soon as the trees are received, they should be unwrapped. The roots should be kept moist and above freezing. If the planting site is not ready, dig a temporary hole in the garden and heel-in the roots in moist soil in a shady spot. Trees should be planted while still dormant, or at the latest, before much leaf growth occurs.

Fruit trees require full sunlight and should not be planted in the shade of a building or large tree. The orchard area should be plowed and the soil disked before planting. Prune off damaged, broken, diseased or dead roots. Cut off the tips of excessively long roots so they are no more than 15 inches long. Usually very little root pruning is needed. Dig a large hole a foot or more deep and wide

enough to contain the roots without crowding when they are extended in their natural position. Do not put fresh manure in the hole.

Depth of the hole is important and must be adjusted according to special needs of each tree. If the roots have been budded onto size-controlling rootstocks such as M.9, it is essential that the scion be above the surface of the ground. The bud union is the point at which the scion variety bud had been inserted into the rootstock and there usually is a small crook at this point. Dwarf trees are budded high in the nursery (14 inches) so they can be planted deep for good anchorage.

Put the topsoil into the bottom of the hole. Do not use grass sod to fill the hole. Bring in good soil from another part of the garden if necessary. Tramp hard with the heel of your boot to firmly pack the soil. Pour on a pail of water just after planting. No fertilizer is applied at planting time, nor during the first summer.

Any labels attached to the tree

must be removed at planting, as the wire or string will girdle the trunk after growth begins.

Just after planting, cut off the top of the tree at a height of 30 inches. If there are several side branches, remove half of them to balance the root loss.

You need to stake dwarf apple trees because they have poor anchorage due to their brittle roots; heavy fruit crops will topple them. They need support throughout their lifetimes. Semidwarf trees may also require staking. Semivigorous and vigorous trees will stand alone without staking.

Just after planting a dwarf tree, a 2 x 2 inch stake, 4 feet long, is driven 2 feet into the ground at a distance of about 6 inches from the tree trunk. The tree is supported by tying it to the top of the stake with a strip of cloth. As the tree grows, the tie must be loosened so that it does not girdle the tree.

Pruning

Pruning fruit trees is an art. A strict rule is not to prune too much, especially in the early years. The tree should be trained in the first year or two so that it will begin to develop into its proper shape. Select branches with wide crotch angles. In the third to sixth years, very little pruning may be needed. Overpruning will delay bearing.

Prune in late winter or early spring. Summer pruning of small twigs is also a good practice and helps to keep tree size down. Each spring cut out all dead and broken branches. During the first two years, select branches spaced at intervals along the main stem. Cut off all branches lower than 20 inches. A short trunk and closely spaced lateral branches will aid in developing a small, compact tree.

Train the tree so that it has a central leader which is taller than the other side branches. Shape it like a

Christmas tree. A 5-year-old tree should have 5 to 7 side branches, well spaced around the main central trunk.

You may need to partially shorten the leader and to remove some of the high central branches to prevent the tree from growing too high. Heavy cropping tends to deter too much branch growth.

Trees on dwarf rootstocks have less excessively vigorous growth than trees on seedling roots. Pruning itself has a dwarfing effect on the tree. Sometimes, dwarf trees need very little pruning.

Cut out branches which cross each other, as well as vigorous upright suckers in the middle of the tree. Thin out parts of the tree which are too thick and which hamper penetration of chemical sprays and sunlight.

Make pruning cuts flush with the main limb, without leaving stubs. On young trees no healing paint is necessary.

Crotch angles of some varieties, especially spur type Delicious, tend to be very narrow. The branches grow almost straight up, close to the center of the tree. These should be spread out in the first, second, and third years and later if necessary.

Spreaders should be placed before you make pruning cuts. Cut a thin lath board about 18 inches long with V cuts on both ends. The V on one end is braced against the central leader and the other against the branch to force it outward to an angle of about 45°. Branches can also be forced outward by loosely tying their tips to a stake driven firmly into the ground. Clothespins or No. 9 wire 6 to 16 inches long and sharpened on both ends also are very effective in spreading small branches. Spreading of branches discourages too much vigorous tree growth and also induces early fruit production.

Dwarf trees can also be trained on a wire trellis similar to grapevines.

Fertilizer

Beginning with the second year, apply fertilizer annually about two weeks before bloom. It must not be applied in mid to late summer because this stimulates late summer growth which will be too tender and result in winter kill during very cold winters.

Ammonium nitrate at $\frac{1}{4}$ pound per tree multiplied by the number of years the tree has been set, but never more than $2\frac{1}{2}$ pounds per tree, is applied to moderately fertile soils. Very fertile soils need less.

The quantity of fertilizer is also adjusted according to the tree's vigor. If shoot growth the previous year was more than 12 inches long, less fertilizer will be needed.

Too much nitrogen causes excessive branch growth, inhibits fruit set, causes poor fruit color and flavor, delays ripening, and encourages fire blight disease. Conversely, pale green or yellowish leaves in the summer and short shoot growth may indicate the need for more nitrogen fertilizer the following spring.

Phosphorous fertilizer generally neither benefits nor harms apple trees. If the soil is low in potassium, apply some.

A 10-10-10 fertilizer at three times the above rates of ammonium nitrate is an equally good substitute.

Fertilizer is scattered under the outer parts of the branches. Since ammonium nitrate dissolves easily, you don't need to dig holes in the soil.

Stable manure can be used instead of chemical fertilizers, but it is usually more expensive and less available.

Mulches of any plant material, such as straw, grass or sawdust, suppress weed growth, hold soil moisture during a dry summer, maintain favorable soil temperatures, and add organic matter to the soil. Mulches should be six inches or more deep and extend to the tips of the branches. Woody materials, such as sawdust, wood

chips or coarse hay, will require extra nitrogen fertilizer to aid decomposition. Mulches may harbor harmful mice in winter.

Thorough irrigation benefits fruit trees in midsummer when little rainfall occurs. Watering is especially important at planting time and during the first summer. In Western States, of course, fruit trees are almost always irrigated every summer.

Frost (28° F or lower) occurring after bloom kills all the blooms and young fruit and there will be no crop. Frost injury to blossoms occurs most frequently in the low parts of a valley, because cool air is heavier than warm and it drains to the low areas.

On a sloping hill there may be good air drainage and less damage will occur. Trees near houses in suburban areas will suffer less frost damage than those in rural areas. Late blooming varieties, such as Golden Delicious or Rome Beauty, sometimes escape late spring frosts.

Frequently there is little the home orchardist can do to protect against frost.

Pest control is one of the most difficult aspects of growing your own fruit. It is not possible to produce usable apples without applying chemical sprays. Pears do better. When pears are grown without insect control, it is often possible to use about half of the fruits.

Insects which can be really serious problems on apples include the codling moth, apple maggot, red-banded leaf roller, tent caterpillar, aphids, mites, and apple tree borers. Serious diseases include apple scab, powdery mildew, and fire blight. The home gardener usually must accept less than complete control or apply more spray than is actually needed.

Mow the orchard weekly so that tall grass and weeds do not compete with the trees for soil moisture and nutrients. Fertilizers do not reduce the need for grass and weed control,

but mulches and herbicides can be useful in helping control weeds. Modern herbicides can kill all grass without damage to the trees. If weeds are controlled, no soil cultivation will be needed.

Meadow mice and rabbits can chew off the trunk bark. If the bark is chewed completely around the trunk, the tree will die unless it is bridge grafted. Crushed stone packed around the base of the trunk, and wire guards of ¼-inch mesh screen made into a tightly closed cylinder 1½ feet high and 6 inches in diameter wrapped around the base of the trunk, can help control mice. Rodenticides are sometimes used.

If the orchard is near a wooded area, deer may chew off the growing tips of young shoots. Tankage, a pulverized animal slaughter by-product, in a small cloth bag hung in the tree sometimes helps to repel deer.

Birds may peck into early summer apples which ripen from mid-July to mid-August, and can cause serious damage. Late ripening varieties are not injured by birds.

Thinning is necessary when too heavy a crop of fruit is set. It results in larger, better colored and higher quality fruits.

Prevent too early cropping by removing all fruits just after bloom in the spring of the first and second years. This encourages maximum early tree growth. Fruit removal from the leader will encourage an upright leader.

Up to five or six years of age, apple trees usually do not overset. But after six years, thinning may be needed. Reduce the crop to a fruit per spur, spaced 4 to 6 inches apart.

By thinning in the years of excessive fruit set, alternate cropping varieties such as Baldwin and Wealthy can be forced into a more consistently annual cropping behavior.

Harvest when fruits begin to drop and soften or become fully colored, and have developed good eating quality. Early summer apple varieties tend to ripen unevenly, and several pickings over a 2-week period may be needed, but the fruits on individual trees of late varieties all ripen at once.

Certain varieties such as McIntosh begin to drop even before they ripen. Others such as Cortland will not drop, even long after they have become overripe.

Harvest Bartlett pears before they begin to turn yellow. Ripen them at room temperature off the tree in the basket.

Yields of fruit trees will vary, depending on such factors as pests, rootstocks and variety. Fruit buds for the 1979 crop develop on the tree beginning in June, 1978, and they require adequate foliage for proper flower development.

Some varieties such as Golden Delicious crop at a young age, often 3 years, but others, such as Northern Spy, are much less precocious, often beginning about the 8th year.

Mature apple trees on dwarfing rootstocks usually produce 1 to 2 bushels per tree. On seedling roots, 15-year-old trees may bear 5 to 15 bushels.

Pear trees may produce half the volume of fruit borne by apple trees.

Storage of early ripening summer apple varieties is generally not practical, but late October varieties store well. Such apples store best at 31° F at high humidity and will stay tree-fresh through the winter. A home fruit storage can be made from a large garbage can or a large discarded home refrigerator buried in the ground with its door at the surface. In the case of a refrigerator, the lock must be removed to prevent children from accidentally being trapped inside.

Peaches, Nectarines, Plums, Apricots, Cherries . . .

Climate Puts Limits on What You Can Raise

by John H. Weinberger and Harold W. Fogle

Growing peaches or other stone fruits in your home garden can reward you with luscious, tree-ripened fruit. But you must give your trees the care they require. Here are three specifics:

—Regular sprays for insect and disease control are absolute necessities to growing unblemished fruits.

—Birds and bees will take their share unless you protect ripening fruits.

—You must select varieties adapted to your climate to be assured of regular crops.

Despite such requirements, the opportunity to have fruits of various flavors, tastes and textures for up to six months in your home garden is a real inducement to plant stone fruits.

Peaches, nectarines, plums, apricots and cherries are called stone fruits because they have a hard, stony pit. They can be eaten fresh, or saved for future enjoyment by canning, preserving, freezing, or drying. Sour cherries are most often used in pies.

The climate where you live limits your selection of the kinds of stone fruits you can grow. Individual varieties must be adapted also. One or more of the stone fruits can be grown in every State except Alaska.

Low winter temperatures hamper the growing of stone fruits in Northern States. Some fruit buds of peaches, nectarines, and Japanese plums are usually killed by temperatures below 0° F and a reduced crop results. Lower temperatures damage

or may kill the trees. European and native plums, cherries and apricots are hardier in fruit bud and wood than peaches or Japanese plums.

Along the southern border of the country, winter temperatures may be too high to break the rest period of the buds of many varieties. Only varieties with a low chilling requirement succeed there. In the vast area of the country between the marginal areas most stone fruits can be grown successfully.

Nectarines do best in a climate where rain rarely falls in the three weeks before ripening. They are very susceptible to brown rot disease.

Japanese plums, except for a few varieties, are not adapted to the humid climate of the Southeast. Diseases affect the trees and the fruits of most varieties.

Apricots bloom early in spring. The blossoms are usually killed by frost or freezes each year in all but the most favorable locations.

Sweet cherries are not adaptable to the extreme North or South. Everywhere birds will get a good share of the fruit before the home gardener is ready to harvest unless the tree is protected by netting or otherwise.

Peaches should receive first consideration by the home gardener for their wide adaptability, long ripening period, and ease of growing. Nectarines, where adaptable, are equally as good.

European plums need more care than peaches. They bloom later than Japanese plums and may escape frost. Japanese plums, where adapted, produce large and attractive fruits with a minimum of care.

Apricots in the home garden should be tried only in commercial apricot-growing regions.

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Sweet cherry trees reach large size, which adds to the problem of growing them in a backyard.

Contact your county Extension office for recommended variety lists and cultural practices.

Location, Spacing

Stone fruit trees should not be planted in a low or frosty location, where frost damage to blossoms and young fruits is probable. Moderately elevated ground or a slope will provide the necessary air drainage. Temperatures below 30° F will kill most fruits.

The soil should be reasonably fertile, with a pH of 5.5 to 6.5. Poorly drained soils are not suitable for stone fruits. Avoid planting trees in the permanent sod part of the lawn. Plant them in border plots or edges of the lawn. Fruit trees need full sun. Do not plant them in the shade of larger trees.

Peach, nectarine, plum, and sour cherry trees need the least space for maximum production; 18 to 24 feet is adequate. Apricot and sweet cherries need 25 to 30 feet. Peach and plum trees can be kept small by pruning and maintained in a 10- to 12-foot spacing if necessary.

All fruit can be picked from the ground if trees are kept low by pruning. Training trees on a wall or wire trellis is practical where space is limited.

A single tree can have fruit ripening over several months if three to six early, medium and late ripening varieties are budded into one tree. Budding is best done in late August while the bark still slips. The buds remain dormant until spring, when they are forced by cutting off the branch just above the bud. The ordinary "T" bud is the simplest type to use.

Sweet cherries and some Japanese plum varieties require cross-pollination in order to set fruit. A tree of another variety capable of cross-fer-

tilization must be planted nearby. For best results select two varieties to plant which are known to be cross-fertile. An alternative is to bud or graft a branch of the pollinator variety in the desired tree.

Nearly all peach, nectarine and apricot varieties set fruit with their own pollen. Avoid self-sterile varieties of these fruits.

Select only varieties which do well in your locality. The fruits should have good flavor and smooth texture to make your efforts worthwhile. Extreme firmness and slow softening are not necessary since the fruit will not be shipped. On the other hand, rapid softening makes handling difficult.

Fruits of most commercial varieties will fill these requirements satisfactorily when picked at their peak of perfection. Do not let nostalgia for old varieties overly influence your choice. Peaches, nectarines, and plums have been much improved in recent years.

Hundreds of peach varieties are available. Freestone peaches are preferred for fresh use and for freezing. Both freestone and clingstone peaches may be canned. Varieties grown in the humid region east of the Rocky Mountains are usually different from those grown in dry irrigated areas west of the Rockies.

For the eastern part of the country, a succession of varieties in time of ripening from early to late would be Springold, Candor, Early Redhaven, Dixired, Harbrite, Redhaven, Red-globe, Loring, Redskin, and Monroe.

In States from Texas to Maryland where bacterial leaf spot disease is a problem, give special consideration to resistant varieties such as Sentinel, Ranger, and Dixiland.

Special varieties having a low chilling requirement are needed where winters are too warm for the above varieties. These include Maygold, Junegold, and Suwanee. Desertgold and Flordasun, which require even

less chilling, are suitable for central Florida and the Rio Grande Valley.

A succession of peach varieties for the dry, irrigated areas west of the Rocky Mountains are Springgold, Springcrest, Royal May, Flavorcrest, Regina, Redtop, Suncrest, Fayette, Summerset, and Fairtime. They ripen from mid-April to mid-September. Firm-fleshed clingstone peaches for canning are Loadel, Andross, and Halford. Junegold, Sunnyside, and Fairway varieties are freestones adapted to warmer areas of the region. Desertgold can be grown where winters are short.

Some of these peach varieties may not be available in your area. You might visit a local fruitstand where you can select a locally-grown, adapted variety suiting your needs.

Nectarines are beautiful fruits. In recent years some non-patented varieties have been developed which are available to the home gardener. The earliest is Firebrite, followed in order by Independence, Flavortop, Fantasia, Late Le Grand, Flamekist, and Fairlane. Fairlane ripens about September 1 in California. Remember that in humid climates, nectarines are harder to grow than peaches.

Plum Varieties

European plums can be grown in most States, including some of those too cold for peaches. Suggested varieties are the self-fruitful Fellenberg (Italian Prune), Stanley, and Shropshire. In the Far West, Tragedy and President can be grown and they pollinate each other. French Prune is used for drying. It is self-fertile and can be planted alone.

Varieties developed from native American species of plums are available for areas with severe winters.

Japanese plums ripen from May to September in California. A succession of varieties in season of ripening is Burmosa, Santa Rosa, El Dorado, Lareda, Friar, and Casselman. Santa

Rosa, and Casselman are partially self-fertile and will pollinate the other varieties. In the Southeast, Frontier and Ozark Premier can be grown. Frontier needs cross-pollination. Methley and Santa Rosa are useful farther north.

Frost-protected locations are best for Japanese plums because of their early blossoming.

Blenheim (Royal), Tilton, and Castleton are suitable apricot varieties in California. In other areas Wenatchee (Moorpark), Goldrich, and Early Golden may be used. Apricots bloom earlier than Japanese plums.



Robert Bjork

A sour cherry variety.

The home gardener who wishes to challenge the birds for his crop of sweet cherries might plant Bing, Rainier or Van. They ripen in June and July. Two or more varieties are needed for pollination.

Sour cherry varieties available are Montmorency, English Morello, and Early Richmond.

Planting

A commercial nursery is the most convenient source of trees for the home gardener. Trees are graded by height in feet, or trunk caliper in inches. A medium-sized tree (4 to 6 feet in height or 1/2 to 5/8 inch in diameter) often gives best survival and growth.

Trees should be dormant when

planted. Spring planting is satisfactory in most areas providing the trees are kept dormant before planting. Fall or winter planting also is satisfactory and sometimes preferred in southern areas. If conditions are not suitable for planting at time of purchase, store in moist cellar or "heel-in" outdoors in a trench. Keep the roots moist and cool but avoid freezing.

Remove broken or diseased roots. If the roots have dried out in handling, soak them for several hours or overnight. Avoid planting when roots might be exposed to freezing. Plant the tree 1 or 2 inches deeper than it was growing in the nursery. Fill around the roots with topsoil, and tamp the soil. If the soil is dry, add 1 or 2 gallons of water to the hole. Fill the hole with soil and round off slightly.

Trees usually bear their first appreciable crop the third or fourth year after planting.

At planting time, the nursery tree usually has a single upright stem which should be cut back to 24 to 36 inches. This cut should be just above a mature bud. If there are wide-angled, strong lateral branches, select 2 to 4 which are separated up to 6 inches and spaced around the trunk. Tip these slightly. Remove or severely stub remaining laterals.

Select 3 or 4 scaffold branches during the first dormant period. These selected branches become the tree's primary framework.

Pruning should be minimal until the tree bears fruit. Unpruned trees tend to bear younger than pruned ones. However, branches which cross or interfere with good exposure of the scaffolds should be removed. An open-centered vase-type tree will give good exposure. Some secondary branches may be kept for early fruit and protection of the trunk and crotches from sunscald, but they should not interfere with the tree's basic framework.



In mature trees, keep vigorous current-season wood coming along to bear next year's crop of peaches and nectarines. The other stone fruits produce spurs which bear part of the fruit. Cut the tops back to reasonable picking height but change the height of cuts slightly each year. Prune to renew the bearing wood annually.

Fertilization

Most of the 12 nutrient elements essential for growth are available in nearly all soils. The tree's growth and production can tell you which ones are deficient. Leaf sample tests may be useful in diagnosing deficiencies.

Nitrogen is most often needed. A tree deficient in nitrogen will have light green to yellowish foliage and reduced shoot growth. In severe cases of N deficiency, small leaves, red specks on leaves and sometimes on fruit, misshapen and insipid fruit, and greatly reduced growth are com-

Peach tree with well-spaced, strong scaffold limbs and open center for maximum exposure to light on the fruit-bearing surface.

mon symptoms. Excessive nitrogen causes rank growth, poor fruit color and flavor, and may subject the tree to winter damage.

The dormant period is a convenient time to apply fertilizers. For a tree growing in sod, you need extra fertilizer to satisfy requirements of both tree and sod.

To remove competition for nutrients and water, keep a bare area under the spread of the tree by cultivation, herbicides or mulches.

Apply a complete fertilizer (10-10-10 or similar mixture) after the newly planted tree starts to put out leaves.

Each subsequent year apply fertilizer in amounts judged necessary for the individual tree based on appearance or leaf analysis. An approximate amount to apply is $\frac{1}{8}$ pound of actual nitrogen per year of tree age up to 1 pound per tree. Spread the fertilizer evenly in a circle slightly larger than the tree spread. Applications may be split, with part applied during the growing season. Avoid nitrogen applications after late July in northern areas.

Regular irrigation in arid areas is needed, and supplemental irrigation in natural rainfall areas is desirable. A temporary drought, particularly during the month before harvest, may severely reduce fruit size and quality, even though the annual rainfall is adequate. Sod or shallow-rooted plants will show water stress before the tree suffers from lack of moisture.

Avoid frequent light irrigation. Instead soak the soil thoroughly to root depth and wait for signs of moisture stress in the indicator plant before irrigating again. Too heavy or too frequent irrigation may damage roots. Cherries are particularly susceptible to excessive moisture.

Heavier soils—particularly those with considerable clay—require less frequent irrigation than light, sandy soils and are subject to slower loss of nutrients to the subsoil.

Frost Protection

Protecting fruit trees from frost is difficult in the backyard. Anti-smog restrictions prohibit use of smudge pots or similar protection.

Choose the most frost-free site available before planting. Record the minimum temperatures in available sites for at least a year in critical areas. Avoid planting in draws or basins where cold air settles. Higher elevations are usually best, but wind-swept knolls should be avoided.

Covering trees with tarpaulins or other material to prevent radiation cooling is one way of protecting them. However, some framework is usually necessary to avoid tree damage. It is cumbersome to cover large trees, and the cover must be left on until air temperature is safely above freezing and then removed before damaging heat is built up. Hence, covering is usually impractical except for small trees.

Low volume sprinkling can be used for frost control. Pruning must be altered to give a heavy, stiff framework to hold the ice load from all-night sprinkling. Protection depends on a continuous film of unfrozen water which releases heat for bud protection. Sprinkling must be continued until air temperature is well above freezing or the night's effort may be lost.

Don't try growing stone fruits unless you provide for adequate pest control. You need spray equipment capable of reaching the tops of mature trees, or you need to be able to hire a custom spraying service when required.

Obtain and follow carefully the pest control calendar from your county Extension office. Timing of sprays is extremely important. Use only currently recommended materials at the rates specified.

Brown rot, caused by *Monilinia* spp., destroys more ripening fruit than any other pest. This is particu-

larly serious in areas where it rains during and just before harvest. Removal of rotting fruit and "mummies" from the trees will help control spread of the fungus.

Scab, leaf curl, and cherry leafspot usually are not troublesome if trees are sprayed regularly. Bacterial leaf spot is not adequately controlled by spraying in extremely sandy soils of the Eastern United States—resistant varieties should be planted.

William E. Carnahan



Several virus and virus-like diseases can spread unchecked unless diseased trees are recognized and removed. They will not recover, and endanger nearby trees.

Precise timing of sprays should give adequate control of insects. However, missed sprays can result in wormy fruit, dead "flags" in the terminal growth, girdling of trunks by borers, or leaf damage by aphids and mites.

Protecting trunks from mice and rabbits with wire screens or plastic wrap-arounds may be necessary on trees growing near forests. Covering ripening fruit with netting is often the only way to protect it from birds and squirrels.

Fruit Thinning

Adequate dormant pruning removes a large number of flower buds. Pruning is the only practical thinning method for cherries, and can do a partial thinning in the other stone fruits. Heavy pruning may reduce the number of buds too drastically if later frosts kill additional fruit buds.

Additional thinning usually is needed after fruits have started development. Trees overloaded with fruit must have the crop thinned out to produce fruit of adequate size and good quality, and to prevent limb breakage.

Peaches, nectarines, plums, and apricots should be spaced 6 to 8 inches apart. Early ripening varieties need the greater spacing, and must be thinned early to give large fruit. Later varieties can be thinned at the pit-hardening stage without much loss in final size.

The advantage of homegrown fruit is that the best quality possible can be attained by ripening it on the tree. Most fruit for commercial use must

It's tempting to want to leave all the fruit on a peach tree. By thinning the peaches, those left on tree will be larger.

be picked three to seven days before soft ripeness to withstand handling and shipping.

Ripeness can be estimated by the disappearance of green and the development of yellow undercolor. Pressing the pads of your fingers against a fruit in your cupped hands will indicate softening of the fruit without damaging it. The fruit should be harvested by this same method, adding a slight twist of the wrist to loosen the fruit from its stem.

Pick the fruit into shallow containers to keep bruising at a minimum. Handle the fruit gently in moving and transporting it.

Fruit which will be used within a short time need not be refrigerated. It will attain its best quality in relatively warm storage.

Most varieties of fruit can be held in refrigerated storage for two to three weeks without excessive loss of quality. Longer storage usually results in internal breakdown of the flesh.

Stored fruit should be checked regularly for rotting or internal breakdown. Use the fruit as close to its prime quality as possible.

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Grapes Are Great But You May Have to Wait; Buying Rooted Vines Can Save You a Year

by J. R. McGrew

Grapes may be used as fresh or stored table fruit, made into jellies or juice, or fermented into wine. There is a wide range of flavors among the many varieties. Grapes can be one of the easiest home-garden fruits to grow and one of the most rewarding.

There are several types, each suited to particular climates, areas and use. Trying to grow types not adapted to your area can be a frustrating experience.

In an article this brief, there is no way to cover all varieties or all the methods of growing grapes. Nor can all the possible mistakes, hazards or pests be discussed. What follows are general statements.

Before deciding to try to grow grapes, you should consider the basic requirements for success:

—A growing season of at least 140 frost-free days.

—A site with full sunshine and good air drainage (not frosty).

—Soils that are neither waterlogged nor shallow, at least 3 feet deep.

—Willingness to spray at least three times per year to control insects and diseases.

—Patience to wait three to four years for vines to reach maturity before cropping.

—Annual pruning of vines.

—Readiness to defend the fruit against birds by netting the vines or bagging clusters.

A few vines may be planted along an existing fence, or a fence or arbor may be built in an esthetically pleasant place. Vines form an excellent

summer privacy screen, but after leaf fall and pruning there is little left.

Purchase of rooted vines from a nursery or garden store saves a year over propagating your own vines from cuttings. If muscadines or grafted vines are to be grown, the purchase of plants is preferable.

Spacing of vines is not critical. Six to 10 feet between vines gives room for each vine, makes pruning easier, and is a more economical use of the space.

Planting will be easier if the soil is spaded or tilled beforehand. Grapevine roots rapidly grow out several feet in the first two years, so working compost or fertilizer into the planting hole will be of little value.

For at least the first 2 years, an area one to two feet around each vine should be kept free of weeds by hoeing, or with a heavy mulch of grass clippings or black plastic. Fertilize young plants only on very poor soils.

Varieties

The choice of grape varieties is both important and complicated. Advice from neighbors, your county Extension office or from State Agricultural Experiment Station bulletins can be most helpful.

For California and parts of the Southwest, there are many excellent varieties of Old World grapes (*Vitis vinifera*). There are seedless table varieties, muscats and many wine varieties, each best adapted to certain areas.

For the Southeast (from Tidewater Virginia, through the central areas of the Carolinas, south through Florida, and west through the southern part of Texas) Pierce's disease kills or shortens the life expectancy of many popular grape varieties.

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In these areas the kinds of grapes that may be expected to give the best results are the muscadines, like Scuppernong or modern self-fertile varieties, and a few tolerant varieties introduced from the Florida Experiment Station at Leesburg; Stover, and Lake Emerald, and a few older varieties such as Champanel, Herbemont and Lukfata. Other varieties may survive to produce a crop or two, but have not proven successful over a longer period.

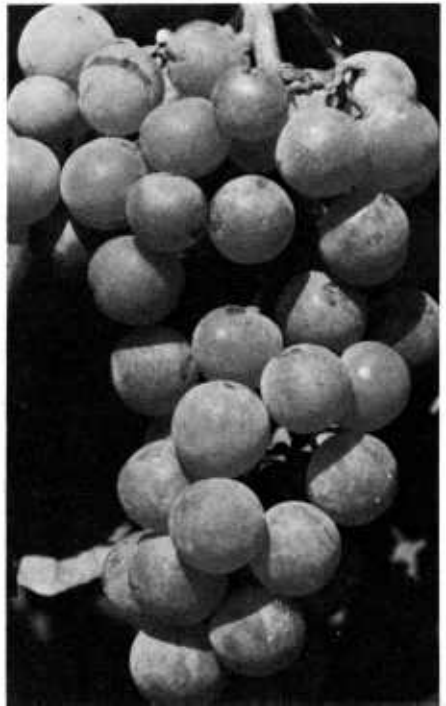
For the rest of the country, where the climate is humid enough to permit wild grapes to survive, the problem of variety selection is complicated by the several diseases and insects that attack cultivated grapes. The American and French-American varieties are somewhat tolerant of these problems and therefore less risky to grow.

In the shorter season areas (140 to 160 frost-free days), you can grow early ripening varieties such as Beta (blue) for juice and jelly; Foch (blue), Cascade (blue), and in better sites Aurore (white), for wine. Light cropping of vines may be useful in short-season areas because it can advance ripening of the fruit by about two weeks.

In the medium season areas (160 to 200 frost-free days), Concord (blue) and Niagara (white) are two of the most popular and easily grown varieties for table use and for juice and jelly. There are several semi-seedless varieties, like Himrod (white) and Suffolk Red, table grapes such as Seneca (white), Alden (blue) and Steuben (blue), and many French-American wine grapes that are satisfactory. Chardonnay and White Reisling, representatives of vinifera wine grapes, may survive if sprayed carefully and frequently.

For growing seasons longer than

Top, table variety, Steuben. Right, semi-seedless Suffolk Red.



200 days, late ripening varieties are preferred. Concord and Niagara are suitable for juice or jelly. White wine varieties include Villard blanc and Vidal 256, for red wine-Chambourcin and Villard noir. A muscat flavored grape of interest is Golden Muscat.

If you have a protected site, in cold areas, and if you are willing to take a chance on occasional crop loss and especially if you are willing to take extra effort to protect vines against pests, you may succeed with varieties that might otherwise fail.

Vines should be planted at about the same depth they were grown in the nursery. If vines are grafted, the graft union should be about 2 inches above ground level.

Roots should be spread out in all directions in the planting hole. They may be trimmed to about 2 inches if you choose to plant the vines in a narrow hole made with a post-hole digger.

The top should be cut back to leave two or three buds. When the new shoots begin to grow, remove all except the one or two shoots that are the most vigorous and straight. Tie these loosely to a light stake. Several times during the first season remove lateral shoots that develop at the point of attachment of each leaf. This allows the main shoot to grow more rapidly and a full year may be gained in establishing the vine.

Failure to remove these lateral shoots and the sprouts that appear from the base of the vine throughout the season will result in a bushy vine which seldom has any shoots long enough to reach the trellis.

Leave about four lateral shoots just below any horizontal wires along which you want the vine to grow. When the shoot or shoots reach the highest point of the trellis or arbor, tie them there, pinch off the tip and allow several of the lateral shoots to grow.

If for any reason a vine fails to

make good growth during the first growing season, cut the top back to two buds and treat it as a newly planted vine. It will generally grow more vigorously during the second season.

Training places the crop in a convenient location for vineyard operations and harvest. Pruning controls the size of the crop to a level that can be ripened successfully.

Structures

Structures on which the vines may be trained range from two or more posts set in the ground and strung with two or three horizontal wires (a trellis) to decorative arbors. Bracing should be sufficient to carry the weight of vines and crop under the sort of wind conditions experienced in the area. Trellis posts should not be more than 20 feet apart and arbor posts not more than 10 feet apart.

Wires (11- or 12-gauge smooth galvanized) should be spaced about 2 feet apart up the posts or along the top of an arbor. Closer spacing causes excessive shading. To permit weed control under the vine and to keep the fruit up, the lowest wire should be 30 to 36 inches above the ground.

Train a permanent trunk to the top wire of a trellis or to the top edge of an arbor.

During the dormant season when vines are pruned, fruiting canes (see below) should be trained outward along each wire on the trellis or along an arbor's top edges.

Each bud on the fruiting canes grows into a shoot from 4 to 20 feet long. These are tied along trellis wires as they grow, or on an arbor are spaced out across the top wires to give even exposure to sunlight.

Fruiting canes can be readily identified if we look at a vine in the spring before growth begins. They are the one-year-old shoots (wood of the previous season), with bark that is smooth and brown. At each place

where a leaf grew the previous season, there is a conical swelling, or bud.

During the growing season, each bud grows into a shoot which bears leaves and generally three clusters of grapes. The more buds that are left after pruning, the more clusters will appear on the vine.

An unpruned grape vine will set far more fruit than it can ripen successfully. Fruit from overcropped vines is low in sugar, sour, and has poor color. Excessive over-cropping can severely damage the vine.

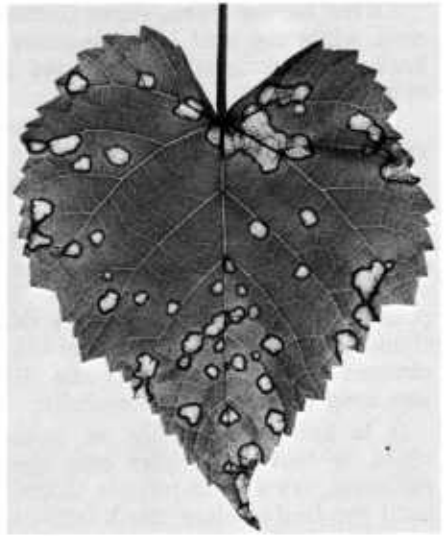
Obviously the cluster size must be considered in calculating size of a crop. With very large clustered varieties, such as Thompson Seedless, as few as 10 clusters per vine (8-foot spacing) should be left. Perhaps 50 clusters of Concord can ripen and as many as 100 of small clustered varieties such as Beta or Foch.

The commercial grower controls crop size by leaving exactly the right number of buds. The home gardener can achieve a far more accurate control of crop size, and do it despite variations in weather or fruitset, by leaving an excess number of buds, two or three times as many as needed, and removing clusters until the right number remain. Removal of excess clusters can be done any time from before bloom until mid-season.

Pest Control

Most county Extension offices have spray schedules for the home gardener and in those areas where grapes are grown, appropriate sprays for diseases and insects of grapes are included. You may be able to get an occasional crop without spraying, but both diseases and insects tend to become progressively more severe from year to year.

Control of weeds for a foot or two around young vines is worth the effort in the improvement of growth you can expect. Once established, the vine will shade out some weed growth.



Some types of weedkiller should not be used near grapes as they are extremely sensitive. Do not use the combination of fertilizer plus weedkiller on lawn areas within 15 feet of a grape vine. The weedkiller may be picked up by the grape roots that extend out this far and the vine can be damaged.

In many areas birds can be a major problem. Netting, which can be used earlier in the season for strawberries and blueberries, is available and if placed carefully over the vines will protect the fruit.

Hornets and wasps on ripe fruit are a common complaint. They are able to attack the fruit only if it has been damaged by insects, diseases or birds, or if it is overripe.

An acceptable taste is the main criterion for table use. On a vine that is not overcropped, the berries of blue varieties will lose their red color and white varieties will change from green to golden yellow. Ripe berries will soften and seeds become brown.

Black rot fungus on an American bunch grape leaf.

As the berries ripen, sugar content rises while the acid level decreases. Both these changes are reflected in improved taste.

Determining the harvest of wine grapes requires either experience or a means of measuring both sugar and acid levels.

The yields of a grapevine greatly affect fruit quality. If you permit vines spaced at 8 feet to produce over 30 pounds of fruit each, the quality will almost surely be low. Only under ideal circumstances and climates can this size crop be ripened successfully.

It is better, especially on young vines, to leave a smaller crop than optimum, say 5 to 10 pounds of fruit, until you find out how much fruit can be ripened successfully in your particular situation.

There are several sources of information at all levels of complexity for the home grape-grower.

The U.S. Department of Agriculture and State Agricultural Experiment Station bulletins and leaflets cover general grape growing, variety recommendations, descriptions of diseases and insects, pests, and recommended spray programs. States which have an established grape industry tend to have more complete and extensive publications.

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Strawberries Like Full Sun — and a Good Deal of Attention

by Robert G. Hill, Jr., James D. Utzinger, and Elden J. Stang

Success in growing strawberries depends on close attention to cultural details. Small well-cared for plantings are generally more rewarding than larger plantings which receive less care.

You can expect nearly a quart of berries from each plant you set if you follow good cultural practices. Well established and cared for plantings can produce berries up to three years.

Besides being a versatile dessert fruit, strawberries are highly nutritious. One cup of fresh strawberries supplies more than the recommended daily Vitamin C requirement. Strawberries also make a welcome addition to the home freezer or can be used for jellies and jams and other preserves.

Strawberries do best when planted where they receive full sun most of the day. They grow and produce well in a wide range of soils—from sandy to heavy loams, but sandy loams are preferred. Strawberries are not particularly sensitive to soil acidity or alkalinity. However, they produce best on acid soils with a pH of 5.8 to 6.5.

Key factors in site selection are soil drainage and freedom from frost. Don't expect good production without adequate soil drainage during the entire year. Strawberries can't tolerate standing water. Since strawberries bloom very early in spring, don't plant them in a frost pocket. Frost pockets are low-lying areas into which cold air drains. The crop in such areas is

likely to be lost to late spring frosts, which destroy the flowers.

Avoid planting strawberries on steep slopes. Heavy rains are apt to bury some plants and wash others out of the soil. If you must use a sloping site, rows should run across the slope or on the contour.

Avoid areas used recently to grow tomatoes, potatoes, or sod. These sites are likely to contain disease and insect pests that may attack strawberries. Likewise, avoid sites heavily infested with quackgrass, Johnson grass or thistle, or else treat the site well before planting to destroy those weed pests.

Performance of a strawberry variety is markedly influenced by local soil and climatic conditions. A variety highly successful in one area may be of little value in another. So select varieties on the basis of area conditions. Ask your county Extension office what varieties are best adapted for your area. No cultural practice can overcome a handicap imposed by poor selection of varieties.

Commercially available strawberry varieties are self-fruitful (they don't require cross pollination), and will produce good crops when only one variety is planted. However, most home gardeners prefer to plant several varieties to extend the harvest.

Two types of strawberries are available. June bearing strawberries produce a single crop each year. *Everbearing* strawberries produce one crop during the normal season and a second crop during fall of the same year. Probably the normal June bearing type is the most popular.

Other factors to consider are quality of the berries, their suitability for freezing, and the degree of disease resistance.

The authors are all members of the Department of Horticulture at the Ohio State University and the Ohio Agricultural Research and Development Center, Wooster. Robert G. Hill, Jr., is Professor and Associate Chairman. James D. Utzinger is Associate Professor. Elden J. Stang is Assistant Professor.

Buying Plants

Buy from a reputable nursery to be sure of getting quality plants true to name. To get plants of the desired varieties, order as early as possible and indicate the desired delivery date.

The best kinds of plants to buy are "virus-free". They can yield 50 to 75 percent more fruit than plants from ordinary planting stock.

There is no apparent visual difference between virus-free and ordinary planting stock. The only way to be certain the plants are virus-free is to purchase *registered* plants. These have been grown under State supervision, and the word *registered* on the bundle label indicates the plants are substantially virus-free, the best that can be obtained.

Virus-free plants of many varieties are available. Use them whenever possible.

Another class of plants, *certified*, also is grown under State supervision. Certification indicates the plants are free of most noxious diseases and insects; however, they may carry virus. Certified plants are the best available of some varieties.

Dormant strawberry plants are best for spring planting. Plants dug early and held dormant in storage, if properly stored, are as good as freshly dug plants. In some cases, stored plants are superior.

When plants arrive, check the bundles. If necessary, moisten the roots, but do not soak them. Plants which cannot be set immediately may be stored in a refrigerator for several weeks, or until planting conditions are satisfactory. Hold plants as close to 32° F as possible in the plastic bags they are shipped in. Be sure the bags are closed by folding only, and not tightly closed.

If no storage facilities are available and planting can't be done in a few days, carefully unpack plants and heel them in. To heel-in, pick a sheltered and well-drained area and dig a shal-

low trench deep enough to accommodate the roots. Open the bundles and place a single layer of plants against one side of the trench so the crowns are partially above the soil line. Cover the roots with soil, moist peat moss, or sawdust, and firm carefully.

Plants so handled can be held for several weeks, if not allowed to dry out. But don't leave plants heeled-in any longer than necessary.

It is wiser and cheaper, in the long run, to purchase nursery stock than to secure planting stock from your own or a neighbor's plantings. The better the planting stock, the better yields you can expect.

Site Preparation

It is best to begin preparing the strawberry site the year before planting. Use the proposed site to grow a cultivated crop during the season prior to planting. Chronic weeds can be controlled and soil fertility levels adjusted during this period. Use soil test results as a guide in adjusting the fertility level. If necessary to plant an area that has been in sod, turn or spade the sod over during the fall before planting. Weed problems in plantings set into newly-turned sod can be overwhelming.

Ideally, work the site during late summer. Seeding the area to ordinary rye in early September helps control erosion. Usually, 2 to 3 pounds of rye seed per 1,000 square feet will give the desired results.

If animal manures are available, they may be applied in fall. A suitable application is 50 to 75 pounds of strawy manure per 100 square feet.

Prepare the site for planting as early as possible in spring, during late March or early April, before the rye gets too tall. Work the soil until it is near seedbed condition.

Apply fertilizer and work it in as you prepare the soil. Adjust rates of fertilizer application based on your experience with the site, or results of

a soil test. On most sites, 1 pound of a 5-10-10 fertilizer per 100 square feet will be beneficial. For convenience, you may mix and spread the recommended soil insecticides with this fertilizer.

Don't work the soil when it is wet.

Making the Planting

The training system to be followed in strawberry planting determines the distance between rows and between plants in the row. Most home gardeners use the *matted* row. No effort is made to limit the number of runner plants, but they are kept within a row 18 to 24 inches wide. Plants of most varieties are usually set every 18 inches in rows 48 inches apart.

The other system is the *spaced* row. The number and location of runner plants is predetermined. The spaced row system requires much more labor than the matted row. It also requires setting more plants per unit area.

Early spring planting is best. Set plants as soon as the soil can be prepared, normally during late March and early April. Don't attempt to plant until the soil is dry enough to work. If plants can be maintained in a dormant condition and irrigation is available, planting can be delayed.

Before planting, remove all but two or three of the most vigorous leaves and prune away about a third of the

Strawberries planted in matted row system used by most home gardeners.

roots. Place the plants in the soil so the roots are spread out. Cover the roots until the crown (where the leaves arise) is just above the soil surface. If the crowns are covered with soil, or the roots exposed, plants will do poorly and may die.

Hand planting can be done by a two-person team. One person forces a spade or long-handled shovel about 6 inches into the soil and pushes it forward to open the hole. The other inserts the plant to the proper depth and holds it against the side of the hole while the spade is removed. The one with the spade then closes the hole by inserting the spade in front of the hole and pushing forward on the handle. Soil about the roots is then firmed with the foot.

After setting, if the soil is dry, give each plant at least a cup of water. Regardless of the planting methods, make every effort to prevent the plants from drying out.

First Season Care

Remove flower stalks as they appear. If berries are allowed to develop, they will reduce plant growth, runnering, and next year's crop.

Carefully cultivate and hand hoe





the planting throughout the season to control weeds. Frequent, shallow cultivation in one direction only is best. Infrequent, deep cultivation can damage strawberry plants.

Cultivation helps keep runner plants within the allotted row area and permits easier rooting of runner plants. Don't allow the rows to get wider than 18 to 24 inches. Chemical herbicides may be used as an aid in weed control during this period. But for most garden plantings their use is not recommended because of problems in application.

Runner plants produced after August 15 are relatively unproductive and should be removed, unless the desired matted row has not been obtained.

Fertilizer applications are seldom needed during the growing season. But if the new plants appear light green and don't grow well, sidedress with nitrogen fertilizer about a month after planting. Apply 1½ to 2 pounds of ammonium nitrate per 100 feet of row. When applying this fertilizer, select a dry day and brush all fertilizer off the leaves to protect them against fertilizer burn.

If the plants continue to have light green leaves, a similar application may be spread over the rows about

August 1. Avoid getting fertilizer on the leaves.

Fertilizer applications in the spring of fruiting years are apt to cause soft berries and reduce yields.

Since too much nitrogen may cause excessive growth and reduce yields, exercise care in application rates.

Use irrigation and pest control practices as needed.

Winter Care

Mulch strawberry plantings in colder regions as a winter safeguard. A mulch protects plants from severe cold and against soil heaving caused by alternate freezing and thawing of the soil.

The best mulching materials are clean, seed-free wheat or rye straw. Tree leaves and oat straw tend to pack and smother the plants. Coarser materials offer little protection. Sawdust may be used, but straw is preferred. Expose the straw to weather by placing it near the planting in early fall. Most of the grain and weed seeds will germinate before the mulch application, thus reducing a serious spring weed problem.

Apply mulch 3 to 4 inches deep over the plant rows. Do this only after the planting has experienced several sharp freezes—in the lower 20's. It is easier to apply mulch when the ground is frozen. When mulch is applied before growth stops, damage to the crowns could occur. If mulching is delayed, low temperatures could damage the crowns.

Mice sometimes will damage strawberry plants under the mulch. Check with your county Extension office for control methods.

In spring when new leaves begin to develop, fork the mulch off the plants, placing it between the rows. So placed, the mulch controls weed

Removal of flower clusters from new leaf set plants will increase future yields.



Don Normark

growth, conserves moisture, and helps keep the berries clean. Remove only enough mulch from the rows to let the plants develop.

Winter mulch may be re-used to protect flowers from frost. If frost is predicted, mulch can be spread evenly back over the rows. The mulch acts as an insulation barrier which traps radiant heat from the soil and holds it around the plants. Mulch can be left in place for several days, if necessary.

Harvesting

Harvest berries when they are fully colored; those with white areas are not ripe. Pick the berries with the caps and stems attached. To do

Left, mulching strawberries helps keep the fruit clean and conserves moisture. Right, strawberry bloom at frost-hazardous stage. If frost is predicted, remulch the planting until hazard passes.



this, snap the stem, using the thumbnail. Avoid bruising the berries. Keep harvested berries out of the sun and refrigerate as soon as possible. The first harvest generally can be made about 30 days after first bloom.

One advantage of growing your own strawberries is that they may be eaten at peak of quality.

If possible, avoid picking berries when the plants are wet. Harvest as often as necessary, about every other day. The harvest season of a given variety extends over 5 to 7 pickings. Harvesting is made easier by the use of "carriers" that hold 4 or 6 quart baskets.

Pick and remove berries damaged by birds, and any rotted berries.

Renewing Plantings

Strawberries may be fruited more than 1 year. Yield and size of berries are progressively smaller the second and third years. As a rule, it is unwise to attempt more than 3 crops from a single planting.

Only good plantings should be maintained and renewed. Destroy weak, weedy or diseased plantings right after harvest.

Renewal of a planting should be done shortly after harvest. Start by

mowing off the tops as close to the ground as possible without damage to the crowns. Then with a spade or a rotary type tiller, narrow the row width to a strip of plants 8 to 10 inches wide. This can be done by destroying plants on both sides of the row or one side only. The latter is preferred.

As you narrow the row, work the mulch and other organic material into the soil. Fertilize the row as indicated for summer fertilization of a newly set planting. Handle the renewed planting the same way as a first-year planting. Generally a planting should not be renewed for more than 2 seasons.

Irrigation

Strawberries can be grown on a limited basis without irrigation. However, in many seasons full production can't be realized unless the plantings are irrigated. During these seasons, supplemental water assures formation of a good row and helps assure good berry size.

Apply enough water during the growing season to supplement rainfall and to provide an average of 1 inch of water per week. Irrigate when a water shortage is apparent, even before the plants show drought symptoms.

Strawberries are relatively free from disease and insect problems. Normally they produce satisfactory crops in home gardens without spraying. Full production of high-quality berries, however, requires that you follow a careful pest control program.

You can avoid many headaches by selecting sites free of disease and insect problems, getting suitable planting stock, and following good cultural practices. As with other fruit crops, good pest control practices are based on preventing problems rather than overcoming them. Specific problems and control practices will vary from region to region. Contact your



William E. Carrahan

county Extension office for details.

Birds may be a problem during the fruiting season, damaging the ripe fruit. Bird control netting, available commercially, is the best solution. Stretch it over the beds.

Everbearing Berries

Everbearing strawberries are grown primarily for the fall crop. They will produce satisfactorily if grown under the spaced-plant system of culture. Successful production of this type strawberry requires much labor, so planting should be of limited size. They will not do well when grown in matted rows.

The site for Everbearing varieties should be prepared and the plants set with the same considerations as June bearing varieties.

Stretch netting over strawberry plants, so as to protect them against the birds.

These plantings should be maintained under either a sawdust mulch or a black plastic mulch. With a sawdust mulch, care for the planting as if it were a regular planting until early June when the runners appear, then stop cultivation. Fertilize each plant with 2 tablespoons of a 16 percent nitrogen fertilizer or equivalent, spreading the fertilizer uniformly over the soil around each plant.



Ripening cluster of strawberries.

Then cover the entire area of the planting with 1 inch of either hardwood or softwood sawdust. It may be fresh or weathered. Don't apply excessive amounts. Further weed control must be done by hand, since hoeing and cultivation will mix the sawdust with the soil, thus destroying the mulch benefits.

After applying the mulch, start training the runner plants, locating each in the desired position. Force the plants gently but firmly through the sawdust so their roots contact

the soil. The distance between runner plants varies from season to season but will be about 8 to 10 inches.

After the desired number of runner plants has been established, remove all others as they develop through the remainder of the season.

Removal of flowers should continue until the first to the middle of July. The exact date for discontinuing blossom removal depends on the planting. The more vigorous it is, the earlier blossom removal can be stopped.

Harvesting will begin about 30 days after first blossoms appear. The first berries will ripen in August and harvesting should continue twice a week until frost.

Black plastic offers advantages over sawdust as a mulch for ever-bearing strawberries. Its use minimizes problems of weed control and helps keep the berries cleaner. With black plastic, only a slight variation in cultural practice is needed. The mulch may be spread over the row area and the plants set through it at desired locations. Cover edges of the mulch with soil.

Establish runner plants where needed by cutting a slit in the plastic and placing the plant firmly into the soil. Blossom and runner removal are the same under both mulch systems.

Trickle type irrigation lines installed under the plastic mulch can prove helpful during drought periods. Take care not to over water.

June bearing strawberries may be grown according to the spaced plant systems, too, but benefits do not justify the added efforts.

Cane and Bush Fruits Are the Berries; Often It's Grow Them or Go Without

by John P. Tomkins

Homeowners frequently overlook the possibilities of growing raspberries, blackberries, gooseberries, currants, and similar berries. During recent years these fruits in local markets have been scarce and rather expensive. The homeowner might have to grow them or do without.

These cane and bush fruits are easier to grow and much more practical as compared with the tree fruits in home gardens. Cane fruits require less work, occupy a smaller area, need relatively few sprays for pest control, and will produce fruit within a year or two of planting. A small area devoted to berries will give rich dividends in fresh fruit for the home or to be passed along to friends.

Raspberries, currants, and gooseberries are excellent sources of vitamin C. Raspberries and blackberries may be used fresh, canned, frozen, or in pies, jellies, jams or preserves. Gooseberries are used mainly in sauces and pies. Currants may be used alone or mixed with berries to make a very tart and tasty jelly.

These fruits vary greatly in hardiness to low winter temperature. Currants and gooseberries are the hardiest and can withstand -40° F and still be productive. Red raspberry is next in hardiness; some varieties will withstand -35° , although others may be injured at 0° . Black and purple raspberries are next in hardiness and may withstand -25° . Blackberries may be injured around -15° while thornless blackberries, boysenberries, and youngberries may be injured when the temperature falls close to zero.

All cane fruits may be injured at

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somewhat higher temperatures than indicated if they receive poor cultural care during the growing season. However, they may withstand temperatures 5° to 10° F lower than indicated if properly hardened or given some winter protection.

Success of a cane fruit planting depends largely on selection of the proper varieties for your area. Varieties differ greatly in berry quality and size, season of ripening, hardiness to low winter temperature, and disease susceptibility. Growth and yield are influenced by length of growing season, temperature, rainfall and humidity. A good variety in New York may be very poor in Maryland, Maine, California or Washington.

The most reliable information on varieties for a given area may be obtained in fruit publications available at your county Extension office.

Fall Bearers

Much good work is being done by the berry breeders in the U. S. Department of Agriculture and at various state Agricultural Experiment Stations. One of the most interesting developments has been the production of fall-bearing raspberries which have a summer crop on floricanes (canes produced the previous year) and a fall crop on primocanes (canes produced during the current season).

The fall crop is very successful in areas with a frost-free growing season of 165 days or longer.

The best fall-bearing raspberry variety is Heritage. Another promising fall-bearing variety is Augustred from New Hampshire. In New York it has a fall crop that ripens 35 days earlier than Heritage. Augustred is worth a try where the frost-free growing season is 130 days or less.

During recent years, breeders have developed some varieties of thornless blackberries which are very vigorous and productive. The weakness of these varieties is a tendency to injury during winter by temperatures near 0° F. However, the home gardener can cover these canes with mulch during winter and the buds and canes will survive at temperatures much lower than 0°.

The most important soil factor for growing raspberries is good drainage to a depth of 3 to 4 feet. Plants in full leaf will not tolerate standing water or a high water table for 2 to 3 days without root injury, subsequent decreased yields, and perhaps death of the plant. Raspberries tolerate a wide range of soil types from clay to sand if drainage is good.

Currants and gooseberries tolerate a heavier soil and poorer drainage than cane fruits.

The most suitable soil is a sandy loam, rich in organic residues, with a good moisture-holding capacity and a pH of 5.5 to 6.8.

Select a site for planting in which perennial weeds have been eliminated and where tomatoes, eggplants, peppers and potatoes have not been grown within the previous two years. These crops build up a fungus disease known as verticillium wilt which damages or kills many cane fruit varieties. A location in full sunlight is desirable, although cane fruits will thrive in areas shaded for part of the day.

Buy plants from a reliable nursery. This is a key to success in bramble fruit production. The disadvantages of poor stock can never be overcome by a good site or even superior cultural knowledge. Be sure plants come from certified or inspected stock.

Prepare the site by growing cultivated crops at least a year before planting cane fruits. Work 1 inch or more of organic residues such as lawn clippings, rotten leaves, or well rotted

manure into the top 4 to 6 inches of soil. Before planting, mix about 1 pound of 10-10-10 or equivalent fertilizer per 100 square feet of soil. If the soil reaction (pH) is under 5.5, add limestone or hydrated lime as indicated by a soil test. Your county Extension office or a reputable garden store can suggest how to go about having a test made.

Plants are usually obtained and planted in early spring. If they arrive before soil preparation or when the soil is too wet for planting, store the plants—if well wrapped—in a cool place. If unpacked, heel them into the ground in a shallow trench in a cool shady area so the roots do not dry out.

Set plants in rows with 30 inches between plants in the row for raspberries and blackberries, 3 to 4 feet between plants for currants and gooseberries, and 5 to 8 feet for trailing and thornless blackberries.

Space between rows will vary from 6 to 10 feet depending on cultivation equipment. Nine to 10 feet between rows is usually adequate and helps to prevent spread of fungus diseases which tend to be prevalent with the plantings in closer rows.

Set plants in the ground to a depth of 5 to 6 inches, or at least 1 inch deeper than the plants were grown in a nursery row.

Purple or black raspberries are grown in hills. Black raspberry never develops new canes from root suckers; purple raspberry may develop a few.

Red raspberry develops many new plants from root suckers, and is usually grown in a hedgerow system. New suckers developing along the row are controlled either by cultivation or timely mowing to keep the row of new canes 6 to 18 inches wide.

Cane fruits have an unusual growth habit. The canes are biennial and the roots perennial. The new canes are

known as primocanes. The next year these canes are known as floricanes.

Buds on floricanes develop shoots with leaves and terminate in flowers. After the canes have fruited they die. Remove them at this time or when pruning in winter.

Obviously new primocanes are being formed each year. Primocanes on thornless blackberries, dewberries, and boysenberries tend to grow along the ground. The next year these canes are tied along the trellis where they fruit. After the canes have fruited they may be removed and destroyed.

Pruning

Black and purple raspberries usually are not trellised. When the primocanes get 18 to 24 inches long—generally during May or June—prune off the tip of each cane. This forces 3 to 7 buds nearest the severed tip to start growth, and eventually they form laterals 3 to 7 feet long. The following winter prune back the laterals to about 8 inches from each main cane. All buds on the laterals and main canes are potential fruit buds.

If you live in a snow belt, prune black and purple raspberries in early November before heavy snows. Melting snows in early spring may damage unpruned laterals in areas where snow is 3 to 7 feet deep.

You prune red raspberry quite differently from black and purple raspberry. Tips of the primocanes are not pruned the first year. Red raspberries may be grown without a trellis, but a better crop will be obtained with less damage from fungus diseases if the raspberries are confined to a row 6 to 9 inches wide. The canes are secured to a vertical trellis with the bottom wire at 36 inches and the top wire at 60.

Red raspberry normally is pruned in late winter. Remove old fruiting canes and new canes which are damaged or weak. Leave only 2 to 4

robust canes, preferably 2 canes per foot of row. Tie these canes securely to each wire.

Sometimes red raspberry is grown in a hedgerow 18 to 24 inches wide. A horizontal trellis may be used with wires 36 to 42 inches above the ground. Frequently a trellis is not used and the fruiting canes are pruned to a height of 36 to 42 inches so they stand upright when loaded with fruit. This is a cheap and simple system but the plants are subject to fungus diseases.

Boysenberry, dewberry, thornless blackberry and youngberry are usually trellised. Fruiting canes are separately wrapped around the wire and tied along the bottom and/or top wire of the trellis. Allow new canes to grow along the row on the ground during the first year. Remove old canes after fruiting.

Currants and gooseberries are perennial bushes. Usually you remove canes or branches after the fourth year. A mature bush might consist of 12 to 15 branches under 4 years of age. You usually prune currants and gooseberries in early spring before growth starts.

All these berries may be grown under clean cultivating, sod, or a permanent mulch. The author prefers either clean cultivating or the mulch. The average homeowner has many organic residues around the home such as lawn clippings, leaves, or shredded vegetation. A raspberry planting is an ideal place to use these materials.

If you grow raspberries under clean cultivation, the area between rows is cultivated to a depth of 1 to 2 inches at intervals of 2 weeks from early spring to end of the harvest season. This controls weeds and raspberry suckers in the row. If you use sod culture, mow the area between the row like a lawn throughout summer to control growth of weeds, grasses and suckers. Where a per-

manent mulch is used, mow at timely intervals to control raspberry suckers between the rows.

Highest yields will be obtained with permanent mulch. Clean cultivation is the next highest in yield. Sod usually results in the lowest yield, but in some cases is the easiest system for a homeowner to maintain.

Two Cautions

A key to cane fruit is a weed-free planting given tender loving care the first half of the season and then somewhat neglected the second half after the berries are harvested. Serious mistakes are using too much nitrogen fertilizer, and cultivating after the last of August.

Cane fruits respond to timely irrigation during periods of drought. Water may be applied by sprinklers, soaker hoses, or trickle irrigation.

Sprinklers are easier to operate and faster, but if the foliage is wet for extended periods the plants are more susceptible to certain fungus diseases. It is suggested the homeowner irrigate by soaker type hoses or trickle irrigation.

Probably the best system is trickle irrigation, which applies a few gallons of water a day. It requires very little water at very low pressure. With trickle irrigation the water is applied along the row at intervals of 18 to 24 inches. It does not wet the entire surface.

Most people recognize the importance of irrigation between bloom and harvest for the fruiting canes. But irrigation may be needed from May to September for adequate growth and development of the primocanes which are next year's fruiting canes. A permanent mulch controls weeds and reduces water loss by evaporation from the soil's surface.

A raspberry planting usually responds to 1 to 2 pounds of 10-10-10

fertilizer or equivalent applied per 20 feet of row in early spring before start of growth. If you use less nitrogen, cease cultivation by mid-July and allow weeds, grass or cover crop to grow between the rows. The plants then are less likely to be susceptible to low winter temperatures.

In a very cold area you can protect canes and buds from winter injury by bending the canes to the ground in late fall before the ground freezes, covering the tips with soil. This keeps the canes below the snow line. Or you can cover canes with mulch. The author was able to grow Thornfree blackberries at Ithaca, N.Y., and had a beautiful crop after a winter of -18° F during the coldest night.

When canes are given winter protection by covering with mulch, how do you know when to uncover them in spring? Wait until warm weather—but uncover them before the buds start growth.

Harvest red raspberries when the fruit is ripe, usually about the end of strawberry season. There are early, mid-season and late varieties of raspberries. A given variety will produce fruit over a 17- to 25-day period. Blackberries ripen after raspberries.

If you laid out a good variety planting of red, black or purple raspberries; blackberries and thornless blackberries, and fall-bearing raspberries, in some States you can have fresh berries for your table almost daily from strawberry season until early November.

Currants and gooseberries are ripe when soft, well colored, and tasty. In making jelly, some people like tart berries which are not fully ripe. Others prefer berries that are fully ripe and high in sugars. Few people are aware that immature gooseberries, "hard as marbles," make a tastier pie than ripe berries.

Yields per plant will differ greatly depending on variety and cultural

Photos by Paris Trail

Top left, Jewel black raspberry. Top right, Brandywine purple raspberry. Bottom, Heritage fall-bearing red raspberry.



Left, Paarman gaaseberry at time of harvest. Below, White Imperial currant.



care. Raspberries and blackberries should average a quart or more of fruit per plant. Thornless blackberries and boysenberries may produce somewhat higher yields. A mature currant or gooseberry plant should yield 4 to 6 quarts a year.

A raspberry planting may be productive for 7 to 12 years. Currants and gooseberries should be fruitful and productive for 20 years, and in some home gardens the same bush has been productive for 50 years.

Remove any plants that become unproductive. Buy new plants and set them in a different location.

Ripe fruit is prized by birds, mice, and raccoons. If birds are a serious problem, obtain netting with $\frac{3}{4}$ - to 1-inch mesh and cover the planting. An electric fence with wires at a height of 5 and 10 inches is effective

in keeping raccoons and similar animals away. Mice are likely to be a problem with a permanent mulch.

Mice and bird problems can be solved in part by owning a cat which travels through the garden. Presence of the cat tends to keep birds away. If mice are a serious problem, apply a prepared mouse bait under the mulch.

It is likely that a few birds and a few mice will have to be tolerated. You might try to grow a little more fruit and share with the birds. Birds often are helpful in controlling certain insects.

Many insects and diseases damage cane fruits. Only a few of these problems are likely to occur in a given area. You might attempt to grow these fruits without pest control treatments until a problem arises, then



George A. Robinson

have the problem identified by the county Extension office or a good garden store.

You can avoid many pest problems by: (1) planting only quality nursery stock; (2) keeping plants well

spaced with a narrow wall of foliage well exposed to light; (3) use nitrogen fertilizer at a light to moderate rate; (4) removing diseased or sick plants and all cane after they have fruited, either burning them or removing them; (5) allowing a few birds to live in the vicinity of the garden; (6) replanting with quality stock every 5 to 7 years; and (7) being cautious about accepting a plant from a friend because it may be diseased.

Far Further Reading:

Blockberries, Currants and Gooseberries, Ext. Bul. 97, Cornell University, Ithaca, N. Y. 14850. 30¢.

Controlling Diseases of Raspberries and Blackberries, U.S. Department of Agriculture Farmer's Bul. No. 2208, on sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. 35¢.

Growing Blockberries, U.S. Department of Agriculture Farmer's Bul. No. 2160, on sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. 35¢.

Growing Raspberries, U.S. Department of Agriculture Farmer's Bul. 2165, on sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. 25¢.

Shoemaker, James S., *Small Fruit Culture*, 4th Ed., AVI Publishing Co., Westport, Conn. 06880. \$19.

Thornless Blockberries for the Home Garden, U. S. Department of Agriculture H&G Bul. No. 207, on sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. 30¢.

Japanese beetles are a common garden pest. Top, adult beetle feeds on blockberry leaf. Bottom, Japanese beetles in grub stage.

Just About Any Home Garden Can Produce Blueberries

by G. J. Galletta and A. D. Draper

Nearly everyone knows how great blueberries are in pies, muffins, pancakes, or as a fruit topping for breakfast cereals. However, most people have not experienced the delightful flavor and texture or subtle and delicate aromas of improved hybrid blueberries at the plump and proper stage of ripeness—right from the bush.

Just about anyone in the continental United States should be able to grow prime blueberry plants in the backyard, or as a hedge along the property border.

Blueberries and other perennial fruit plants are often regarded as difficult to grow. But attention to a few facts about blueberries, and timely observance of a few practices, should result in excellent bush growth and fruit yields.

Blueberries vary in nature. Some are vine-like with creeping branches and some spread by underground rhizomes (prostrate stems). Plants may vary in height from two to eight feet. Plant shapes range from semi-upright to upright free-standing. Fruit is borne on perennial stout stems called canes.

Most cultivated blueberries are hybrids between two or more of the taller growing species and are referred to as "highbush blueberries." In the Southern United States it is also possible to grow selected hybrids of the very tall-growing blueberry species known as the "rabbiteye" or Southern highbush blueberry.

Blueberries have a mass of delicate and fibrous roots with no root hairs. The root system is confined to the

upper foot of soil, usually the upper 8 to 10 inches. The root system is not a strong competitor, consequently blueberries thrive on open porous soils with a high water table and good drainage.

Like most other plants of the Heath family—heather, azalea, cranberry, and rhododendron—blueberries grow best in acid soils (pH 3.5 to 5.0, with 4.5 about optimum).

Many acid soils are light and sandy. Nutrients and water are generally held on the organic matter fraction of such soils. Consequently, heavier garden soils such as clay loams would need a fair amount of organic matter added to the blueberry planting area to increase the acidity, porosity, drainage and tilth of the soil.

Important aspects of blueberry culture are an acid soil requirement and a need for full sunlight for best flower bud development. For these reasons, never plant blueberries in an area which has been limed in the last 2 to 5 years, or near trees which shade the bushes, rob them of moisture, or prevent free air movement around the plants.

Free Air Need

Free air movement is especially important in the spring when early morning frosts can kill the flower buds. For this reason avoid low-lying planting sites with poor air drainage and increased frost hazards.

Highbush blueberries should be spaced 4 to 5 feet apart in rows 8 to 10 feet apart. Rabbiteye blueberries should be planted 5 to 6 feet apart in rows 10 to 12 feet apart. For hedges, highbush can be planted as close as 2 feet apart and rabbiteye 3 feet apart, but pruning must be

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more severe to provide the leaves and stems with adequate light.

Most highbush varieties will set fruit with their own pollen. For best fruit set, however, plant at least three varieties in any one location. Cross-pollination tends to produce larger fruits with more seeds which ripen faster and more uniformly than those which have been self-pollinated. Having several varieties in a proper ripening sequence yields fruit over a longer period.

At least two varieties of rabbiteye types must be planted together, since these varieties will not set fruit with their own pollen. The early rabbiteye varieties ripen 4 to 6 weeks after the early highbush varieties in eastern North Carolina.

Generally, highbush blueberries should be planted in areas having 160 or more frost-free days, with 800 to 1,200 hours below 45° F in the winter, and minimum winter temperatures of not less than -20°.

Rabbiteye varieties differ, but generally need 400 to 600 hours of winter chilling (below 45° F). It is not known how many frost-free days are required but the rabbiteye will grow between 30 to 37 parallels of latitude in acid soils at locations having mild winters.

Varietal choices for planting vary from region to region. The following are the better choices resulting from experience in separated test sites. New varieties are marked "trial" or "try".

Regional Varieties

Regional varietal choices for planting:

(1) North Florida, Gulf Coast, Lower Southwest, and extreme Southern California (San Diego and south)

Highbush—try the new Flordablue and Sharpblue.

Rabbiteye—Woodard, Bluegem, and possibly Tifblue; try the new Climax and Bluebelle.

(2) Coastal Plain of Georgia, South Carolina (South of Charleston), Louisiana, Mississippi, Alabama, East Texas, Southern California (Los Angeles and south)

Highbush—try Flordablue and Sharpblue.

Rabbiteye—Tifblue, Woodard, Southland, Delite, Briteblue, Climax, Bluebelle, Garden Blue.

(3) Mountain and Upper Piedmont of region 2

Highbush—Morrow, Croatan, Harrison, Murphy, Bluetta, Patriot, Bluecrop, Berkeley, and Lateblue.

Rabbiteye—same as region 2.

(4) Richmond, Va., south to Piedmont and Coastal Plain Carolinas, Tennessee, lower Ohio Valley, east and south Arkansas, lower Southwest and mid-California

Highbush—Morrow, Croatan, Harrison, Murphy. Try Bluecrop and Patriot except in coastal plain areas.

Rabbiteye—Tifblue, Woodard, Homebell, Southland, Garden Blue, Menditoo; try Climax and Bluebelle.

(5) Middle Atlantic States, Midwest, Ozark highlands, mountain areas of region 4, northern California, Oregon, Washington

Highbush (in ripening sequence)—Bluetta, Collins, Patriot, Bluecrop, Blueray, Berkeley, Darrow, Lateblue, Elliott; (also older clones like Ivanhoe, Pemberton, Burlington and Dixi are good home garden types. Additionally, Herbert and Elizabeth have high dessert quality).

(6) New England and cooler areas of Great Lakes States

Highbush—Bluetta, Collins, Patriot, Bluecrop, Blueray, Meader, Berkeley, and Northland.

Many poorly drained soils, especially in the South, are infested with a root-rotting fungus called *Phytophthora cinnamomi*. Almost all highbush blueberry varieties are susceptible to damage by this fungus. An exception is the new resistant variety from the U.S. Department of Agri-

culture and the Maine Agricultural Experiment Station, named Patriot.

Most rabbiteye varieties are tolerant to the root-rotting fungus. It is also possible to buy plants of high-bush varieties grafted on suitable invigorating rabbiteye rootstocks like Garden Blue or Tifblue. Normally such plants are grafted to order, are more expensive, and need to be pruned differently than own-rooted plants.

Transplants

For most successful transplanting, order certified or State-inspected 2-year-old nursery plants in the 12- to 24-inch sizes. Three-year-old plants of up to 36 inches in height also transplant well. Plants older than 3 years or less than 2 years may die from water stress during the first growing season.

Before or shortly after transplanting, prune the plants to 3 or 4 strong shoots well spaced around the crown (stem base). Prune back each of the remaining shoots to remove the plump, rounded fruit buds. Cut to just above a vegetative bud (narrow and pointed bud), located preferably toward the outside of the stem.

In setting or planting, dig a hole 12 to 18 inches deep and 18 inches wide.

If your soil has a good organic matter content and the proper acidity (pH 3.5 to 5.0), thoroughly mix the soil taken from the hole and replace it along with the plant, setting the plants 1 to 2 inches deeper than they grew in the nursery. After planting, firmly press the soil around the plant with your feet, and water the area thoroughly.

Mulch the blueberry plants for at least 18 inches around the plants in all directions with 4 to 6 inches of well-rotted sawdust, peat moss, pine bark, pine straw, leaf mold, etc. Grass can be permitted to make a sod for walkways at the edge of the mulch

if it is mowed during the growing season.

If you have a mineral soil low in organic matter, mix 1 cubic foot (2 to 3 shovels) of peat moss, rotted sawdust, or screened pine bark with the soil removed from the planting hole. Make sure the organic soil mixture is placed below, around and above the roots.

Sulphur can be used to make soil more acid. Add 1 pound per 100 square feet for sandy soils and 3 to 4 pounds per 100 square feet for loam soils, and work the sulphur into the soil before planting.

In areas with mild winters, you can either plant blueberries in the fall or you can plant fully dormant plants in the spring as early as the ground can be worked.

If blueberries are unmulched, cultivate them with a tined rake, fork, or hoe no deeper than 2 inches so as not to damage roots near the soil surface. Primary reasons for tilling the soil are to improve aeration and control weeds. Around mulched plants, either pull weeds by hand or gently hoe them out. Replenish the mulch at the rate of 2 inches per year.

Watering

The first year following transplanting of the blueberry plant in the field or garden is critical. The young plant is very sensitive to drying out, over-watering, fertilizer level, and weed competition.

An inch of water per week through the growing season is usually considered essential for maximum growth and fruiting of blueberries. Water is especially critical just after setting the plants, through the first two growing seasons, and at the time of flowering and fruiting.

Water can be applied from an open hose, porous hose, by sprinklers, or by surface irrigation.

Since blueberries bear their fruit

on new shoots produced during the previous growing season, it is essential to balance growth and fruit production with proper fertilization and pruning.

The purpose of fertilizing and pruning the plant during the first 3 to 4 years is to establish a number of well-spaced, stocky canes bearing many branch shoots with 6 to 12 flower buds each. During the plant's mature years, the cultural objectives are to keep the plant from getting too tall; to keep the canes branching freely; and to keep the plant producing a modest supply of new renewal canes.

Certain fertilizer salts, such as lime and chlorides, should be avoided in feeding blueberries. Don't fertilize blueberries at planting, but fertilize lightly 4 to 6 weeks later. Blueberries generally respond to nitrogen in the ammonium form, and at least once a year it is wise to apply a complete fertilizer (nitrogen-phosphorus-potassium) in a 1-1-1 or 1-2-1 ratio, such as 8-8-8 or 5-10-5. This applies especially to the East Coast. In Michigan a 2-1-1 fertilizer is preferred. For the home garden, azalea and camellia fertilizer mixes are satisfactory.

One ounce of complete fertilizer per year of plant age up to a maximum of 8 ounces per plant per year for mature plants is a good rule of thumb for fertilizing blueberries. During the first two years, the fertilizer is split and applied several times through the growing season.

From the third year on, apply the complete fertilizer just as the flower buds are breaking. Apply an ammonium nitrogen fertilizer about 6



Photos by William E. Carnahan

Top, spraying to control insects (note attire for protection against spray. Gloves also are a good idea.) Right, netting spread over frame will keep birds from eating your berries.

weeks later. Occasionally, an additional application of nitrogen fertilizer is made in early summer if the plants are quite yellow after the fruit harvest. Bear in mind that blueberries are very sensitive to excess fertilizer.

Broadcast fertilizer evenly around the plant. Extra nitrogen should be added to mulched plantings to help decompose the mulch in early years of the planting, but the plant's age and vigor in relation to the quantity of fertilizer applied must be kept in mind.

Pruning

Blueberry plants need not be pruned. However, on unpruned plants the twig growth will get thinner, the branches will shade each other out, the fruit will be very small, and the plant will die sooner than expected. Hence, it is suggested that blueberries be pruned annually during the dormant season. This will lengthen bush life, produce strong new growth, space the bearing wood evenly for best light distribution, and reduce the crop so as to increase berry size and regulate ripening time.

Prune lightly in the first two years to remove low branches, overlapping branches, and flower buds.

From the third year on, remove old canes that are weak or being shaded. Cut back very vigorous upright shoots to force branching at a lower level. Prune out overlapping canes and branches. On the remaining canes, remove the short weak shoots and tip back long shoots to about 6 to 8 buds. Reduce very heavily branched canes by a third.

Select several renewal shoots around the plant and cut them back to 12 to 18 inches if they come from the ground, and 4 to 6 inches if they arise as a branch on an older cane.

Stem borers and leaf and stem

spotting fungi may prove troublesome to young blueberry plants. On bearing-age plants, problems may be caused by leaf chewing insects, bud mites, stem and leaf fungi, and fruit worms. Your county Extension office can suggest appropriate controls for these problems, and recommend varieties resistant to some pests.

Many species of birds are especially fond of blueberries. The berries can be protected with a variety of cloth barriers, nets, or cages during fruiting.

Weekly harvesting of the fully colored and plumpest berries is necessary to get the maximum flavor and fruit-keeping quality. Many rabbiteye and several highbush varieties do not attain prime flavor until they have been fully colored on the plants 5 to 10 days.

Blueberry plants will live 25 to 30 years, with at least 10 to 15 prime bearing years. Mature plants in their prime can be expected to yield 6 to 8 pounds of fruit for highbush varieties and 12 to 15 pounds for rabbiteye varieties. Yields as high as 24 pounds for highbush and 50 pounds for rabbiteye have been reported, but these are rare.

For Further Reading:

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Nut Crops—Trees for Food, Ornament, Shade, and Wood

by Richard A. Jaynes and Howard L. Malstrom

Trees are planted to give shade, to improve landscapes, and sometimes to produce food for man or wildlife. Nut trees provide all of these benefits. Wherever trees can be grown in the United States there are one or more kinds of nut trees suited for the climate.

Black walnut, pecan, and hickory can reach heights beyond 90 feet when mature. Other nut trees are low and spreading, like Chinese chestnut, butternut, Japanese walnut and heartnut. In outline they may resemble old fashioned apple trees. Almond trees are even smaller, while filberts and chinkapin chestnuts are little more than shrubs. If an evergreen is needed, large seeded nut pines are suitable.

The pecan is the most popular nut tree native to the United States. It is a species of hickory and in the same plant family as walnuts. The pecan grows throughout the southern United States from the Carolinas to Arizona and north, along river bottom land, as far as Iowa in the Midwest.

Pecan trees prefer a rich, deep, well-drained soil, and long, warm growing seasons. In the South the frost-free period extends from 190 to 220 days, but it may be as short as 150 days in the Midwest. Although trees will survive in much of the Northwest and Northeast, the cooler summers don't allow development of full kernels.

Numerous varieties have been selected for their fine nuts and other desirable characteristics. Early matur-

ing selections are required for the Midwest. In the high rainfall area of the Southeast, disease-resistant varieties that need less spraying are preferable.

Besides pecan trees there are several other native hickories. Two, shellbark and shagbark, are notable for their sweet tasting nuts. They are harder than pecans. Though shellbark and shagbark are not grown in commercial orchards, amateur nut growers propagate and grow several selections having large kernels that separate readily from the shell when cracked. Shellbark hickory does best on lowland and river bottom soil. Shagbark is common on thinner, more acid, upland soils.

Eastern black walnut is our most valuable native hardwood, and the nuts are harvested in huge quantities each year. The nuts' tangy flavor isn't lost even in baking.

Black walnuts, native to the eastern United States, are grown from Nebraska and Texas to southern Vermont and South Carolina. They do best on limestone-derived soils.

Persian (English) walnut is an introduced species. Like almond, filbert, and pistachio, it is adapted to the West Coast. These nut trees all originated in arid, mild climates of Europe, Asia, and the Middle East. The climate of parts of California, Oregon, and Washington is similar to that of their native habitat. Hardy members of the species are grown extensively in home and farm yards in the Midwest and East. They are often referred to as the "Carpathian" strain because many originated in the colder Carpathian mountains of Europe.

Butternut is an extremely hardy, native walnut valued for its nuts in

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Pecan Varieties

Variety	State of origin	Pollination type*	Relative production	Kernel quality	Disease resistance
Southeast					
Chickasaw	Tex.	II	excellent	fair	good
Desirable	Fla.	I	good	good	fair
Elliott	Fla.	II	good	fair	good
Farley	—	I	fair	excellent	fair
Kernodle	Fla.	II	fair	good	fair
Mahan	Miss.	II	fair	poor	poor
Schley	Miss.	II	good	excellent	poor
Stuart	Miss.	II	good	good	good
Southwest					
Ideal	—	II	good	good	poor
San Saba Imp.	Tex.	I	good	good	poor
Sioux	Tex.	II	good	excellent	poor
Western	Tex.	I	excellent	good	poor
Wichita	Tex.	II	excellent	excellent	poor
Midwest					
				Kernel quality	Remarks
Colby	Ill.	II	poor		Retains foliage late in fall
Fritz	Ill.	II	—		Hardy tree for extreme north
Greenriver	Ky.	II	good		Susceptible to spring frost
Major	Ky.	I	good		Good producer; susceptible to aphids
Perque	Mo.	I	good		Susceptible to aphids, squirrels and birds

* I. Pollen shed before females are receptive. II. Pollen shed after females are receptive. Interplant at least one tree from each group for best pollination.

the colder areas of our north central and northeastern states. Other species of walnut, such as the Japanese walnut and heartnut and their hybrids, are locally important.

Commercial production of filbert (hazelnut) is limited largely to Oregon's Willamette Valley where the European filbert variety Barcelona is the principal selection grown. The American filbert, hybrids with the European filbert, as well as some European varieties are grown in the eastern United States. Eastern filbert blight and cold winters restrict their wider use.

Almonds and pistachio are grown in the Sacramento and San Joaquin Valleys of California and to a limited degree in other southwestern States. Spring frosts, high humidity, and rain-fall limit their success elsewhere.

American chestnut was destroyed by an introduced bark parasite in the early half of this century. Blight-resistant Oriental chestnut trees, notably the Chinese chestnut, are widely grown for their nuts. They are hardy and thrive wherever peach trees can be grown.

Chinkapin chestnuts, native to the Southeast, are small trees or shrubs



R. A. Jaynes

that bear small, tasty nuts. The Chin-kapin nut size makes them especially suitable producers of wildlife food.

Macadamia is a tropical nut tree of Australia and now an important crop in Hawaii. The tree has met with some success in warmer areas of California and in Florida.

Other trees such as oak, beech, ginkgo and pine, often not thought of as nut trees, can be grown for their nut fruit. Among the nut pines, pinyon pine is native to the arid Southwest, Korean pine is hardy in the Northeast, and Italian stone pine is hardy in the Deep South.

Flowering

Pecans, hickories, walnuts, filberts, and chestnuts have both male and female parts on the same shoot, but in separate flowers. In pistachio the male and female flowers are borne on separate trees. Flowers of these species are not showy and are largely wind-pollinated, except for chestnut which is both wind- and insect-pollinated.

Walnuts and hickories, including pecans, shed pollen about a month after the buds break in spring, while filberts flower during the winter or early spring before vegetative growth begins. Chestnuts, by contrast, flower later, about two months after shoot growth begins in spring.

Many pecan, walnut, filbert, and chestnut varieties or seedlings are unfruitful unless they receive pollen from another tree of the same species. Failure of self-pollination may be due to a difference in time of pollen shedding and female receptivity on the same tree, or a pollen incompatibility. To ensure cross pollination, two or more varieties need to be present in a planting.

Almond—related to peach, plum, and other stone fruits—and macadamia have colorful flowers and are pollinated by honey bees, which are usually prevalent in residential areas. Macadamia is self-fertile. Almond flowers are self-incompatible, so two or more compatible varieties must be selected for a planting to insure pollination.

Numerous superior pecan trees have been selected from native groves. Recently, outstanding varieties have been developed from the breeding program sponsored by the U. S. Department of Agriculture at Brownwood, Tex.

Newer selections of Persian walnut, like pecan, are considerably improved over older varieties. Many of the new Persian walnut varieties bear on lateral branches or spur shoots and are capable of producing more nuts. They have also been selected for hot or for cool climates. Characteristics of several of the older and newer varieties grown on the West Coast are given in the second table.

Developing burs on a Chinese chestnut tree.

Persian Walnut Varieties for West Coast

Old varieties	Danger of spring frost damage	Relative production	Kernel quality	best adapted to
Eureka	moderate	good	excellent	cool
Franquette	none	poor	good	cool
Hartley	slight	good	good	hot
Payne	great	excellent	excellent	cool
New varieties				
Amigo*	slight	good	fair	cool
Chico*	moderate	good	good	hot
Gustine	moderate	excellent	excellent	hot
Lompoc	moderate	good	good	cool
Midland	slight	good	good	cool
Pioneer	slight	good	fair	hot
Pedro*	slight to none	good	good	cool
Serr	moderate	good	excellent	hot
Tehema	slight to none	excellent	good	hot
Viva	moderate	excellent	excellent	hot

* Good pollen producers for cross pollination with other varieties.

Many varieties of Carpathian walnut are adapted to the Midwest and East. These include Colby, Hansen, Lake and Metcalfe. Unfortunately, such selections are not readily available from nurseries.

The most widely planted almond variety is Nonpareil. Mission, Ne Plus Ultra, and Peerless are often used to pollinate it. However, the newer varieties—Davey, Karpareil, Merced, and Thompson—are also good pollinators for Nonpareil, and produce better quality kernels.

Barcelona is relatively resistant to most insects and diseases but the nuts are poorly filled. Several new hybrids yield more kernel per nut but produce smaller crops. In Washington, Noosack is commonly grown with Alpha and DeChilly as pollinators. Royal is adapted to colder areas along with Gem or Hall's Giant.

Availability of varieties of walnuts, butternuts, heartnuts, chestnut, filberts for the East, and shellbark and

shagbark hickories is like that for Carpathian walnuts. Outstanding trees selected for vigor, production, nut size, and good cracking have been named and propagated, largely by amateur nut growers, but few nurseries list them.

Location, Spacing

Pecans and the large walnut trees should be spaced at least 40 to 50 feet from buildings, trees, and other obstacles if they are to remain a long time. Trees on poor soils with inadequate water will reach only half to three-quarters the size of those growing under good conditions. In areas of late spring frosts, plant on the north side of buildings to delay bud break in spring. Or plant on the upper portion of slopes to avoid frost pockets.

Smaller filbert and almond trees may be spaced about 25 feet apart. Almond is drought-hardy and tolerates poor soil, but it must not be ex-

posed to late spring frosts. Filberts have shallow roots and can be grown on relatively shallow soils.

Chinese chestnut trees grow to about 40 feet and should be planted about 40 feet apart. They prefer an acid soil, pH 5.5, in contrast to the various walnuts which generally perform better on less acid soil, pH 6.5.

All nut trees should be planted when dormant after leaf fall and before leafing-out in spring. If the roots of a dug tree are allowed to dry, the tree will probably die. Buy young trees from reputable nurseries.

A narrow, deep hole is required to accommodate the pecan's tap root; roots of other nut trees spread out more as a rule. The hole should be large enough so tree roots are not twisted and folded back.

Once in the hole with soil filled back in, the tree should be gently lifted a little so the roots point down. Final depth of the tree in the soil should be the same as in its former location, and can be determined by the different bark color at the old soil line. Apply water to settle soil around the roots and prevent the tree from drying out.

For the first year after planting, the goal is to keep the trees alive. Ample soil moisture is the most critical factor. An inch of water per week by rain or irrigation is adequate. Excessive daily watering may waterlog the soil and kill a tree as readily as lack of water.

Maintenance of an area around the tree base free of weeds and sod will maximize tree growth. A mulch or herbicides will assist in controlling weeds and conserving moisture.

Pruning can begin the winter after the first summer of growth. Large trees like pecan and Persian walnut should be trained to a modified central leader (main trunk) rather than an open vase. A tree of this type has 5 or 6 main branches radiating from the trunk, beginning at a height of 5

feet to prevent limbs sagging to the ground. The central leader system gives greater strength and results in less limb breakage. After the first 5 years, when the tree is shaped, little pruning need be done except to thin crowded or dead branches.

As trees mature, prune out crowded branches. But don't cut back the terminal portion of pecan twigs, because these bear the fruit. The terminals can be pruned back on most walnuts because they bear on lateral twigs. If the variety does not fruit well on lateral branches, cut the main branches about a quarter of the way back.

On older pecan and walnut trees where seasonal growth is only a few inches, many small cuts may be necessary to thin fruiting wood and open up crowded areas of the tree. This type of pruning will stimulate new growth and rejuvenate the fruiting wood.

Filberts commonly form suckers at the base and grow in bush form. In the Northwest, suckers are removed to maintain single-stemmed trees. In the East, filberts grow best as multi-stemmed shrubs, but thin suckers constantly to maintain tree vigor.

Fertilizer

Shortly after planting, a handful of 10-10-10 can be broadcast around the tree, but not in the tree hole. Excessive fertilizer or a heavy narrow band can result in damage or even death of young trees. The second year and thereafter, add 1 to 4 pounds of 10-10-10 per inch of trunk diameter during winter in the South or early spring in the North. Nitrogen is the most commonly lacking nutrient; deficient trees have weak growth, pale green foliage, and small leaves. In Western areas, walnuts can suffer the effects of many nutrient deficiencies and even excessive toxic amounts of some elements.

Potassium deficiency is common

where topsoil has been removed by land leveling, construction, or where the soil is extremely sandy as in arid western areas and where excessive nitrogen has been applied in the southern United States. Boron, manganese, iron, copper, and magnesium can also be deficient.

Many States have Cooperative Extension Service laboratories, which will analyze soil and plant tissue samples. Consult local agricultural authorities for advice on taking leaf or soil samples and interpreting results as regards fertilizer needs.

Production of good nuts often depends on pest control. An itemized list of potential spoilers would be long but for each tree species there are only a few notable insects or diseases expected. Consult local agricultural authorities on identifying pests, control measures, and current pesticides registered for use.

The most common disease of pecan trees in humid areas is scab, which affects leaves and nut shucks and can ruin the crop. Crown gall, a bacterial disease which forms tumors at the base of the tree trunk, is also prevalent in some locations. Aphids, mites, spittlebug, and leaf casebearer all feed on foliage. Shuckworm and pecan weevil, as well as spittlebug, are the insects most damaging to nuts. Most pecan varieties have little resistance to scab and no resistance to the above insects. Shagbark and shellbark hickory are attacked by the same pests as pecan.

One of the most serious pests of Persian walnut in the West is the navel orange worm. The larvae eat the kernel while the nuts are still on the tree. Harvest nuts early and clean up nut husks, leaves, and dead limbs to reduce damage from this pest. The maggot of the husk fly, and codling moth larvae, can cause early season destruction of the immature kernel or stain the kernel in late season. The walnut weevil or butternut cur-

culio may also attack the nut, but of greatest consequence is larval injury to stems and branches.

Walnut blight, caused by bacteria, is found on all walnut species, but the Persian walnut seems the most susceptible. The disease rarely kills a tree but infects trunk, limbs, shoots, and leaves, spreading to the nuts—which are destroyed. The bacteria overwinters in dead twigs infected the year before, so complete sanitation practices will help eliminate the pest.

Walnut anthracnose or leaf blotch is caused by another bacterium. Symptoms include defoliated trees and unfilled, deformed nuts. Fungicidal sprays are the usual control.

Another serious problem with all walnuts and some pecan varieties is bunch disease. Symptoms include die-back, stunting, and brooming of growth. The causal agent is a mycoplasma. Control measures are unknown.

Brown rot and shot hole fungus are two serious diseases of almond fruit. Bacterial canker is also prevalent during rainy spring weather and affects blossoms and young shoots. These diseases can be controlled with dormant sprays and fungicide applications in early spring. Insects such as brown almond mite, peach twig borer, and plant bugs can be controlled with insecticides. Red spider mite, as with other nut trees, may occur in late summer, especially under dusty, dry conditions. It can be controlled by spraying.

Insects and diseases have not been a serious problem with filberts in the Northwest. But in the East, eastern filbert blight and filbert bud mite have limited the successful growing of filbert as yard trees. Effective control measures have not yet been developed.

Chestnut blight fungus, the disease that destroyed the American chestnut, may also attack the more re-

sistant Chinese chestnut trees. Pruning weak, shaded branches, as well as suckers, and keeping trees in vigorous condition helps control blight damage on resistant trees. Chestnut weevils (two species of *curculio*) infect ripening fruit, and feeding larvae cause great damage to nuts. These weevils can be controlled with sprays.

In areas where particular pests cause serious damage, yearly preventive sprays are warranted. Other pests may be controlled by careful observation, taking control measures when you see the pest or damage. Spraying for one pest often may limit other similar pests present at the same time.

Harvest, Storage

Ripening of nuts occurs from August to November, depending on the species and variety. With the exception of chestnut, most nuts have a high oil content and long shelf life. However, harvest nuts immediately after they fall from the tree, especially where there is rodent predation, rainfall, high humidity, or hot weather. Ripe nuts remaining in trees can be knocked off with poles.

Husks of pecan, shagbark and shellbark hickory, chestnut, and Persian walnut open and fall off when the nut is ripe. The husks of black and other walnuts have to be removed. All nuts should be air-dried before storage. Nuts, especially pecans, keep longer if left in the shell and refrigerated at 35° F. Shelled nuts keep well frozen.

Chestnuts, with their low oil and high carbohydrate content, have special needs and should be refrigerated at 35° to 40° under high humidity shortly after harvest. One method is to take the freshly harvested nuts, that have a high water content to begin with, mix them with slightly damp or nearly dry peat moss, and refrigerate in closed plastic bags.

Because so many selected varieties

of nut trees are not readily available commercially, amateur growers may decide to do their own propagating. Trees can be grown from seed, but seedlings seldom produce as good nuts as named varieties. However, seedlings can be converted to a named selection by grafting or budding a short stick (scion) or bud of a selection to them.

Techniques used to propagate selected varieties are explained in numerous pamphlets and books. The rootstock and scion are usually of the same or closely related species.

Most temperate climate nuts germinate best if they receive a cold treatment. This may be supplied by refrigeration at 40° F, or simply by sowing the nuts in the fall and letting mother nature furnish the moist cold treatment during winter. Where temperatures well below freezing are expected, a straw or similar type mulch should cover nuts in winter. Protection from rodents, such as wire screening, may also be needed.

How often when the suggestion is made to plant a nut or fruit tree does the answer come back, "Why bother? By the time the tree bears, I'll be gone." Such a response shows an unfortunate short-sightedness and lack of concern for those who come after us. If Johnnie Appleseed or so many others had thought this way, the world would be the poorer for it. The tree planter leaves a valuable legacy behind him, not only in a harvest of wood but in valuable food sources of man and wildlife and a better place to live.

For Further Reading:

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Subtropical Fruit Choice Wide— From Avocado to Tamarind

by Robert J. Knight, Jr., and Julian W. Sauls

Subtropical fruits number over a hundred and range from avocado and citrus to soursop and tamarind. Thus the information in this chapter has to be general rather than specific and you should seek more detailed advice from your county Extension office. Nurserymen can be most helpful too, as can experienced gardeners, garden clubs, or other specialized groups such as the rare fruit organizations active in Florida and California.

Fortunately, cultural requirements for most subtropical fruits do not differ from those of other shrubs, trees or vines grown for fruit, ornament, shade or other specialized use. In fact the outstanding ornamental value of most fruit crops fits them admirably for a dual role.

Because they come from many parts of the world with varied environmental conditions, subtropical fruit crops differ in the degree of cold they can withstand and in soil and moisture requirements. Some are adapted to warm-temperate conditions, and others are tropical plants which will tolerate brief cold spells and thus survive winters in the warmest parts of the continental United States.

When you select fruits to plant around your home, choose those known to grow well in your locality. Otherwise you may go to a lot of trouble to grow a plant that may prove disappointing despite your best efforts. Your own personal preferences, tempered by knowledge of

what grows well in the area, should determine what you plant.

Most tree fruits should be planted 12 to 20 feet apart and away from the house, walks, drives, and power lines. Those tropical fruits listed as small trees or shrubs at the end of the chapter can be planted somewhat closer. Where there is significant danger of cold damage, plant subtropical fruits in the warmest part of the yard, which generally is the south side of the house.

Most failures in growing fruit trees at home can be attributed to poor transplanting or poor care. Commercial fruit growers routinely transplant fruit trees with almost no failures.

Good preparation of the planting hole is essential. Dig the hole only as deep as and about a foot wider than needed to accommodate the root system. Regardless of your soil type, it would probably benefit from the addition of liberal amounts of organic matter such as rotted manure, compost or peat.

For bare-root plants, prune off dead or damaged roots. Make a cone of soil in the center of the hole and set the plant on it, carefully spreading the roots out in the hole. For container-grown plants, remove the container and set the plant in the hole.

In either case, set the plant at the same depth it was growing in the nursery or container.

Fill the hole three-fourths full of soil. Then fill with water to settle soil around the roots and eliminate air pockets. After the water drains through, finish filling the hole with soil, then water again. A ring of soil a few inches high around the planting hole can be used to form a watering basin during the first year.

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At planting, bare-root fruit trees should be pruned to balance the top with the reduced root system, which requires removing about a third of the top. Most people are reluctant to prune this heavily, but it's for the good of the tree. If you're unsure about doing the job right, have the nursery where you bought the tree do it for you. Container-grown plants are not usually pruned since they have an intact root system.

Training

Initial training of the fruit tree is done at planting to assure that the tree takes the desired shape. For example, the growing tips of branches are pruned off to force branching. Even so, most subtropical fruit trees are not trained appreciably, but simply allowed to develop naturally.

Mature trees are pruned to remove dead or damaged wood, or to eliminate limbs that may interfere with traffic in the yard. Such pruning can be done at any time of year.

Pruning cuts should be clean and close to the trunk to avoid leaving stubs which enable wood-rotting organisms to enter the tree. Protection with pruning paint is recommended if the cut is larger than an inch or so in diameter.

Subtropical fruit trees are not in such prominence that they require "special" fertilizers as yet. You cannot run down to the garden center and pick up a bag of "Kiwi Special" or "Atemoya and Cherimoya Food". Fortunately, subtropical fruits will grow just as well on a complete, balanced garden fertilizer such as 6-8-8, 10-10-10, or 12-12-12. However, if your area has alkaline soils or soils known to lack specific micronutrients such as iron, manganese or zinc, these may need to be supplied.

Newly planted trees should not have fertilizer until they resume active growth after transplanting. Then,

fertilize sparingly and frequently until they mature and begin to produce fruit. Using 10-10-10 as an example, young trees should receive about a pound of fertilizer per year of tree age, that is, 1 pound in the first year, 2 in the second, and so on. Total fertilizer for the year should be divided into several applications so young trees receive some fertilizer every 2 to 3 months.

Mature, bearing trees can be fertilized at double that rate, or 2 pounds per year of tree age. Thus, a 10-year-old tree would receive 20 pounds per year, which would be split into 3 applications—early spring, early summer and early fall. Fertilizer can be spread on the ground under the tree and then watered in.

Lime may be needed in some cases to raise the soil pH so it is suitable for optimum tree growth. However, liming should be based on a soil test and recommendation from the county Extension agent.

Occasionally, some fruit trees may need certain micro-elements, particularly in very sandy soils or alkaline soils. Micro-elements are included in some fertilizers and are also available in nutritional sprays which are applied separately as foliar (leaf) sprays. In all cases follow recommendations of your county agent.

Mulches

Mulches around fruit trees help in weed control and water conservation. They also reduce lawn mower damage to tree trunks since you don't need to mow close to the trees.

In some cases, organic mulches can lead to fertilizer deficiencies as the micro-organisms that decompose them rob nutrients the tree could use. They also contribute to increased cold damage by inhibiting radiation of ground heat to the tree. In other cases, organic mulches increase the incidence of diseases such as foot rot and root rot. For these reasons, we

recommend clean cultivation instead of mulches for citrus, avocado, lychee and some other fruits.

Mulches from your yard could include leaves and grass clippings. Or you can obtain sawdust, wood chips, pine bark, gravel and other mulches from local nurseries.

A lot of gardeners don't understand about watering plants. This is one reason why so many fruit trees die shortly after transplanting. Too little water causes the tiny root hairs to die, and the leaves then wilt for lack of water. On the other hand, too much water forces air from the soil, again causing the root hairs to die for lack of oxygen, and the leaves will wilt. For best results, water fruit trees infrequently but thoroughly.

Frequent, shallow waterings cause shallow rooting. A shallow-rooted fruit tree is subject to drought and poor growth. Consequently, when you water, water long and water well. Apply water only as fast as the soil can absorb it and keep watering until the soil is wet at least a foot down.

Newly transplanted trees need a good soaking every 2 to 4 days until they are well established. Mature trees need water every 7 to 12 days, depending on the climate and soil type. Since sandy soils don't hold much water, they require watering about once a week, while clay soils will go several days longer before drying out.

Fruit trees growing in the lawn area will compete with the lawn for fertilizer and water. In such situations pay particular attention to needs of both tree and lawn. The tree will compete much more aggressively than the grass. The grass will soon begin to thin out and may disappear completely once the tree begins to create heavy shade.

Cold protection often is required for many subtropical fruits. Young trees are more susceptible to cold than large, mature trees, but also easier to protect. Banking a mound

of soil around the trunk of a young fruit tree will keep the rootstock and trunk alive even if the top should freeze. Pull the bank down in spring after cold danger is past.

Small trees can be covered with blankets, paper or plastic to prevent freezing. Lawn sprinklers have been turned on trees, but too much water can cause problems for the root system and ice can cause limb breakage. In some cases, a frame covered with clear polyethylene can be built around the tree to form a mini-greenhouse. Some slow-burning heating materials are available and work quite well; check with your county Extension agent or nurseryman.

Most subtropical fruits have enough insect and disease problems to make growing them troublesome at times. You need to learn the potential pest problems and how to control them. To do this requires a little effort on your part in order to be able to recognize the damage before it becomes serious, identify the insect or disease responsible, and take effective remedial action before the damage progresses too far to control.

Containers

Many subtropical fruits can be grown in containers in areas where freezes occur each year. The size and mobility of the containers allows the plants to be moved indoors during winter months. Thus, the plants are treated pretty much as houseplants with regard to water, fertilizer, humidity, light, and pest control.

As with houseplants, water container plants infrequently but thoroughly. Take care to acclimate the plants to the different conditions when they are moved outdoors in spring or indoors in fall. Plants going outdoors should be moved to a shady spot for a couple of weeks before being exposed to full sunlight. Reverse this process when moving them indoors in fall.

When plants are indoors, put them in areas receiving the most natural light possible. Keep them away from heaters, doors and heating ducts. Because of lower humidity indoors, you need to increase the humidity around the plants, by misting or other means.

Growing plants in containers or patio tubs will reduce plant size due to the reduced volume of soil in which they're growing. Even so, the plant may soon grow too large to bring indoors. When this happens, prune back the plant severely.

Following is information about some fruits that can be grown in many parts of the Southern and Southwestern States. The letters **Wt** (Warm-temperate), **St** (Subtropical) and **T** (Tropical) are intended to give an approximation of temperature requirements of each species. However, other factors, such as amount of rainfall and the time of year that rain comes, will also determine whether a particular fruit can be grown in your area.

Avocado (*Persea americana*). St. T. Shade tree with rough dark bark suitable for growing bromeliads and orchids. More than one variety should be planted together for cross-pollination. Plant locally adapted varieties. Will not tolerate heavy, poorly drained soils.

Banana (*Musa acuminata*, *Musa* hybrids). T. Rootstock may survive light freezes. Giant, treelike herb, planted for ornament where cold precludes fruiting. Many varieties have been introduced but the most widely grown are Cavendish (a commercial crop), Apple (sometimes called Ladyfinger), and Orinoco (also called Horse banana and good for cooking). The starchy cooking banana called Plantain is very tender to cold.

Carambola (*Averrhoa carambola*). T. Tree varying from small to large. Characteristic 5-angled fruit of yellow or deep orange color varies from sour to sweet and is pleasantly aromatic. Plant grafted varieties (Golden Star, Mih Tao). Cross-pollination aids fruit set.

Carob (*Ceratonia siliqua*). Wt. Small tree with attractive dark green leaves

that prefers a Mediterranean climate, very dry in summer with rains during winter. Trees may be male or female, so more than one should be planted to ensure fruiting. The brown, leathery pods are rich in sugar and furnish a chocolate substitute.

Cattleya guava (*Psidium cattleianum*). St. Shrub or small tree with beautiful mottled trunk and glossy dark green leaves. The small, round fruit, bright red or yellow-colored, is subacid in flavor and may be eaten fresh or made into jellies or jams. Plants grow readily from seed and are normally so propagated.

Feijoa (*Feijoa sellowiana*). Wt. Shrub. Compact, cold-resistant and most attractive, selected varieties such as Coolidge fruit well without cross-pollination, but seedlings may not do so. Flowers are edible. Fruit can be eaten fresh, and makes a firm jelly.

Fig (*Ficus carica*). Wt. Small tree. Adapted to a wide range of climates, fig will not tolerate nematodes. Where these are a problem, heavy mulching and occasional application of an approved nematocide, according to prescribed rules, will help. Lemon, Brown Turkey, and Celeste varieties are recommended.

Guava (*Psidium quajava*). T. Small tree. Somewhat weedy unless pruned to shape it, the guava can be attractive, particularly when in bloom. Fruit of some seedlings and selected varieties is excellent for jelly, while that of varieties such as Ruby x Supreme and Indian Red is good to eat out-of-hand. Fruit flies are a problem where abundant.

Jaboticaba (*Myrciaria cauliflora*). St. Shrubby tree. Grows slowly but where well established produces abundant crops of black, grapelike fruit excellent to eat fresh or use in jellies or wines.

Kiwi, Yangtao (*Actinidia chinensis*). Wt. Vine. Not successful in warmer parts of Florida, this deciduous species is sensitive to nematode damage. Flowers of named varieties (females, for example Hayward) must be pollinated in order to fruit, so a pollinator should grow nearby. Because of its excellent quality this fruit should be planted wherever it can be grown well.

Longan (*Dimocarpus longan*) is a ly-

chee relative that bears clusters of attractive, smooth, golden brown, sweet-flavored fruit that is less tart than lychee fruit. The tree is less demanding as to soil and moisture than lychee, and makes a shade tree of stately proportions. Kohala, from Hawaii, bears large fruit of good quality.

Loquat (*Eriobotrya japonica*). Wt. Small tree. The dark green, deeply ribbed leaves of this tree combined with its tendency to produce fragrant creamy-white flowers over a period of months make the loquat a universally valued ornamental. The excellent fruit quality of grafted varieties such as Wolfe, Gold Nugget (Thales), and Champagne make these worth the effort needed to find them. Fruit is excellent eaten fresh, but may also be made into pie, jam, and jelly.

Lychee (*Litchi chinensis*). T. Tree. Somewhat finicky, demanding slightly acid, well-drained soil, with abundant moisture and no salts in soil or water, this tree covered with its bright red fruit is a sight to remember where it grows well. Long popular in Southeast Asia, the fruit has many American devotees. It may be eaten fresh or dried like raisins. The most dependably productive varieties are Sweetcliff and Mauritius.

Mango (*Mangifera indica*). T. Tree. Of the many existing varieties, take the time to select one that appeals to you: Carrie, Irwin, Glenn, Keitt, and Tommy Atkins are outstanding. Blooming trees can cause allergic reactions; do not plant near bedroom windows or air conditioner intake. The mango is one of the world's most popular fruits.

Passion fruits (*Passiflora edulis*, purple, and *P. edulis* f. *flavicarpa*, yellow). St. T. Vines are ornamental. The purple-fruited form is sensitive to nematodes and soil-borne fungus disease, but withstands more cold than the yellow-fruited form, which is disease-resistant. Self-pollinating types should be planted where possible, otherwise fruit production may be sparse.

Pineapple (*Ananas comosus*). T. Perennial herb. This bromeliad makes an attractive house plant where outdoor temperatures are too low for it. The plant can be moved to a porch or patio during warm weather. Given enough

light it will eventually flower, then produce a fruit of fine quality provided conditions are warm enough.

Pomegranate (*Punica granatum*). Wt. Small tree that tolerates extremes of heat and alkaline soils, but thrives under a wide range of conditions. Needs full sun for best performance. Wonderful and Sweet are the varieties best known for their fruit quality. Other varieties are grown primarily as ornamentals.

Tamarind (*Tamarindus indica*). T. Large tree related to the carob, with very acid fruit in pods. Pulp of the tamarind, an essential ingredient of many chutney recipes, also is used to make a refreshing ade-like drink. Where the climate is warm enough for it, this tree is easy to grow.

Annonaceous Fruits

Atemoya (*Annona cherimola* x *A. squamosa*). T. Moderate-sized tree, a hybrid of the cherimoya and the sugar-apple, that combines the excellent fruit quality of the cherimoya with the fitness for low elevations of the sugar-apple. Flowers abundantly in warm weather, but may need to be hand-pollinated to assure fruit set. Desirable varieties are Kaller (African Pride) and Bradley. Others are under test.

Cherimoya (*A. cherimola*). St. Small tree adapted to high elevations in tropical South America, producing a large green fruit with a sweet, delicately aromatic pulp that surrounds many smooth dark seeds. Does not grow well in southern Florida but is more successful in California where it withstands temperatures as low as 25° F.

Soursop or guanabana (*A. muricata*). T. Small tree, very sensitive to sudden cold spells, that bears a large, rough fruit with a refreshing acid flavor that is excellent in drinks and sherbets. Should be planted in a sheltered location.

Sugar-apple (*A. squamosa*). T. Small tree that bears a soft-pulped, many-seeded fruit similar to the cherimoya but without that fruit's fine aroma. Grows well at sea level in southern Florida and other areas of similar climate.

Cactus Fruits

Indian fig (*Opuntia ficus-indica*). Wt.

Large treelike cactus with smooth flat joints and few spines. Yellow flowers in spring are followed by large red or yellow fruit. Bristles can be irritating; handle fruit with care. Prefers a dry climate and does not thrive in humid situations.

Citrus

Calamodin (*Citrus blancoi*). Wt. St. Small tree of great ornamental value that grows and fruits well in small containers. The fruits resemble small oranges but are acid and not good to eat out-of-hand. Flavor is excellent for drinks and marmalades.

Grapefruit (*Citrus paradisi*). St. Medium to large-size tree, excellent for shade and for growing orchids and hanging plants, providing up to 300 pounds of excellent breakfast or juice fruit per year. Varieties include Duncan (white, seedy pulp, excellent flavor), Marsh (white, seedless) and Ruby (pink pulp, seedless).

Kumquat (*Fortunella japonica*). Wt. Shrub or small tree, very cold-tolerant, extremely attractive when in fruit. Nagami is the most common variety, with oblong fruit, deep orange in color having a thick edible skin and an acid pulp. Adapted to candy making or use in marmalades.

Lemon (*Citrus limon*). T. Small tree that remains in active growth all year and thus is less cold-resistant than the tangerine or even the orange. Of irregular growth habit, the lemon must be pruned from time to time to promote an attractive shape. Eureka, Lisbon and Villa Franca all bear similar fruit, of acceptable commercial quality; Eureka makes a smaller tree than the others. Novelties are Meyer with a less acid fruit, and Ponderosa, which bears very large, mild-flavored lemons.

Lime (*C. latifolia*). T. Small tree that bears large, juicy green fruit useful in drinks, pies, and as a condiment. The most disease-resistant and dependably productive variety is the seedless-fruited cultivar known as Tahiti, Persian, or Bearss. Less resistant to disease and cold, and bearing smaller seedy fruit of a delectable flavor, is the Key or Mexican lime, *C. aurantifolia*. (A hybrid between the Key lime and the Kumquat, the Limequat produces a valu-

able acid fruit in areas too cold for the lime itself. Eustis fruits well in the open as well as in containers.)

Orange (*C. sinense*). St. Tree of moderate size, probably the most popular of all citrus fruits, available in a number of varieties that ripen at various seasons. Hamlin is one of the earliest, ripening in November, followed by Pineapple and Washington Navel, which ripen from December to February, and then by Valencia, which ripens in April or later and can be "stored on the tree" into the summer months.

Tangelo (*C. reticulata* x *C. paradisi*). St. Tree, hybrid between tangerine and grapefruit, bearing fruit which combines characters from both parents. Vigorous and cold-resistant. Several varieties are available. Minneola and Orlando need to be planted near other citrus trees for cross-pollination. The Temple tangor (*C. sinensis* x *C. paradisi*) bears a sweet, juicy fruit similar to tangelos.

Tangerine (*C. reticulata*). St. Tree of attractive growth habit, fairly resistant to cold, whose beauty is enhanced by the waxy, deep orange-colored fruit in season. Dancy ripens before Christmas, as does Clementine, which can be "stored on the tree" in good condition for months. Closely related are the cold-hardy and early dwarf Owari Satsuma, which ripens from October to Christmas, and the Kara, Honey and Kimow mandarins.

Persimmons

Black-sapote (*Diospyros digyna*). T. A tropical Mexican and Central American persimmon that grows well in southern Florida. The dark brown pulp is rich in vitamin C, and also a source of calcium and protein. It was important in the diet of Central America before Columbus.

Japanese persimmon (*Diospyros kaki*). Wt. Small tree, attractive even when out of fruit with its large, hairy leaves; highly ornamental when the bright orange-colored fruit is ripening. Trees grafted on *D. lotus* or the native American *D. virginiana* are available. Fuyu bears fruit that is non-astringent even before fully ripe. Fruit of Hachiya and Tane Nashi is astringent until fully ripe, but then delectable. In dry climates, fruit may be sun-dried to make a fine-flavored product.