Grapes

Grapes have the longest history of all the cultivated fruits and are among the most widely grown. The fruits are used to make juice, jellies, wine, and pies, and the leaves can be used in cooking. Grapes also are delicious eaten fresh, and their popularity has increased since the development of new seedless table grape cultivars for the Northeast and the Southeast.

Keys for Success

Choose disease-resistant cultivars that are hardy for your site.

Make sure your site gets full sun and has good air drainage.

Prune vines annually during the dormant season, removing up to 90 percent of new growth.

Choosing Cultivars

Home gardeners can choose from a wide variety of grape cultivars, each differing in time of ripening, productivity, vigor, hardiness, fruit size, color, and flavor. The grapes most widely cultivated in the Northeast are derived primarily from *Vitis labrusca* and are referred to as American bunch grapes. The following cultivars of this species produce well in much of New York State:

- **Concord**—the primary cultivar grown in the Northeast and the standard for hardiness.
- **Niagara**—the leading white grape cultivar, though it is not as hardy as Concord and is moderately susceptible to several grape diseases.
- **Catawba—**a late-ripening red cultivar that requires a favorable site and a long growing season to reach full maturity.
- **Delaware**—one of the highest-quality American bunch grapes, both for eating fresh and for making white wine. It ripens two weeks before Concord. The tender skin of the red berries, however, is subject to cracking, and the leaves are susceptible to fungal diseases. It requires a deep, fertile, well-drained soil for satisfactory vine growth.
- **Ontario**—the best of the early-ripening American cultivars. It produces white fruit. Vines are vigorous but not as hardy as those of Concord.

Another grape species, *Vitis vinifera,* is native to southern Europe and recognized throughout the world for its wine quality. Chardonnay, Riesling, Cabernet Sauvignon, and Gewurztraminer are cultivars derived from *V. vinifera*. Unfortunately, these cultivars are extremely sensitive to cold temperatures. Some are grown successfully in the Northeast by taking special precautions, such as burying the canes each fall and tying them back up to a trellis in the spring.

Vinifera grapes are too sensitive to cold to be grown in the coldest areas of the Northeast.

Several cultivars have been derived from crosses between species. The most important group is from crosses between *V. vinifera* and *V. labrusca*. These French-American hybrids produce good wines yet are much hardier than the *V. vinifera* parent.

Baco Noir and De Chaunac are very vigorous red wine grape hybrids, but they require cluster thinning to keep plants from producing too much fruit and weakening the vines. Aurore is one of the best white-wine grape hybrids for consistency of production, but the berries tend to split. Seyval, Vidal, and Cayuga (white), Marechal Foch (black), Cascade (blue), and Chancellor (red) are all excellent wine grape hybrids. Horizon is a high-yielding cultivar that produces neutral white blending wine grapes, and it is relatively free of defects that affect its culture or use for wine.

Seedless grapes for fresh consumption can be grown throughout the country, but the cultural practices used to grow them are different from those for the other three groups. See "Seedless Table Grapes," page 52.

For more information on cultivar selection, see "Wine and Juice Grape Varieties for Cool Climates" at www.nysaes.cornell.edu/hort/faculty/reisch/bulletin/wine/index.html.

Purchasing or Propagating Vines

Purchase grapevines from a reputable nursery. Place orders early to ensure that the desired cultivars will be available. Request that the grapevines arrive in early spring, and plant as soon as possible after they arrive.

An alternative to purchasing vines is to propagate vines from cuttings of a known variety. (It is illegal to propagate vines that are patented.) Making your own cuttings is inexpensive, requires no special equipment, and is usually successful. Most grape cultivars root readily from dormant hardwood cuttings.

First, choose healthy plants of moderate vigor growing in sunny areas to supply cutting stock. Take cuttings (no more than one or two per plant) anytime from late fall after the leaves have dropped to early spring before

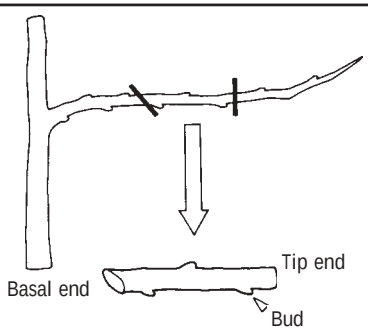

Figure 15. You can propagate your own grape vines by making cuttings from dormant one-year-old canes.

buds swell. Select one-year-old canes that are 1/4 to 1/3 inch in diameter (see Figure 15).

Cut the bottom of the cane at a 45 degree angle just below a bud or node, and make an upper cut 1 inch above a bud. Each cutting should have about three buds. Place cuttings in damp peat moss, seal in a plastic bag, and store at 30 to 40 degrees F in a root cellar, refrigerator, or hole in the ground until the spring. If stored in the ground, place mulch over the top to maintain uniformly cold temperatures.

When planting in the spring, be sure to position the end of the cutting that was closest to the trunk in the ground and the end of the cutting that was nearest the tip above ground. If planted in well-prepared soil, roots will form from the bottom of the cutting.

Site Selection

A favorable site and climate is essential for successful grape growing. Specific requirements include

- full sun.
- good air drainage.
- a 150-day frost-free growing season.
- minimum winter temperatures above –25 degrees F (USDA Hardiness Zone 4b or warmer).
- 2,000 growing degree days above 50 degrees F (see www.hort.cornell.edu/gardening/weather/ for more information on growing degree days).
- soil that is neither excessively wet nor droughty.

Grapes tolerate a wider variety of soils than most other fruits.

Southern slopes or exposures protected by buildings or windbreaks are preferable to northern slopes and low ground, which tend to be cooler throughout the growing season and delay fruit ripening. Grapes tolerate a wide range of soil types and are not as sensitive to extremes in drainage as other fruit crops. Still, they are most successfully grown on deep, well-drained sandy loams.

It's important to choose cultivars that are well-matched to your site. You can grow grapes just about anywhere in New York, but not all varieties will survive (much less thrive) in every location. If you are in Zone 4 or Zone 5, be sure to carefully check nursery catalog information about hardiness. Cultivars vary in their susceptibility to winter injury. Temperatures below –15 degrees F can cause winter injury to all but the hardiest cultivars (see Table 4).

Table 4. Choose grape varieties that won't suffer winter injury in your area.

Low Winter Temperature (USDA Hardiness Zone)	*Suitable Varieties*
0°F (Zone 7a)	Almost any
-5°F (Zone 6b)	Most northern vinifera
-10°F (Zone 6a)	Hardy vinifera and moderately hardy hybrids
-15°F (Zone 5b)	Hardy hybrids and most American varieties
<-15°F (Zone 5a and colder)	Hardy American varieties

Planting and Early Care

Prepare the soil and adjust pH and nutrient levels as indicated by a soil test the season before planting (see "Before You Begin," page 1). Plant purchased vines in spring as soon as the soil can be worked. Space vines a minimum of 8 feet apart both within and between rows, digging a hole large enough to spread out roots sufficiently.

Stake canes at planting. They won't grow straight without support.

After trimming away broken or excessively long roots, lay out the root system in the hole and cover completely with soil. Planting depth should be the same as in the nursery, usually about 2 to 3 inches above the root level. Remove all but the best single cane and tie it to a stake or the bottom wire of a trellis to hold it erect. This cane will become the trunk. It won't grow straight without support.

After several weeks, buds should begin to grow. When the new shoots are about 10 inches long, remove all but the strongest as well as any other shoots that arise from the trunk. Also remove any flower clusters or side shoots as the single cane grows.

Fertilizing

Use no fertilizer the first year. In following years, apply 10-10-10 around the vines in early spring before growth begins:

Year 2: 2 ounces per vine

Year 3: 4 ounces per vine

Year 4: 8 ounces per vine

Year 5 and after: 16 ounces per vine

Commercial grape growers usually test the soil and conduct leaf analyses at least every three years to detect nutrient deficiencies or imbalances.

Pruning and Training Young Vines

Grapes will grow on just about anything. In the wild, they climb large trees to get their leaves into the sun. But in home plantings, you need to rein in that vigor by pruning and training the plants to keep them manageable and productive.

You can train grapes to grow on an existing arbor, fence, or other structure. If you are starting from scratch, a good trellising method is the four-arm Kniffin system (see Figures 16 and 17). No matter what system you use to support your vines, the principles are the same. There are several things to keep in mind:

- You don't want the vines to become overgrown. You should have only one or two layers of leaves during the growing season.
- Typically, you should remove 90 percent of the new growth during dormant-season pruning.
- Grapes bear fruit from buds on one-year-old wood that elongate into new shoots.

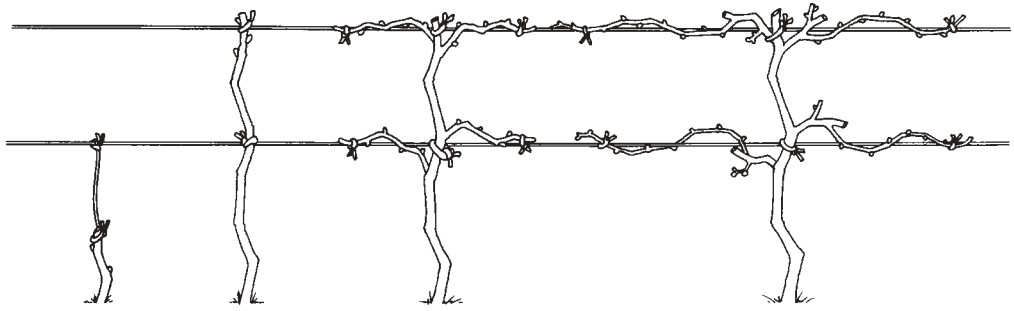

Figure 16. Stages of training a vine to the four-arm Kniffen system on a two-wire trellis

The four-arm Kniffin system uses a trellis made by stringing two lines of galvanized wire (size 9, 10, or 11) or monofilament between durable wooden trellis posts set about 24 feet apart. The top wire of the trellis should be about 6 feet high and the lower wire about 3 feet high.

During the first year, follow the recommendations for planting and fertilization given previously. If the cane does not reach the top trellis wire in the first year, train it to grow as a single cane the following year until it reaches the top wire.

In early spring of the second year, tie the cane to the top trellis wire and cut it off just above the wire. Leave four to six buds in the vicinity of each wire and remove the rest. As new shoots begin to grow from the remaining buds, remove any flower clusters that form.

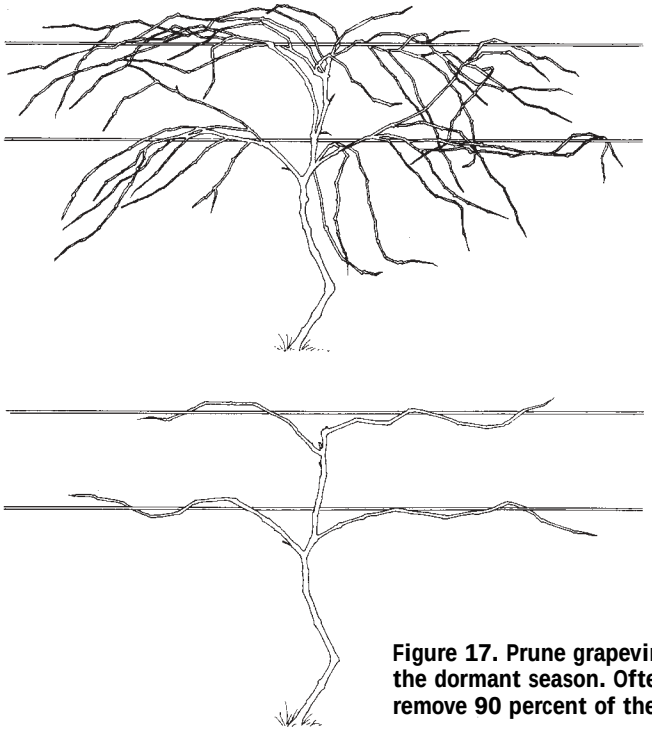

Figure 17. Prune grapevines hard during the dormant season. Often, you need to remove 90 percent of the new growth.

In early spring of the third year before growth starts, select four canes near the top wire and four canes near the bottom wire. Remove the rest. Tie one cane going in each direction on both wires. Allow these four arms to fruit up to the sixth bud along the arm. Cut the other four canes back to a stub containing two buds. These stubs are the "renewal spurs," which will produce fruiting canes next season.

Pruning Mature Vines

In early spring, remove the fruiting canes from the previous year. Tie one of the two canes from the renewal spur to the trellis wire and cut after the 10th bud. Cut the remaining cane to two buds for next year's renewal spur.

Continue this pattern of choosing fruiting canes and renewal spurs each season, adjusting the number of buds on each fruiting arm. Too many buds results in poor fruit quality and vegetative growth. A shortage of buds reduces the crop.

Grape buds vary greatly in fruitfulness. The most productive buds form at the top of the trellis where the shoots of the previous season were exposed to the most light. The distance between leaves should be about 6 inches, and the diameter of the cane between the leaves should be 1/4 inch or more.

Pruning Neglected Vines

Renew old neglected vines in stages. In the first year, limit the vine to a few new canes originating as close to the trunk as possible, and remove all fruit clusters from the new canes. Do not remove the old canes at this time.

Select one vigorous cane originating from the root or low on the trunk and tie it to the wires of the trellis to form a new trunk. Treat this sprout as a young vine, training it to the four-arm Kniffin system. Remove the old trunk after one year.

Training Vines to an Arbor

You can grow grapevines on arbors to furnish shade as well as fruit. Follow the same principles for pruning, modified to match your vines to the size of the arbor.

Trained to an arbor, grapes provide shade as well as fruit.

The primary differences between trellis training and training vines to an arbor are in the amount of old wood left, the number of buds retained, and the distribution of the fruiting canes. Keep more fruiting canes and spurs, and consequently more buds, than you would on a vine confined to less space.

Allow the trunk to grow longer on taller arbors. Train short permanent arms originating from the trunk so the foliage will cover the arbor to the best advantage. For best results, prune arbor vines annually.

Diseases and Insects

Insect and disease problems can be reduced by planting vines in a sunny location with good air drainage. Troubles can still occur even when following proper growing practices in an ideal location. Weather conditions, winter hardiness of the cultivar, infection from the previous year, history of pesticide use, surrounding vegetation, and insect life cycles all influence a cultivar's susceptibility to insects and diseases for a particular year.

Below are the insects and diseases that you are most likely to encounter:

Powdery mildew. This fungus can infect all green tissues of the grapevine. It appears as a white or grayish white powdery covering on the upper and lower surfaces of the leaves and fruit. Leaves infected while they expand become distorted and stunted. When green shoots are infected, the fungus appears dark brown to black and remains as brown patches on the surface of dormant canes. Cluster infection before or shortly after bloom can result in poor fruit set and considerable crop loss.

Fruits are susceptible to powdery mildew as well. If grapes are infected when they are pea size or larger, their skin stops growing but the pulp continues to expand and the berry splits. When attacked as they begin to ripen, purple

or red cultivars fail to color properly and look blotchy at harvest. High relative humidity promotes infection. Infected shoots should be pruned and destroyed. Good winter pruning increases air circulation and reduces the chances of heavy infection.

Susceptible cultivars include Aurore, Chancellor, Chardonnay, Delaware, Einset, Niagara, Riesling, and Cabernet Sauvignon. Less susceptible cultivars include Canadice, Cayuga, Ives, and Steuben.

Black rot. This fungal disease can cause complete crop loss in warm, humid climates. All green tissues can be infected. Leaves are susceptible for about one week after they unfold. When infected, they develop brown circular lesions, and within a few days black spherical spore-producing bodies form within the lesions. Leaf stem infection causes the leaves to wilt. Shoots display large, black elliptical lesions, weakening them and making them easily broken by wind. Berries are susceptible from bloom until they begin to ripen, and fruit infection can result in substantial loss. An infected berry first appears light brown, and then black spore-producing bodies develop on its surface. Later, the berries shrivel and turn hard and black to become so-called mummies.

Warm, humid, or wet weather encourages the spread of black rot. Preventive measures include proper site selection and row orientation to maximize good air drainage. Proper pruning, to open up the canopy to improve air circulation and spray coverage, and spring cultivation of mummies are also beneficial. American cultivars and their hybrids vary widely in their susceptibility to disease. Susceptible cultivars include Concord, Dutchess, Niagara, Riesling, Seyval, Aurore, Catawba, Canadice, and Cabernet Sauvignon. Less susceptible cultivars include Cayuga, Chancellor, Elvira, Foch, Fredonia, Ives, and Remaily.

Downy mildew. This fungus can infect all green, actively growing parts of the vine. Leaves develop yellowish green lesions on their upper surfaces 7 to 12 days after infection. As lesions expand, the affected areas become brown, withered, or mottled. A white "downy" fungus grows on the lower leaf surface within the borders of the lesion. Severely infected leaves curl and drop from the vine. The disease attacks older leaves in late summer and autumn, producing a mosaic of small, angular yellow to red-brown spots on the upper leaf surface. When young shoots, leaf stems, tendrils, or cluster stems are infected, they frequently become distorted, thickened, or curled with a white downy appearance. Eventually, severely infected portions wither, turn brown, and die. Infected green grapes turn light brown to purple, shrivel, and detach easily. White cottony spores are abundant on these berries during humid weather.

In general, Catawba, Chancellor, Chardonnay, Delaware, Fredonia, Ives, Niagara, White Riesling, and Rougeon are susceptible to downy mildew. Canadice, Cascade, Concord, Himrod, Remaily, and Steuben are less sus-

ceptible. Watch for this disease in warm, humid weather, and follow the cultural practices recommended for controlling black rot.

Botrytis. This fungus causes blight infection and bunch rot of grapes. Blight infection begins on the leaves as a dull green spot (commonly surrounding a vein) that rapidly becomes a brown, withered lesion. The fungus also causes blossom blight or shoot blight, resulting in significant crop losses if not controlled. It can grow on dead blossom parts in the cluster and then, before grapes begin to ripen, move from berry to berry within the bunch, initiating the early development of sour rot. Botrytis occurs most commonly on ripening berries, where infection and rot spread rapidly throughout the clusters. The berries of white cultivars become brown and shriveled, and those of purple cultivars develop a reddish color. Under proper weather conditions, the fungus produces a fluffy, grayish brown growth.

The fungus readily colonizes tissue injured by hail, wind, birds, or insects. Fog or dew and temperatures of about 60 to 80 degrees F are ideal for spore production. Rainfall is not required for disease development. Again, good cultural practices assist in controlling this disease. Aurore, Chardonnay, Elvira, and Riesling are susceptible cultivars.

Japanese beetles. Most gardeners will experience Japanese beetle damage on grapevines nearly every year. Fortunately, vines can tolerate a large amount of feeding before fruit quality or yields are reduced. But if populations are high enough, beetles can defoliate a grapevine in just a few days. Check vines daily once beetles appear. Most gardeners either pick the beetles off the vines and kill them or treat the vines with an insecticide.

Grape berry moth. Not frequently a problem, these small, inconspicuous brown moths lay eggs singly on buds, stems, or newly formed berries in early spring. Later, the moth usually deposits eggs directly on the grapes. The newly hatched larvae feed on tender stems, blossom buds, and berries, often inside protective silk webbings that can surround the entire cluster. When grapes are about 1/8 inch in diameter, the larvae burrow into them, creating sites for infection by fungi and attack by fruit flies. Infestations vary greatly from year to year and even within a vineyard.

With light infestations, remove injured berries by hand and destroy them (do not discard them on the ground because insects may continue to develop). You can control the moths somewhat by gathering the infected leaves in the fall and destroying them.

Grape cane girdler. Adults are small, shiny black weevils. In May the female hollows out a small cavity in a shoot and deposits a single egg into it. She then girdles the cane just below and several inches above the egg cavity. The shoot either breaks off at the girdled point or dies back to the first node below the egg cavity and drops to the ground. The girdling by the female causes the terminal growth of new shoots to bend over above the upper

girdle and blacken, shrivel, and drop to the ground. Later the whole infested shoot dies back to the lower girdle and falls from the vine. Vines "pruned" by the grape cane girdler have a ragged appearance, suggesting serious injury to the plant. But the actual damage is usually minor. Girdling of the terminal growth has little or no effect on the crop unless fruit-producing nodes are close to the attacked shoot tips

Grape leafhoppers. Populations of these insects fluctuate widely from place to place and year to year. Adults begin feeding in May on grapes and other plants such as strawberries, raspberries, and several woody plants. In June, they lay eggs singly, just beneath the underside of the leaf, producing a slight blister. Nymphs appear in late June and reach the adult stage by late July. Adults and immature leafhoppers feed on the undersides of leaves, sucking out the leaves' juices. Feeding is limited initially to the lower leaves. The tissue surrounding the feeding puncture turns pale white and eventually dies. Plant injury shows up first along the veins, but later the whole leaf is affected. Heavy feeding by leafhoppers causes premature leaf drop and lowered sugar content, increased acidity, and poor fruit color. Ripening fruit is often smutted or stained by the sticky excrement of the leafhoppers.

Cold, wet weather in the spring and fall decreases leafhopper populations, as do wet winters. Fall cultivation and cleaning up adjacent weedy land eliminate favorable overwintering sites in and near a vineyard.

Harvest

Pick grapes only after they are fully ripe, about a week after they reach full size and color.

Harvest grapes only after they are fully ripe. The sugar content of grapes does not increase after they are picked. Often grapes have good size and color one week before the sugar content is sufficiently high. After the sugar content has peaked, quality deteriorates rapidly.

Yields depend on the cultivar, the weather, the vigor of the vine, and your management. By the third year, you can expect each vine to produce 5 to 10 pounds of fruit.

Grapes harvested in the best condition will store longest. Handle clusters with care and remove any discolored, injured, or undesirable berries. Cool them as soon as they are picked. Storing them in a refrigerator with the temperature set around 35 degrees F is preferable to a cellar or other cool place where temperatures fluctuate. Wrap grapes loosely in plastic material to prevent excessive moisture loss.

Seedless Table Grapes

Seedless grape cultivars suitable for the Northeast are a relatively recent development. They are more challenging to grow in home plantings than other cultivars and require different practices. While moderately hardy, they may

not perform well in colder sites. Even though they are less than perfect, their flavor far exceeds that of Thompson or Flame seedless grapes from the West Coast.

Seedless cultivars suitable for the Northeast include:

- **Canadice**—a hardy, productive, and popular vine, but berry size is small and bunch rot is often a problem.
- **Himrod**—a vigorous vine that has moderate resistance to disease, responds well to cultural practices, and produces a good white grape.
- **Einset**—a grape with excellent storage qualities, productivity, flavor, and hardiness, although some people do not like its thicker skin.
- **Vanessa and Reliance**—high-quality grapes, but with thin skins that are susceptible to cracking and diseases.

Growing top-quality seedless grapes involves many time-consuming steps. Commercial growers spray gibberellic acid and use special tools to girdle trunks or individual fruiting canes to improve berry set and increase berry size. They also increase berry size by thinning individual berries from each cluster and thinning clusters before and after bloom.

Homegrown seedless grapes are smaller but usually are more flavorful than store-bought grapes.

Home gardeners can grow seedless grapes without using all these commercial practices. The grapes will be just as flavorful but smaller than those found in the supermarket.

A common system for training seedless grapes uses cross-arms on trellis posts up to 42 inches wide. Wires in the middle of the cross-arms support fruit canes. Catch wires at the ends of the cross-arms support the shoots. The wires position the fruit for easy harvest.

Because seedless grapes tend to be large, they attract birds as well as raccoons. Diseases and insects also can cause more problems than with other varieties.