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Small Fruit in the Home Garden

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As a general rule, plant selection and production area in a home garden should be limited to what you can properly care for. It is better to have a small, well-tended planting area rather than a large, neglected one. Small fruits offer certain advantages over fruit trees for home culture because small fruits require less space for the amount of fruit produced, and they bear fruit one or two years after planting. Success with small-fruit planting will depend on the attention given to all phases of production, including crop and variety selection, site selection, soil management, fertilization, pruning, and pest management.

Planning the Small-Fruit Garden

Site Selection

Locate your small-fruit planting in full sun as part of or near the vegetable garden. Select a site that is free from frost pockets, low/wet spots, and exposure to strong prevailing winds. Blueberries should be planted far enough from the roots of trees to avoid competition for moisture and nutrients. Blueberries can be planted to form a dense hedge or used in a foundation planting around the home. Where space is limited, small fruits could also be integrated with ornamental plants (see fig. 1). Caneberries (blackberry and raspberry) grow best on leveled lands. Grapes and raspberries can be planted on a trellis or a fence along a property line.

Strawberries can be used as a border for a flowerbed or as a groundcover. Avoid planting early varieties on south-facing slopes and be sure to select a site where tomatoes, potatoes, or eggplants have not been grown. These crops often carry verticillium wilt, which lives in the soil for many years, and some strawberry varieties are very susceptible to this disease.

Strawberries bloom very early in the spring, and the blossoms are easily killed by frost. In areas where late frosts are a hazard, try to select a site for planting that is slightly higher than surrounding areas. Do not set strawberries in soil that has recently been under sod. Land that was under crop cultivation for the prior year or two would have soil better prepared for strawberries and will assist in controlling weeds and white grubs — both of which are troublesome in strawberry plantings. Where grubs and ants are a problem, chemical control might be necessary.

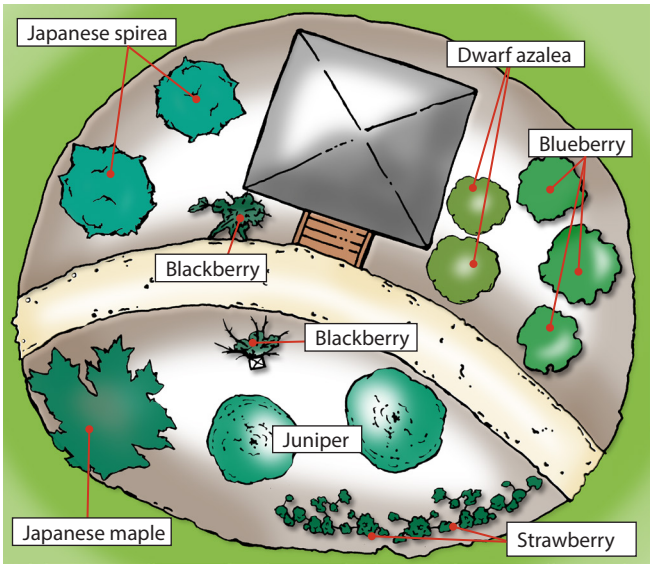

Figure 1. Small fruits can be integrated with ornamental plants in a home garden setting.

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Soils

Small fruits thrive in a fertile, sandy loam soil that is rich in organic matter, but they will give good returns on the average garden soil under adequate fertilization and good cultural practices. Incorporation of additional organic matter before planting is desirable. Small fruits are best planted on raised beds 8 to 12 inches high and 2 to 4 feet across. Drip irrigation is highly recommended.

For best results, small-fruit plants should be set no closer than the minimums indicated in table 1. Overcrowding frequently results in weak plants and low yields. It also makes insect and disease control more difficult.

Special attention should be given to variety selection. Varieties must be adapted to your soil and climatic conditions. If possible, without sacrificing too much yield or quality, select varieties with the fewest insect and disease problems. Table 2 lists some varieties of small fruits suggested for planting in the home garden under Virginia's environmental conditions. These varieties are highlighted in a table (over some others that are described only in the text sections that follow) because the authors have first-hand experience with these varieties in regard to production, berry flavor evaluation, and yield data collection. Currants and gooseberries are not included in this publication. For variety recommendations for currants and gooseberries, refer to Chapter 9 of The Mid-Atlantic Berry Guide for Commercial Growers, 2013-2014, available at http://extension.psu.edu/publications/agrs-097/view.

Table 1. Space requirement, yield, bearing age, and life expectancy of small-fruit plants.

Fruit expectancy	Minimum distance		Annual yield per plant (pounds)	Average bearing age (years)	Life expectancy (years)
	Between rows (feet)	Between plants (feet)			
Blackberry (erect)	10	5	5-10	1	5-12
Blackberry (trailing)	8	6	5-10	1	5-12
Blueberry	6	5	4-6	3	20-30
Grape (American)	8	6	10	3	20-30
Grape (hybrids)	8	5	10	3	20-30
Grape (muscadine)	8	10	15	3	20-30
Raspberry (red)	8	3	3-5	1	5-12
Raspberry (black)	8	4	3-5	1	5-12
Raspberry (purple)	8	3	3-5	1	5-12
Strawberry (June-bearing and day-neutral)	3	1	1-2*	1	1-2
Strawberry (ever-bearing)	3	1	.75-1	.33	2

* Per parent plant grown in the matted-row system.

Table 2. Suggested varieties for home small-fruit planting.

Crop	Variety	Type[1]	Fruit size[2]	Yield/plant (pounds)	Flavor[3]
Blueberry	Brightwell	R	M	5	G
	Powderblue	R	M	5	G
	Premier	R	M	5	G
	O'Neal	SH	M	2-3	VG
	Suziblue	SH	VL	2-3	E
	Duke	NH	M	2-3	VG
	Legacy	NH	M	5	VG[t]

Table 2. Suggested varieties for home small-fruit planting. (cont.)

Crop	Variety	Type[4]	Fruit size[2]	Yield/plant (pounds)	Flavor[3]
Blackberry	Chester	F	M	10-15	G
	Kiowa	F	VL	10-15	E
	Natchez	F	VL	5-10	G
	Navaho	F	M	5-10	E
	Prime-Ark 45	P	L	10-15	VG
	Prime-Ark Freedom	P	VL	10-15	VG
Crop	**Variety**	**Type[4]**	**Fruit size[2]**	**Yield/plant (pounds)**	**Flavor[3]**
Raspberry (red)	Caroline	P	M	3-5	E
	Heritage	P	M	5	G
	Himbo Top	P	L	3-5	VG
	Joan J	P	M	3-5	E
	Josephine	P	L	3-5	E
	Killarney[5]	F	M	3	G
	Nova[5]	F	M	3	E
Crop	**Variety**	**Type[6]**	**—**	**Fruit color[6]**	**Flower type**
Grapes (for table use)	Concord	Seeded	—	Blue/black	—
	Delaware	Seeded	—	Red	—
	Himrod	Seedless	—	Golden-yellow	—
	Mars	Seedless	—	Black	—
	Niagara	Seeded	—	White/green	—
	Seneca	Seeded	—	White/yellow	—
	Steuben	Seeded	—	Blue/black	—
	Sunbelt	Seeded	—	Blue/black	—
Grapes (for wine)	Chambourcin[7]	—	—	Red	—
	Chardonel[7]	—	—	White	—
	Norton	—	—	Red	—
	Traminette	—	—	White	—
	Vidal Blanc[7]	—	—	White	—
Grapes (muscadine)	Carlos	—	—	Bronze	Perfect
	Magnolia	—	—	Bronze	Perfect
	Nesbitt	—	—	Black	Perfect
	Scuppernong	—	—	Greenish-bronze	Female
Crop	**Variety**	**Type[9]**	**Fruit size**	**Yield/plant (pounds)**	**Flavor[3]**
Strawberry (June-bearing varieties)	Camarosa[8]	MS	M	0.8-2	G
	Camino Real	ES to MS	L	1-2	VG
	Chandler	MS	M	1-1.5	G
	Flavorfest	MS to LS	M	0.8-1.5	VG
	Sweet Charlie[8]	ES	S	0.5-0.8	E

[1] Type: R = rabbiteye, SH = southern highbush, NH = northern highbush. Rabbiteye and southern highbush varieties are suitable for southern and Central Virginia; northern highbush varieties are suitable for Northern Virginia and the mountains.

[2] Fruit size: VL = very large, L = large, M = medium, S = small.

[3] Flavor: E = excellent, VG = very good, G = good.

[4] Type: F = floricane (one crop per year), P = primocane (two crops per year). All blackberry varieties listed are thornless except for Kiowa and Prime-Ark 45.

[5] Killarney and Nova are floricane-bearing raspberries not suitable for southern or Central Virginia.

[6] For grapes: seeded or seedless type and fruit color (table or muscadine grapes) or wine color (red or white).

[7] These grape varieties must be grafted to a rootstock to ensure adequate vigor and tolerance to root-feeding phylloxera.

[8] Camarosa and Sweet Charlie are suitable only for the Coastal Plains and Piedmont regions of the state.

[9] Bearing: ES = early season; MS = midseason; LS = late season.

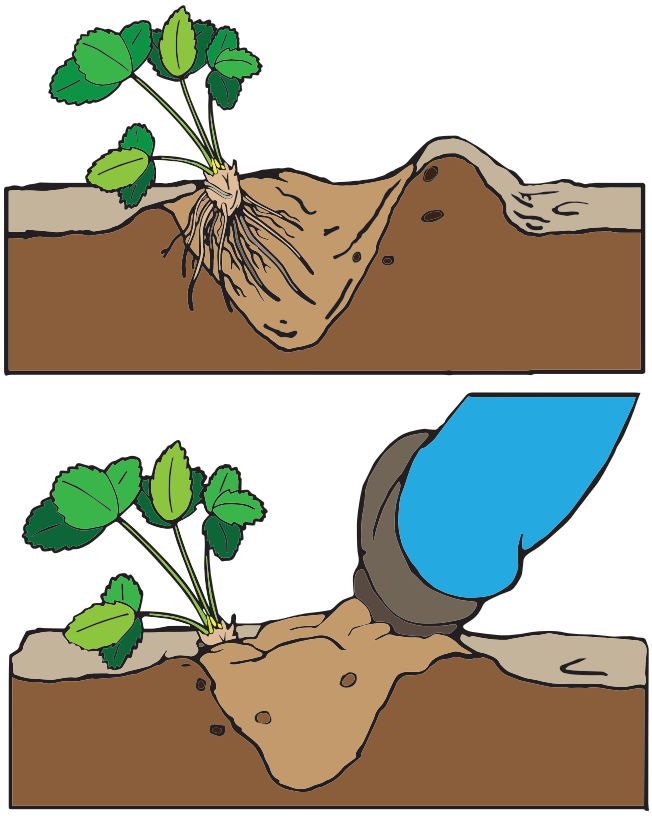

Figure 2. Plants are temporarily placed in a trench and packed with soil around the roots to prevent drying of roots until they are to be transplanted to their final spot.

Ordering Plants and Caring for Your Transplants

Placing Your Order

Obtain the best nursery stock available. Buy certified plants from a reputable nursery. Place your order early, as soon as you decide what you want. Specify variety, size, and grade of plants desired and the preferred time of shipment. It is best to have the plants arrive at the time you are ready to set them out. Unless you specify otherwise, some nurseries will only send plant material at the proper time to be planted in your area.

When your order arrives, unpack the bundles and inspect the plants. The roots should be moist and have a bright, fresh appearance. Shriveled roots indicate that the plants have been allowed to freeze or dry out in storage or transit. Such plants seldom survive. Water the root system lightly only if the roots are very dry.

Minimizing Plant Stress

If the plants cannot be set immediately, they should be kept in cold storage. Wrap them in a garbage bag or other material that will prevent them from drying out and store them at a temperature just above freezing. Strawberry plants in small quantities can be held in the refrigerator for a few days. If refrigerated storage is not available, remove the plants from the bundle and heel them carefully in a trench of moist soil in a shaded location (fig. 2). Pack the soil firmly around the roots to eliminate all air pockets and to prevent the roots from drying out.

There is probably nothing that causes more disappointment and failure in small-fruit plantings than the lack of careful preparation and attention to detail at the time the plantings are established. Prepare the soil by loosening it and making it free of clods. Set the plants carefully, irrigate well, and generally create conditions favorable for new growth. Detailed suggestions for the establishment of each of the small fruits follows. These suggestions should be closely followed for best results.

Once planting has been established, future success will depend on the care given. If the planting is to be productive and long-lived, it must be properly fertilized. Competition from weeds or other plants must be avoided. Insects and diseases must be controlled, and the plants must be properly pruned. Study the maintenance suggestions for each of the small-fruit crops and plan to care for the planting properly. To do otherwise will probably result in disappointment and wasted effort.

Blueberries

Three types of blueberries can be grown in home gardens in Virginia: rabbiteye, southern highbush, and northern highbush. Although blueberries can be grown in any area where native blueberries, azaleas, mountain laurel, or rhododendrons do well, they have a better flavor when grown where nights are cool during the ripening season. They are very exacting in soil and moisture requirements. Berries should be picked as soon as they ripen to minimize an infestation with spotted wing drosophila.

Rabbiteye and southern-highbush-type blueberries are best-suited for climates where summers are generally hotter. These varieties have low winter

chilling requirements. “Chilling” is a measure of accumulated hours of temperatures below 45 F in the dormant season. In general, the chilling requirement for rabbiteye and southern highbush type is 250 to 600 hours; for northern highbush, the requirement is 800 to 1,000 hours. Therefore, when buying blueberry plants for your garden, make sure to ask whether you are buying rabbiteye, southern highbush, or northern highbush type. Home growers can find information on chilling hours achieved at a given geographic location for blueberry growing season from the State Climate Office of North Carolina at https://climate.ncsu.edu/cronos/blueberry/chill_model?-. This site uses a slightly more complex model for calculating chilling hours as compared to the one described above.

Variety Selection

To provide adequate cross-pollination and to increase chances for a good crop of fruit, two or more varieties that bloom at the same time should be planted. The following varieties suggested for planting ripen over a six- to eight-week period beginning in early June and continuing through July. Most are vigorous and productive under good growing conditions and produce berries of large size and good quality.

Rabbiteye Varieties

Alapaha, Climax, Premier, Titan, and Vernon are early season varieties. Brightwell, Powderblue, and Tifblue are midseason varieties. Centurion and Ochlokonee are late-season varieties. In Central and southern Virginia, planting early, mid-, and late-season rabbiteye varieties will allow you to harvest fruits during the July-August months.

Titan is a new variety; it is the largest fruited rabbiteye variety that has been developed to date. Vernon also has large berries. Alapaha and Ochlockonee have medium-sized berries with good eating quality and less-pronounced seeds than other rabbiteye varieties.

Southern Highbush Varieties

Most of the southern highbush varieties bloom early in the season and could be damaged by frosts in late spring. Southern highbush varieties are recommended for Central and southern Virginia. Suziblue, Palmetto, and O’Neal are early-season varieties. Suziblue has very large fruit and excellent flavor. Palmetto is a medium-sized berry with outstanding flavor. O’Neal is a popular variety with medium size and very good flavor fruit. Camellia, Jubilee, and Magnolia are midseason southern highbush. Camellia has a very large-sized fruit. Jubilee and Magnolia are smaller-fruited varieties with good plant vigor. Bird and deer feeding can be a problem with southern highbush varieties.

Northern Highbush Varieties

Northern highbush blueberries are self-fertile; however, larger and earlier ripening berries result if several varieties are planted for cross-pollination. In Virginia, the northern highbush varieties should be planted in Northern Virginia and in the mountain region with adequate soil conditions.

Duke, Earliblue, Patriot, and Spartan are early season northern highbush varieties. Duke is a popular variety with medium-sized fruit and very good flavor. Earliblue produces very early in the season; it is not a heavy producer. Patriot is a heavy producer with very large berry size. Spartan has large berry size and good flavor.

Bluecrop, Blueray, and Legacy are midseason northern highbush blueberries. Bluecrop, although lacking in vigor, is very hardy and drought-resistant. The fruits are medium-sized. Blueray is very hardy and productive and is recommended for planting. The fruit is large, dark blue, and flavorful. Legacy is a highly adaptable variety, slower in production in the first few years; however, yields can be very high once the plants become established.

Elliott and Jersey are late-season northern highbush varieties. Elliott has a good, mild flavor when fully ripe (if not fully ripe, the flavor will be very tart). It is winter-hardy and bears firm, medium-sized fruits. Jersey, one of the leading commercial varieties, is also a favorite in the home garden. The plants are vigorous and hardy, producing heavy crops of medium, dark berries of good quality. Because these are picked fully ripe, they are also more susceptible to damage caused by spotted winged drosophila.

Establishing the Planting

Soils

Blueberries are shallow-rooted plants and must either be irrigated, heavily mulched, or planted in a soil with a high water table. Adequate drainage must be provided because they cannot tolerate saturated soils. A high

water table in clay soils promotes root rot diseases. Raised beds with drip irrigation are preferable. They grow best in porous, moist, sandy soils high in organic matter, with a pH range of 4.2 to 5.2. Have the soil tested and if the pH is not in the 4.2 to 5.2 range, work materials such as peat moss, pine needles, pine bark, or sulfur into the area where the plants are to be set. This should be done six months to a year before planting. To acidify sandy soils, sulfur is recommended at the rate of 0.75 pound per 100 square feet for each full point the soil tests above pH 4.5. On heavier soils, use 1.5 to 2 pounds. Once proper soil pH is established, it can be maintained through the annual use of an acid fertilizer, such as ammonium sulfate or cottonseed meal. The soil's pH should be tested every three years.

Planting

Vigorous, 2-year-old plants about 15 inches high are recommended for planting. Set them in early spring about three or four weeks before the average date of the last frost. For rabbiteye varieties, plant every 4 to 5 feet in a row, with 10 feet between rows. For northern and southern high bush varieties, plant 3 to 4 feet in a row, and 6 to 8 feet between rows.

Give the roots plenty of room. Where the plants are to be set, dig the holes wider than the root systems and as deep as necessary. It is not necessary to incorporate organic matter or other soil amendments into the backfill soil. Trim off diseased and damaged portions of the top and roots and set the plants at the same depth that they grew in the nursery. Spread the roots out and carefully firm the soil over them. Water thoroughly after planting.

Maintaining the Planting

Soil Management

Mulching is the preferred soil management practice in the blueberry planting. The entire area around and between the plants should be mulched. Hardwood or softwood bark and sawdust, applied to a depth of 4 or 5 inches is recommended. Many growers use a combination mulch — a layer of leaves on the bottom with 2 or 3 inches of sawdust on top. Renewed annually, this heavy mulch retains moisture, keeps the soil cool, and adds needed organic matter. If soil pH is an issue, make sure to mulch with pine bark or apply sulfur on top of mulch. Mulches provide a relatively warm environment, and can attract voles particularly during winter season. In areas where voles are a problem, mulch application should be less thick and be applied more frequently. Control through trapping and chemical baiting may be needed.

Fertilization

No fertilizer should be applied at planting time, and usually none is needed during the first growing season. On poor soils, however, the application of 2 ounces of ammonium sulfate around each plant about the first of June is beneficial.

Ammonium sulfate, at the rate of two ounces per plant, should be spread in a circle around each plant, about 6 to 8 inches from its base, just before the buds begin to swell the second spring. Increase the amount each succeeding spring by one ounce, until each mature bush is receiving a total of 8 ounces annually. Cottonseed meal has proven to be an excellent fertilizer for blueberries and is used by many home gardeners. It supplies the needed nutrients and helps maintain an acid soil. Use it at the rate of one half pound per plant. Where sawdust is used as a mulch, it will be necessary to apply additional nitrogen to prevent a deficiency as the sawdust decays. Usually about 0.75 pound of ammonium sulfate for each bushel of sawdust is sufficient.

Pruning

Until the end of the third growing season, pruning consists mainly of the removal of low spreading canes, and dead and broken branches. As the bushes come into bearing, regular annual pruning will be necessary. This may be done any time from leaf fall until before

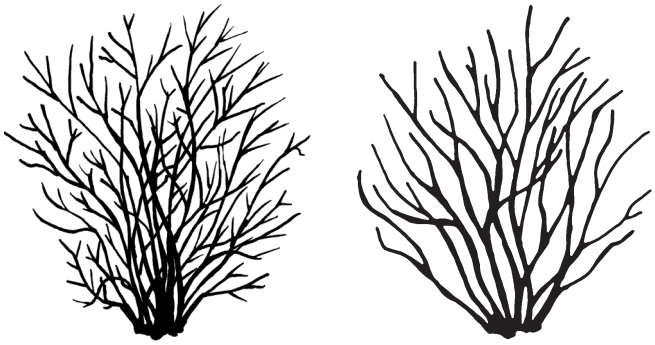

Figure 3. Left, unpruned blueberry plant. Right, after pruning, a mature blueberry bush should have 10 to 15 canes.

growth begins in the spring. A mature blueberry plant should produce three to five new canes per year. During pruning, clean out old, dead wood, and keep three best 1-year-old canes. Locate the oldest canes and prune out one of every six existing canes; cut as close to the ground as possible. A mature blueberry bush should have 10 to 15 canes: two to three canes each of 1-, 2-, 3-, 4-, and 5-year-old canes (fig. 3).

Pest Management

Birds are by far the greatest pests in blueberry planting. Covering the bushes with wire cages, plastic netting, or loosely woven cotton fabric cloth (e.g., tobacco cloth) is perhaps the best method of control. Aluminum pie tins have been used successfully. They are suspended by a string or wire above the bushes such that they twist and turn in the breeze and keep the birds away. Spotted wing drosophila will lay eggs on ripe or ripening fruits; infestations can be minimized by picking fruits as soon as they are ripe.

Harvesting the Planting

Some varieties of blueberry will bear the second year after planting. Full production is reached in about six years, with a yield of 4 to 6 quarts per plant, depending on vigor and the amount of pruning. Blueberries hang on the bushes well and are not as perishable as blackberries or raspberries. Picking is usually necessary only once every five to seven days, more frequently if bird pressure is high. Blueberries will keep for several weeks in cold storage.

Caneberries

Both raspberries and blackberries (often referred to as caneberries or brambles) will usually yield a moderate crop of fruit the second year after planting and a full crop in the third season. With good management, it is possible for gardeners to extend the productive life of well-maintained plantings beyond 10 years.

Variety Selection

Caneberry plants are biennial in nature; the crowns are perennial. New canes grow from buds at the crown each year. For blackberry and raspberry, there are two fruiting types: primocane and floricane. Primocane fruiting-type raspberry and blackberry bear fruits on the first-year cane (shoot), which is ready for harvest in late summer. After harvest, if the cane is pruned at the point below where it produced fruit in the first year, the lower part of the cane will produce another crop (second harvest) the following summer after the cane is exposed to chilling during winter months. The second year cane, bearing fruit, is referred to as "floricane fruiting-type." Therefore, primocane fruiting blackberry and raspberry varieties can produce two crops (harvests) each year.

Of the many varieties of blackberries and raspberries available, few have proven totally satisfactory for growing under Virginia conditions. Only top-quality, virus-free, 1-year-old plants of the best varieties should be planted.

Blackberries

Of interest to homeowners would be the thornless blackberry varieties that would allow children and adults to pick berries without the concern of being scratched on the skin. However, there are some very tasty and productive thorny blackberry varieties. Information about some popular blackberry varieties follows.

- Chester is a thornless, late-bearing, semierect variety that is high in yields with a medium fruit size. The variety is resistant to cane blight.
- Kiowa is a thorny, early-season variety that bears the world's biggest blackberry fruit. Kiowa blooms earlier and longer than other blackberry varieties. The berry ripens in early June.
- Natchez is a thornless, early-bearing variety that produces large fruit that ripens in early June. When fully ripened, it is very sweet and tasty. Natchez is a semierect variety and needs trellising for improved production and better fruit quality.
- Navaho is a thornless, erect, mid- to late-season blackberry that produces better-quality fruits when trellised. Fruit shape is conic, berry size is medium but very firm, and the flavor is excellent.
- Prime-Ark 45 is thorny primocane variety that produces firm berries, free of molds and diseases. Berries are large in size with good flavor and are suitable for long-distance shipping.
- Prime-Ark Freedom is the world's first thornless primocane-bearing variety, released in 2013. This is an erect type that produces very large fruits and has

a good flavor. The fruit is harvested in the fall and is good for fresh consumption. As a primocane-type blackberry, the Prime-Ark Freedom can produce two crops per year.

Dewberries and boysenberries are also included under blackberries. Dewberry is a trailing form of blackberry, and boysenberry is a hybrid of loganberry (Rubus loganobaccus) and various blackberries and raspberries. The boysenberry plant is easily winter-killed and should be planted only in areas with mild winters. Plants are extremely vigorous and productive, and the berries are large and flavorful when fully ripe. Thornless boysenberries are also available. Recommended varieties of dewberry and boysenberry include the following.

- Lavaca, a seedling of the boysenberry, is superior to its parent in production, size, and resistance to cold and disease. Fruit is also firmer, less acidic, and of slightly better quality.
- Lucretia Dewberry, the best of the trailing blackberries, is relatively winter-hardy, vigorous, and productive. Fruits are very large — often 1.5 inches long — shiny, sweet-flavor berries.

Raspberries

Raspberry types are based on berry color: red, black, and purple. Chances for success with raspberry plantings are better if the plantings are located in the cooler mountain sections of the state. Fruit production and quality can be improved if trellises are used when planting raspberry.

Red raspberries have generally been more successful in warmer areas of the state than have the other types.

- Caroline is an early primocane-bearing variety. Fruit is conical, medium-sized, and firm and has excellent flavor. The variety has medium vigor and good disease resistance.
- Heritage is a primocane-bearing variety. Fruit is medium-sized, firm, and of good quality. This variety is resistant to most diseases but is susceptible to late leaf rust.
- Himbo Top is a primocane-bearing variety with high tolerance to phytophthora root rot disease. This variety produces a large, firm, conic fruit, bright red in color, with very good flavor.
- Jaclyn is the earliest of the primocane-bearing varieties. Fruits are dark red, large, and have an excellent flavor. Used primarily for fresh consumption.
- Joan J is a very productive, spine-free, primocane-bearing variety. Fruit is very firm, glossy, and dark red in color. Used for fresh consumption.
- Josephine is a primocane-bearing variety that has an upright, vigorous plant. Berries are dark red in color, large, have excellent flavor, and a long shelf life. Plant is resistant to potato leafhopper.
- Killarney is a high-yielding, floricane-bearing variety. Fruit is medium-sized and bright-colored, but it is soft in warm weather. This is a hardy cultivar and suitable for colder climates. Susceptible to mildew and anthracnose. Good flavor and freezing quality.
- Latham is a floricane-bearing variety. Plants are vigorous with few spines, are moderately productive, and susceptible to fire blight and powdery mildew. Berries are small in size, soft, and somewhat tart.
- Nova is midseason, floricane-bearing variety. Fruits are somewhat acidic in taste. Considered to have better-than-average shelf life. Plants are hardy and resistant to cane diseases and late leaf rust but are susceptible to cane botrytis.

Black raspberries are very susceptible to viral diseases and are readily infected when grown near red varieties carrying a virus. Plants of red and black raspberries should be separated by at least 700 feet.

- Cumberland, a floricane-bearing variety, ripens about one week later than New Logan. Cumberland has long been a favored variety due to its attractive firm berries with fair flavor. Plants are vigorous and productive but not particularly cold-hardy.
- Jewel, a floricane-bearing variety, has firm, glossy, large, and flavorful fruits. Plants are vigorous, cold-hardy, upright, and resistant to most diseases. Jewel is a high-yielding variety.
- New Logan yields heavy crops of good-quality, large, glossy black fruits. Plants hold up well during drought and are relatively tolerant to mosaic and other raspberry diseases.

Purple raspberries are a hybrid of the red and black types. The fruits have a purple color and are usually larger than the parent varieties. They are tarter in taste compared to either the reds or black raspberries and are best used in jams, jellies, and pies. They are excellent for quick freezing. Plants are less hardy than the parents but are vigorous and very productive.

- Brandywine is the best purple raspberry available. It ripens later than most red or black varieties. The fruit is large, firm, and quite tart but of good quality. This variety is resistant to most diseases but is susceptible to crown gall.

- Royalty has a delicious sweet flavor, soft fruit, and high productivity. It is excellent for fresh use and for jam and jelly. Royalty is resistant to mosaic-transmitting aphids and raspberry fruit worm. Canes have thorns.

Establishing the Planting

Soils

Caneberries grow best in deep, sandy loam soils rich in organic matter. Ideal soil should have a pH of 6.0 to 6.5 and be well-drained to a depth of at least 3 feet. Caneberries are sensitive to excess waterlogging, and even temporary water accumulation can weaken canes, hinder plant growth, and increase incidences of diseases — particularly root rots. Therefore they are best grown on raised beds.

Planting

Caneberries should be planted in late fall or early in spring, about four weeks before the average date of the last frost. Work the soil as for garden vegetables, particularly where the plants are to be set. When planting in rows, allow at least 8 feet between rows to facilitate cultivation. Red and purple raspberries can be set 3 feet apart within the row; set erect and semierect blackberries plants 5 feet apart. Black raspberry rows should be no less than 4 to 5 feet apart and trailing blackberry rows no less than 6 feet apart.

Set the plants at about the same depth they grew in the nursery. The crown should be at least 2 inches below the soil line. Spread out the roots and firm the soil carefully around them. Do not allow the roots to dry out. Most caneberry fruits come with a portion of the old cane attached. This serves as a handle in setting the plants. Soon after new growth begins, the handle can be cut off at the surface of the ground and destroyed as a safeguard against possible anthracnose infection.

Maintaining the Planting

Soil Management

Caneberries grow best in soils containing 3 percent or more organic matter. Organic matter in soil can be maintained using a permanent mulch. Mulch should be applied soon after setting the plants and maintained throughout the life of the planting by replenishing annually or as needed. Hardwood or softwood bark should be applied at least 5 or 6 inches in depth. If mulch material is unavailable or if cultivation seems necessary, keep the cultivation very shallow to avoid disturbing the roots and repeat cultivation as often as necessary to control weeds until the beginning of harvest.

Fertilization

If materials low in nitrogen are used, it might be necessary to add sufficient nitrogenous fertilizer to prevent a temporary deficiency as the mulch begins to decay. Usually about 0.5 pound nitrate of soda or 0.75 pound of 10-10-10 for each 100 square feet of mulched area will be enough. On fertile soils or where good mulch is maintained, it is usually unnecessary to make an application of fertilizer in the caneberry planting. Additional fertilizer should be added after a soil test has been done and on the basis of recommendations. If growth is poor, adding 2 to 3 pounds ammonium nitrate to each 100 feet of row when growth begins in the spring will be beneficial. Adjustments to fertilizer grades and amount should be made based on plant growth and soil type. However, do not overfertilize because it could result in too much vegetative growth, burning of foliage, yield loss, injury to roots, a decrease in fruit quality, and an increase in disease.

Training and Pruning

Trailing and erect-growing blackberries and black and purple raspberries need some kind of support. They can be grown on a trellis, trained along a fence, or tied to stakes. Other caneberries can either be trained to supports or — with more severe pruning — grown as upright, self-supporting plants. Red raspberries sucker so they are frequently grown in hedgerows.

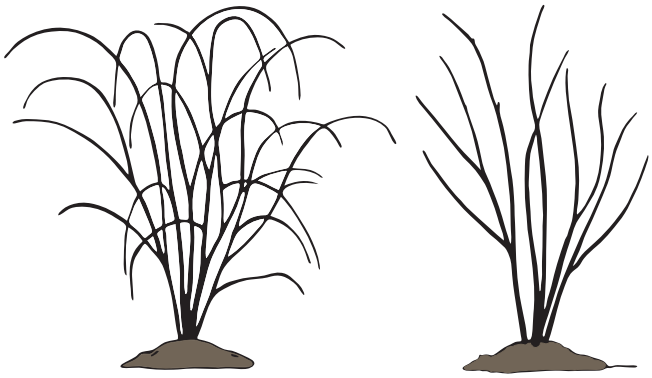

Figure 4. Left, an unpruned blackberry plant. Right, once plants are dormant, only retain four to five of the best canes.

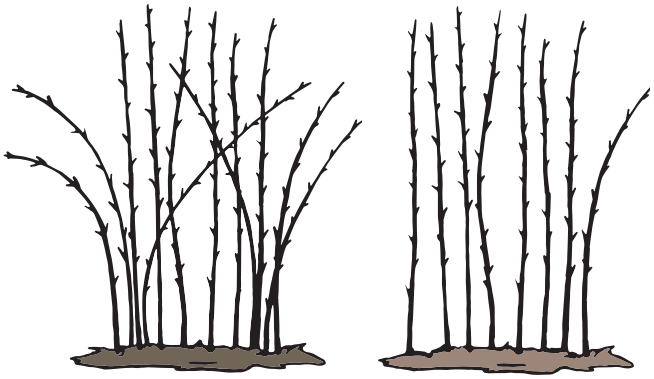

Figure 5. For plants grown in hedgerows, thin canes to 6 to 8 inches. The figure shows, left, before thinning, and right, after thinning.

On vigorous sites, some type of minimal containment trellising might be needed in some seasons.

A simple trellis, used in many home gardens, consists of two wires stretched at 3- and 5-foot levels between posts set 15 to 20 feet apart. Fruiting canes are tied to these wires in the spring. The erect varieties are tied where the canes cross the wires. Canes of trailing varieties are tied horizontally along the wires or fanned out from the ground and tied where they cross each wire.

Where stakes are used for support, they are driven into the ground about 1 foot from each plant and allowed to extend 4 or 5 feet above the ground. Canes are tied to the stake at a point about midway between the ground and the tips of the canes and again near the ends of the canes.

Dormant pruning is usually delayed until the danger of severe cold has passed and accomplished before the buds begin to swell in spring. Dormant pruning consists of the removal of all dead, weak, diseased, and severely damaged canes and the selection and pruning of the fruiting canes for the coming season. At the dormant pruning, thin each plant until only four or five of the best canes remain. Where possible, fruiting canes 0.5 inch or more in diameter are selected. Cut the lateral branches of the black raspberry to 9 to 12 inches long, those of the purple raspberry to 12 to 15 inches long, and the blackberry to 15 to 18 inches long (fig. 4). At the dormant pruning where supports are used, head the canes to 5 feet in height. Canes grown without support should be headed to 3 feet. All dead and weak canes should be removed after harvest or at the dormant pruning. They should be thinned to seven or eight of the best canes per hill, cut to about 5 feet in length, and tied to either a stake or trellis.

Summer top pruning stimulates lateral branching. Summer top pruning consists of removing the top 3 to 4 inches of the new shoots by snapping them off with the fingers or cutting them with shears or a knife. Where trained to supports, let them grow 6 to 8 inches taller than the support before topping. Blackberry plants should be summer top pruned when the young shoots (primocanes) are about 5 feet tall. For black raspberries and purple raspberries, summer topping should be done when young shoots are about 3 to 4 feet tall. To prevent the planting from becoming too thick and reducing yields, it could be necessary to remove excess sucker plants as they appear. This can be done either with a hoe or by hand. In the hedgerow type of culture, leave only three or four shoots per running foot of row. Grown in hills, four to five new shoots can be allowed to develop in each hill. If the plants are grown in hedgerows, keep the width of the rows to 18 inches or less and remove all plants outside the row areas. Thin the canes within the hedgerows to 6 to 8 inches apart, saving the best canes (fig. 5).

Where canes are supported either by a trellis or stakes, cut the canes back to a convenient height for berry picking, usually about 5 feet. Grown as upright self-supporting plants without the use of trellises or stakes, the canes should be cut back to about 3 feet in height whether in hills or in hedgerows. Any lateral branches should be cut to about 10 inches in length.

Primocane-bearing red raspberries and blackberries should not be summer topped because this will reduce the potential of canes to bear fruits in summer. Primocane-type raspberry and blackberry bear fruits on the first-year cane (shoot) that are ready for harvest in late summer. After harvest, if the cane is pruned at the point below where it produced fruit in the first year, the lower part of the cane will produce another crop (second harvest) the next summer after the cane is exposed to chilling during the winter months. In the late winter, three to four canes from each plant are selected and tied to a trellis for the second harvest, and the rest of the canes are pruned from the soil level (fig. 6). This will allow the new primocane to grow for the first year's harvest while the last year's primocanes produce the second harvest. It is important to prune and remove canes after the second harvest and allow the new canes to grow.

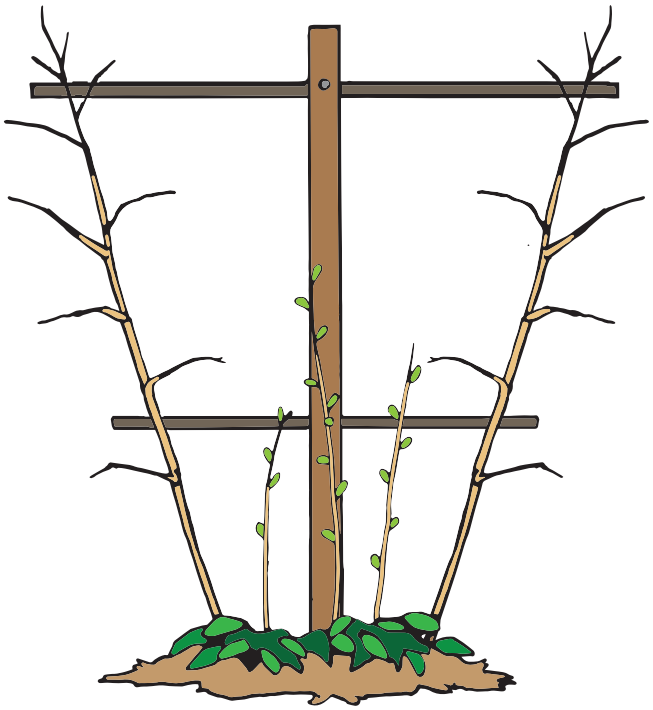

Figure 6. Primocane-fruiting raspberry with second-year canes and new canes.

Grapes

Grapes of some type can be grown almost anywhere. The careful selection of cultivated varieties compatible with local soil and climatic conditions has led to successful production in home gardens and commercial vineyards.

Table Grapes

Grape varieties should be selected for their intended use. Some seeded varieties such as Concord or Niagara can be used either for fresh table consumption, home juice or jelly production, or for wine production, but most varieties were developed or selected for a specific use. The following varieties are generally classified by intended use and have fared reasonably well over a wide geographic area of Virginia, with certain noted qualifications. All-American, hybrid, and Vitis vinifera grapes are self-fertile, meaning that a different pollenizer is not required for them to adequately set fruit.

- Concord is by far the most widely planted blue-black grape. The good-quality fruit ripens unevenly in the hotter areas of the state. A similar variety called Sunbelt was developed in Arkansas to ripen more uniformly in hot climates. Concord is an excellent and versatile variety for the home gardener. The vines are vigorous and productive, and except for black rot, they are relatively disease-tolerant.
- Delaware is a high-quality, red grape ripening about one week before Concord. Quite susceptible to downy mildew, this variety produces clusters and berries that are rather small and vines that grow slowly. Delaware has an unusually good balance of sweetness and acidity. It yields fine-quality white wines and is often used in blends for sparkling wine.
- Himrod, a golden-yellow grape, has good flavor and is considered seedless, although vestigial seeds can be present. Hardy, vigorous, and productive, it has been superior to its sister seedling, Interlaken, in areas where both have been grown.
- Mars has medium-sized, seedless, blue-black berries of the slip-skin type and is sweet and enjoyable. It is a cold-hardy plant with high resistance to black rot, powdery mildew, and downy mildew.
- Niagara has green-white berries and is used in wine and as a table grape. It is the most widely planted white American grape in the U.S. and is used extensively for white juice.
- Seneca, an early-season yellow grape, is noted for its good flavor and tender pulp. It holds well on the vine and will keep in cold storage for about two months after harvest. Vine vigor and productivity are only moderate, and this variety is quite susceptible to black rot and powdery mildew.

- Steuben is a blue-black variety ripening about one week after Concord. The berries are medium in size with a sweet, spicy flavor. They keep well in storage. The vines are hardy, vigorous, and productive. Steuben makes a very nice wine in addition to its use as a table grape.

Wine Grapes

American and Hybrid Varieties

- Chambourcin is a black grape that produces a red wine often compared to merlot. Although Chambourcin can be grown on its own roots, graft it to a rootstock such as C-3309, 101-14, or 420-A for best performance.

- Chardonel is a midseason, white wine grape. It is productive and generally more disease-resistant than one of its parents, chardonnay. Chardonel must be purchased from a grapevine nursery as a grafted grapevine. We recommend any commonly used rootstock variety, such as C-3309, 101-14, or 420-A.

- Norton is a late-ripening, American-type wine grape hybrid of *Vitis aestivalis*. It is a black grape with small clusters and small berries. The fruit can be very acidic, and vines should be trained to a high wire cordon, affording excellent fruit exposure to help reduce fruit acidity.

- Traminette is a midseason, white wine grape with good productivity and partial resistance to several fungal diseases. It produces a wine with some of the spicy, roselike characteristics similar to one of its parents, Gewürztraminer.

- Vidal Blanc is a mid- to late-season white wine grape. It is moderately susceptible to downy mildew, powdery mildew, and aerial phylloxera. Vidal should be purchased from a grapevine nursery as a grafted grapevine. We recommend any commonly used rootstock variety, such as C-3309, 101-14, or 420-A.

Vitis vinifera Varieties

Vitis vinifera grape varieties are the most important and the most abundant grapes grown globally for wine and raisin production. They are, however, difficult to grow in the backyard situation. Vinifera varieties are extremely susceptible to many diseases; most are susceptible to winter cold injury below 5 F, and all vinifera varieties must be grafted to rootstocks tolerant of grape phylloxera. If you choose to grow vinifera grape varieties, pay particular attention to the disease management described in the Pest Management, section.

- Cabernet Franc is a black grape that produces fine red wine. Vines are vigorous and more cold-hardy than other black vinifera types.

- Chardonnay, considered by many to be superior to all other varieties for dry white wine, is only moderate in hardiness, vigor, and productivity. It is a medium-sized, white grape in a compact cluster ripening three to five days ahead of Concord. Vines are extremely sensitive to fungal diseases such as powdery mildew, downy mildew, and black rot.

Muscadine Varieties

In areas where it is adapted, the muscadine grape is a favorite for home plantings. It is highly desirable for juice, jam, and jelly, and some varieties are cultivated for the unusual style of the wine. Muscadine grapes are cold-tender and should not be planted where temperatures fall below 5 F. In Virginia, plant only in U.S. Department of Agriculture's plant hardiness zones 7b or greater (see http://planthardiness.ars.usda.gov/PHZMWeb/).

Many muscadine varieties have imperfect flowers and require pollination from either male or perfect-flowered varieties. Of those suggested for planting, Carlos, Magnolia, and Nesbitt are perfect-flowered and will supply adequate pollination for female-flowered varieties such as Scuppernong.

- Carlos, a 1970 introduction from North Carolina, is a perfect-flowered bronze variety ripening with Scuppernong and similar in size and flavor. It makes excellent white wine and is relatively cold-hardy, disease-resistant, and productive. It is recommended for both commercial and home garden plantings.

- Magnolia is a perfect-flowered, bronze variety of large size and very high quality. The vine is vigorous and very productive.

- Nesbitt is a large, black, perfect-flowered variety from North Carolina. Fruit ripens over a three-week period and vines are relatively cold-hardy.

- Scuppernong, a name commonly applied to all bronze-skinned muscadine grapes, is the oldest and

best-known variety. Berry clusters are usually small and shatter badly, but the grape quality is good and it has a very distinctive flavor. As a female-flowered variety, Scuppernong would require a pollinator variety that blooms at roughly the same time.

Establishing the Planting

Site and Soil Essentials

Grapes should be planted where they have the benefit of the sun for most of the day. They are deep-rooted plants, frequently penetrating to a depth of 6 to 8 feet under good soil conditions. Most grapes require 160 or more frost-free days to ripen the crop, so the site should be relatively high to surrounding topography to allow cold air drainage, and the general climate of the area should afford at least 160 frost-free days. Good air movement aids disease management. Avoid use of volatile herbicides such as those that contain 2,4-D or dicamba in the vicinity of the grape planting because grapevines can be severely damaged by drift from such herbicides.

Grapevines grow best on well-drained, sandy loam soils with 2 to 5 percent organic matter and moderate fertility. Sandy or heavy clay soils may be used, however, if provisions are made for adequate fertilization, moisture, and soil drainage. Grapes are tolerant of a wide range of soil acidity but prefer a 6.0 to 6.8 pH range.

Planting

Dormant grapevines are usually set in early spring, at or slightly before the average date of the last frost. Vigorous, 1-year-old plants are preferred. Allow plenty of room between plants within a given row — at least 5 feet for the American bunch varieties and 8 feet or more for the vigorous-growing muscadine type. Trim the roots to about 6 inches in length to encourage formation of feeder roots near the trunk. Where the vines are to be set, dig the holes large enough so the roots can be spread without crowding and the plants can be set at about the same depth that they were grown in the nursery. For grafted vines, use care in firming the soil around set vines to ensure that the graft union remains about 3 inches above the final settled soil line. After buds have broken and all risk of frost has passed, prune the planted vine to a single cane and head it back to two buds.

Maintaining the Planting

Soil Management

Mulching is the preferred soil management practice in home grape planting as mulch will suppress weeds and conserve soil moisture. Using hardwood or softwood bark mulch to a depth of 4 to 6 inches is recommended. There have been cases where mice have girdled vines with mulch up to the trunk, so it is best to keep some space between the trunk and mulch through the winter.

Although grapes are deep-rooted plants, they do not compete well with weeds and grass, especially shortly after planting. If mulch material is unavailable, some cultivation should be done. Cultivation should be shallow and performed only as necessary to eliminate undesired vegetation.

Fertilization

Like all fruit plants, grapes usually require nitrogen fertilization. Except in sandy soils, this element could be the only one needed in the fertilization program. In the home garden, 2 ounces of calcium nitrate (15.5 percent nitrogen) per vine should be applied after growth begins in the spring. Spread the fertilizer in a circle around the plant, 10 to 12 inches from the trunk. Repeat the application about six weeks later. Repeat this fertilization at the same timing and rates in the second and third seasons. A blended fertilizer, such as 10-10-10, applied at 3 ounces per vine can be substituted where phosphorus and potassium are also needed.

Fertilizer applications to mature, bearing vines should be based on the growth and vigor of the plant. If the average cane growth is only 3 feet or less, additional nitrogen might be needed. Where proper pruning is practiced and competition from weeds and grass is kept to a minimum, however, it is doubtful that you will need to go beyond the amount recommended for a 3-year-old vine.

Training and Pruning

Much attention is given to the training and pruning of grapes. To be most productive, they must be trained to a definite system and pruned rather severely. There are several training systems used. Two that are commonly used are the vertical trellis and the overhead arbor. Both of these are satisfactory in home planting if kept well-pruned.

Of the many variations of the vertical trellis, the single-trunk, four-arm Kniffin system is the most popular (fig. 7). Posts are set 15 to 20 feet apart and extend 5 feet above the ground. Two wires are stretched between the posts, the lower being about 2.5 feet above the ground and the upper at the top of the posts. Set between the posts, the vine is trained to a single trunk with four semipermanent arms, each cut back to 6 to 10 inches in length. One arm is trained in each direction on the lower wire.

During annual winter pruning, one cane is saved from those that grew from near the base of each arm the previous summer. This cane is cut back to about 10 buds. The fruit in the coming season is borne on shoots developing from those buds. Select another cane from each arm, preferably one that grew near the trunk, and cut it back to a short stub with two buds. This is a renewal spur. It should grow vigorously in the spring and be the new fruiting cane selected the following winter. All other growth on the vine should be removed. This leaves four fruiting canes, one on each arm with eight to 10 buds each, and four renewal spurs, one on each arm cut back to two buds each.

The same training and pruning techniques can be used effectively in training grapes to an arbor system. Arbors are generally overhead structures occasionally used in home plantings to add a decorative feature to the garden or lawn. Many variations can be found by browsing the Web. The principal difference between trellises and arbors is that the wires supporting the grapevine arms are placed overhead and parallel with each other on the arbor instead of vertically on trellis posts. Overhead wires or wooden frames are usually placed 6 to 7 feet above the ground, well within reach.

If an arm dies or for any reason needs to be replaced, choose the largest cane that has grown from the trunk near the base of the dead arm and train it to the trellis wire. To renew the trunk, train a strong shoot from the base of the old trunk to the trellis as though it was the cane of a new vine. Establish the arms in the same manner as for a new vine and cut off the old trunk.

A high-wire cordon training system can be used with varieties such as Norton that have trailing or procumbent shoot growth habits (fig. 8). The top wire of the trellis is placed about 6 feet above the ground. One or two trunks are trained up to this wire and then horizontally extended along the top wire to which they are loosely tied. These horizontal trunk extensions are called "cordons" and are annually pruned to short, two- to four-node "spurs" derived from the previous season's canes. It is important to train or comb the current growing season's shoots downward from the cordons if using a high-wire system.

Pruning can be done at any time after the vines become dormant. In areas where there is danger of winter injury, pruning should be delayed until early spring. Vines pruned very late could "bleed"

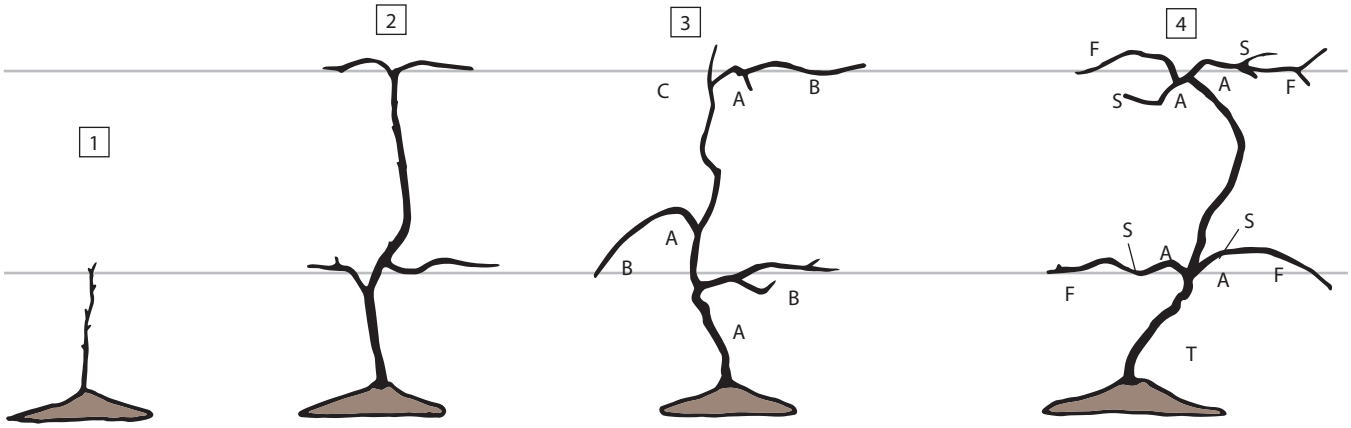

Figure 7. Stages in training the young vine to the single trunk, four-arm Kniffin system. (1) After pruning the first winter: The single cane is cut back and tied to the lower wire. If the cane has grown less than 3 feet during the first summer, it should again be cut back to two buds. (2) After pruning the second winter: Two new canes of four or five buds each are tied on the bottom wire. A third new cane is tied up to the top wire and cut off. (3) After pruning the third winter: Three of the arms (A) and the fruiting canes (B) have been formed. A cane (C) with four or five buds is left to establish the fourth arm. (4) A fully formed vine after pruning the fourth winter: The arms (A) should be shorter than those shown. The vine consists of a single permanent trunk (T), four semipermanent fruiting arms (A), four annual fruiting canes (F), and four renewal spurs (S) with two buds on each.

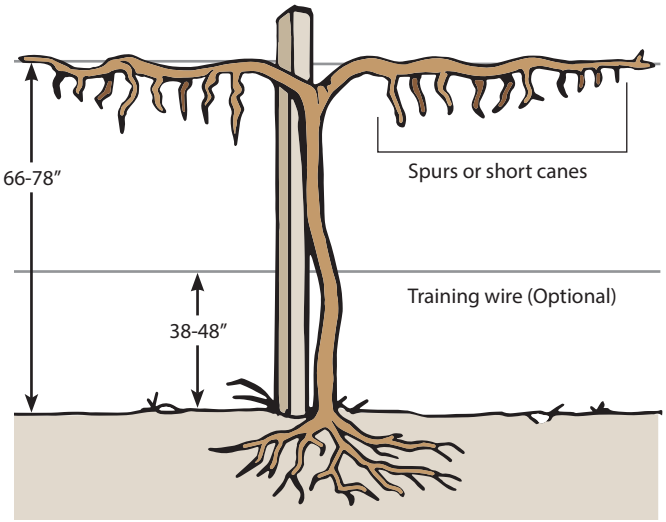

Figure 8. High-wire, cordon-trained system for grapevines. Cordons are semipermanent, horizontal extensions of the trunk(s). Cordon length will depend on in-row vine spacing; the cordon of one vine should extend almost to the cordons of the adjacent vines in the row. Cordons are pruned to short canes or spurs of one to four nodes in length. Total node number should not exceed about five nodes per linear feet of row. Thus, for vines spaced 7 feet apart in the row, total retained nodes should not exceed 35.

excessively, but there is no evidence that this is injurious. "Bleeding" here refers to the oozing or flow of sap from pruning wounds, a phenomenon caused by positive sap pressure within the vine when soil begins to warm in spring.

Pest Management

Grapes and grapevines are subject to diseases and insect pests. Certain varieties, such as Norton, as well as most muscadine varieties, are relatively resistant to common fungal diseases. On the other hand, all of the *Vitis vinifera* varieties and many of the hybrid grape varieties are either moderately or highly susceptible to one or more fungal diseases, including black rot, downy mildew, and powdery mildew. Chief insect pests include Japanese beetles and grape berry moth. If acceptable to the grower, a fungicide spray program will likely be minimally required for American and hybrid grapes and mandatory for *Vitis vinifera* varieties to avoid crop loss to these diseases. Japanese beetle and grape berry moth infestations vary from year to year and might or might not require insecticide sprays. For further information on chemical pest management, please consult Virginia Cooperative Extension's Pest Management Guide for home fruit production, available at www.pubs.ext.vt.edu/456/456-018/456-018.html.

In addition to potential disease and insect threats, ripe grapes are attractive to birds, deer, and raccoons. Bird netting can be used to exclude birds, but it must be applied to the planting soon after grapes begin to acquire color and ripen. Vertebrate pests such as deer and raccoons can be excluded with woven wire, electric fencing, or combinations of fencing small enough to exclude raccoons and tall enough (8 to 10 feet) to discourage deer.

Harvesting the Planting

For best quality, bunch grapes should be fully ripe when harvested. They will not improve in sugar content or flavor after being removed from the vine. Most varieties should be used immediately because they do not keep well after ripening. Cut the clusters off with a knife or shears to avoid bruising the fruit and damaging the vine.

Muscadine grapes grow either singly or in small, loose clusters. Some varieties can be shaken off easily when ripe; others have to be hand-picked. The grapes should be used soon after harvesting since their storage life is relatively short.

Strawberries

Strawberries are the most widely cultivated small fruit in America. They are the favorite of many for pies, jams, jellies, preserves, and for eating fresh. Strawberries are adaptable to a range of soil and climatic conditions, and are well-suited to the home garden (where supplemental watering is readily accessible).

Variety Selection

Strawberry varieties vary in their adaptability to soil and climatic conditions and can be classified into short-day or June-bearing types, and day-neutral or ever-bearing types. The short-day strawberries will initiate flower buds when days are shorter than 14 hours or when temperatures are below 60 F. Most of

the varieties that fruit solely in May-June are short-day varieties, with flower buds initiated from late August to early November; however, the short days in spring (March) will also initiate flower buds. Day-neutral varieties will initiate crown growth and flower buds throughout the season except when temperatures are very high (above 86 F). These varieties will bear fruits in May-June with yields somewhat lower than short-day varieties. Day-neutral varieties will yield a second crop in midsummer at most locations and a third crop, its highest yield, in late summer and early fall. The varieties suggested for planting in Virginia have been selected on the basis of plant vigor, productivity, and quality of the fruit. Virus-free plants of these varieties are available and should be purchased. To keep disease pressure low, replace the strawberries each year and plant the new berries at a different location in the garden than the previous year.

Short-Day or June-Bearing Varieties

- Camino Real has a compact growth habit and a darker fruit color compared to Camarosa. Fruit is attractive and conical in shape. This variety is suitable for both fresh market and processing and is resistant to verticillium wilt and root and crown rots.

- Camarosa is a widely grown cultivar in the world. It has good disease profile resistance but is susceptible to verticillium wilt. Fruit is large, firm, and holds well in the rain. The fruit tastes better when it is picked past its glossy red stage.

- Chandler is another variety popular throughout the world and is greatly adaptable to the eastern United States. Fruit is medium to large in size with medium firmness. Chandler has good taste, is high-yielding, and is suitable for fresh consumption and processing. This variety is susceptible to diseases but harvests over a long period.

- Delmarvel is productive on a variety of different soil types. It is an attractive, large-sized berry with good aroma and flavor. Plants are disease-resistant except for *Rhizoctonia* but exhibit good winter hardiness.

- Earliglow is a variety noted for its superior dessert quality and disease resistance. The medium-large berries are very attractive with a glossy appearance and deep red color. It is one of the best for eating fresh, as a frozen product, and in jams and jellies. The plants are very vigorous and productive; however, they bloom early and are subject to frost injury, and late berries are small in size.

- Flavorfest is a mid- to late-season variety, with a sweet-tasting berry, and a medium-sized fruit. This variety is resistant to anthracnose disease.

- Lateglow was developed for its production of late-season fruit and good disease resistance. Its berries are very large, symmetrical, and attractive. It is a good dessert variety and can be eaten fresh or frozen.

- Sweet Charlie is a winter tender variety with overall lower yields for the season. This variety has a small fruit size. It is grown for its early bearing capacity, excellent flavor, and sweet taste. The plants are susceptible to *Phytophthora*.

Day-Neutral or Ever-Bearing Varieties

- Albion has a relatively open plant canopy. It is resistant to wilts and rots and is one of the most widely grown varieties in Northern California. Berries are cone-shaped with a dark red hue and a sweet flavor. The variety is good for fresh consumption and processing.

- San Andreas has good disease resistance. This variety produces high quality fruit and has an outstanding flavor and an exceptional appearance. Fruits are medium to large in size and symmetrical conic in shape. Fruit color is slightly lighter than Albion. This variety is suitable for fresh market, processing, and home gardens.

Establishing the Planting

Soils

Although strawberries grow best in a fertile, sandy loam soil with a pH of 5.9-6.5, they can be grown successfully in any good garden soil that is well-drained and well-supplied with organic matter. Soil for strawberries should be thoroughly prepared for planting — it should be loose and free of lumps. Raised beds are preferable.

Planting

Virus-free plugs should be set out in late fall or dormant crowns in early spring, about three or four weeks before the average date of the last frost. Plants

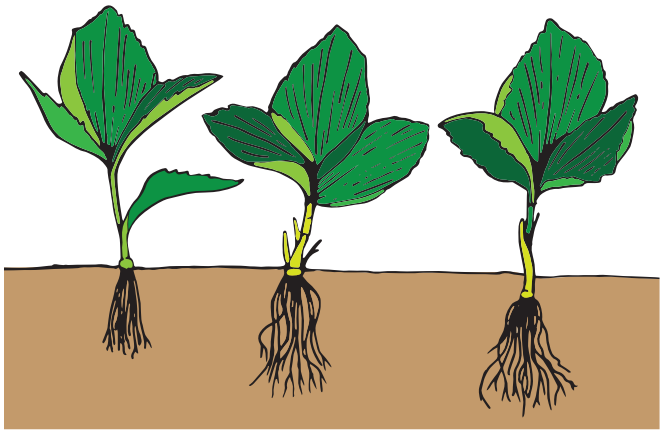

Figure 9. Planting depths: left, too shallow; center, correct depth; right, too deep.

should be placed no less than 12 inches apart in rows that are 2 to 3 feet apart. Take care to set each plant so the base of the bud is at the soil level (fig. 9). Spread the roots out and firm the soil carefully around them to prevent air pockets, which allow them to dry out.

Maintaining the Planting

Soil Management

Cultivation for weed control in strawberries should begin soon after planting and continue at approximately two to three week intervals throughout the first growing season. Cultivation must be shallow to prevent root injury. Hoe as often as necessary to remove grass and weeds growing between the plants.

In colder areas, home garden strawberry plantings should be winter mulched. Any organic material free of weed seeds makes acceptable mulch. Hay, straw, and pine needles are most frequently used. Mulch should be applied 2 to 4 inches deep over and around the plants after the first freezing weather in the fall when the soil is below 50 F (usually around mid-December). This protects them from injury due to freezing and heaving of the soil during the winter. After the danger of frost is over in the spring, about half the mulch should be raked off the plants into the area between the rows. Mulch left around the plants will help keep the berries clean, conserve moisture, reduce diseases, and check weed growth.

Fertilization

Two to three weeks before planting, broadcast 4 pounds of 10-10-10 fertilizer per 100 linear feet of row. If leaves appear light green in color after three to four weeks of transplanting, side dress with 1.5 pounds of ammonium nitrate per 100 feet of row. The limited shallow root systems will not initially benefit from fertilizer placed in the row middles. In coastal plains in late January or February, apply 0.75 pound of ammonium nitrate. In spring, choose a fertilizer grade with higher phosphorus and potassium and apply 0.5 pound of nitrogen per 100 feet of row.

Production System

There are two popular training systems used in strawberry production — the hill system or "plasticulture" system and the matted-row system. Modifications of these systems can be found.

In the hill system or plasticulture system, plants are spaced 12 to 16 inches apart in a single or staggered double row. All runners are removed as soon as they appear, and the plants are encouraged to multiply in large crowns. This system is desired by many because the planting is easier to cultivate and harvest, and it produces larger, better berries than other systems. However, many plants are required and the initial cost of the planting is high. Black plastic mulch is particularly effective with this training system, but it requires drip irrigation lines for optimum performance. This plasticulture system is currently popular with commercial growers.

Under the matted-row system used by many home gardeners, runner plants are allowed to set freely in all directions. The original plants should be set 18 to 24 inches apart in the row. Keeping the width of the plant bed narrow (16 to 18 inches) results in a good grade of fruit that is easy to pick. During the planting season, all flower stems on the plants should be removed as soon as they appear. This strengthens the plants and allows early and vigorous runner production. Runner plants formed early bear the best fruit the following year.

Renovation

If your strawberry planting is in a vigorous condition, it can be retained for fruiting the second year. However, allowing a planting to fruit more than two years often results in smaller berries and weak plants.

If retaining plants, remove the mulch and clip the tops of the plants to within 1 inch of the crowns with a scythe or mower soon after harvest (mid-July). If insects and foliage diseases are prevalent, move the leaves, mulch material out of the planting, and burn them. Apply a quickly soluble nitrogen fertilizer such as ammonium nitrate (NH_4NO_3) at 0.25 to 0.50 pound or 1 to 2 pounds of 10-10-10 per 100 feet of row to encourage vigorous top growth. Any good garden fertilizer supplying an equivalent amount of nitrogen can be used if desired.

Some plant thinning might be needed, particularly in the matted-row system. Thin plants (remove the oldest) to 6 to 8 inches apart after new foliage appears. Keep the planting free of weeds throughout the summer, irrigating when necessary during the dry season to keep the plants growing vigorously. Fertilize again in the early fall as recommended for the first year and renew the mulch after freezing weather begins.

Pest Management

Birds are one of the biggest pests in strawberry planting. It might be necessary to cover the plants with plastic netting to keep the crop from being eaten before the berries are ripe enough to harvest. Aluminum pie tins or used metallic compact discs — suspended by a string or wire above the plants in such a manner that they twist and turn in the breeze — could be successful in keeping birds away.

Culture of Ever-Bearing Varieties

Irrigation is particularly important for ever-bearing varieties because the late-summer/early-fall crop ripens during a period when soil moisture is usually quite low. Soil preparation and fertilizer requirements before planting are the same as those for regular varieties. Best yields are obtained from ever-bearing varieties if they are set in early spring in the hill system about 1 foot apart, cultivated for the first 10 to 14 days, and then mulched to a depth of 1 to 2 inches with sawdust. As the sawdust decays, the development of a nitrogen deficiency could occur. It can be quickly overcome with the application of 1 pound of 10-10-10 to each 100 square feet of mulched area.

Remove runners as soon as they appear to encourage the plants to multiply in large crowns. Blossom clusters should be removed until the plants have become firmly established and are growing vigorously, usually about the first of August. Berries will begin to ripen about a month later, and plants will continue to bear fruit until frost if weed growth is kept down and adequate moisture is supplied. Allow the plants to bear fruit for the spring and fall crops the second year, then replant the following spring.

Harvesting the Planting

In the home garden, strawberries should be allowed to develop an overall red color and become fully ripened before harvesting. Sometimes the tops (sun-exposed) are red but the bottoms are still white and not ready for harvest. It is at the fully ripe stage that the sugar content is highest and the flavor is best. It may be necessary to harvest every day during the peak of the season, especially in warm periods.

Harvest the berries carefully by the stems just above the caps to prevent bruising. Pick all that are ripe. Ripe fruits when left unpicked on the plant, increase infestation of strawberry sap beetle and spotted wing drosophila. Ripe strawberries can be held for a day or two in a refrigerator.

Strawberry Growing in Pyramids and Barrels

In a garden where space is extremely limited or where the gardener wishes to use the strawberry planting as a novelty or decorative feature, the strawberry pyramid or the strawberry barrel can be useful and interesting. Pyramids can be square or round. The frames for a square pyramid can be constructed out of landscaping wood. A suggested soil mixture for the pyramid is two parts good garden soil, one part peat, and one part sand.

In preparing a strawberry barrel, 1-inch diameter holes are made in the sides of the barrel at approximately 8-inch spacing. As the barrel is filled with successive layers of soil, strawberry plants are carefully inserted through the holes so that the roots are held firmly in contact with the soil. A porous tile inserted down the middle of the barrel will facilitate water reaching all of the plants (fig. 10). Though the strawberry barrel may be a successful novelty, yields of fruit will be smaller than those in open field culture, and much more attention to planting, watering, and winter protection are required.

Damage to the strawberry plants growing under normal cultural conditions can be expected if they are not protected from extreme cold during the winter. Owing to the fact that plants growing in a pyramid or barrel are elevated above normal ground level and therefore are highly exposed, additional winter damage can be expected to roots, crowns, and fruit buds. Consequently, care must be taken to provide adequate winter protection. Pyramids can be mulched with 6 to 8 inches of straw after the soil is frozen. In the coldest part of the state, strawberries in barrels will survive better if protected with burlap covering. In cold winters, enclose straw in the burlap for added insulation. However, even with careful mulching, some plant injury can be expected during severe winters.

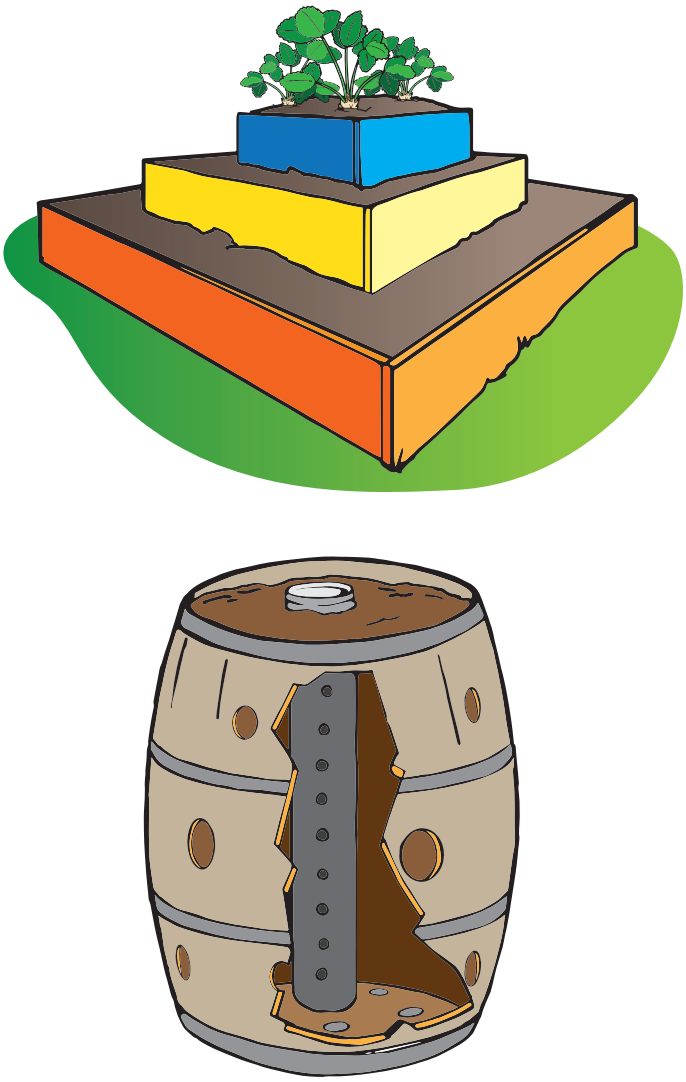

Figure 10. Plants can be grown in a pyramid setting or a barrel, in a home garden.

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