

# AGRICULTURAL GUIDE

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## Pruning and training grapevines

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The grapevine is remarkable because its vining habit can be trained in innumerable ways. Over the several thousand year history of grapevine cultivation, standard training systems have evolved in established grape-growing regions. However, new research and growers in new regions like Missouri have refined these techniques. Growers need a good understanding of the physiology of the grape plant, the differences in cultivar behavior, the characteristics of the specific soil and site, and the intended market before deciding on a training system.

### Structure and physiology of the grape vine

The grape is a perennial, vining plant. You'll need an understanding of its structure and fruiting physiology for proper pruning and training. Refer to the glossary

of terms and figures 12 and 2 for the structure of a grapevine.

#### Vine terminology

**Adventitious shoot** is a shoot from a non-primary bud. It can be found on trunks, cordons, arms, and at the base of canes. These shoots are undesirable and, except in the case of damage to primary shoots, should be removed.

**Apical** refers to the youngest (formed last) portion of a vine part, such as a shoot, cane, or cluster.

**Arms** are the major branches of the trunk on which canes or spurs are borne.

**Axil** is the area between the leaf and the stem to which it is attached.

**Basal** refers to the older (formed first) portion of a vine part, such as a shoot, cane, or cluster.

**Bud** is a compressed shoot containing primary, secondary, and tertiary shoots.

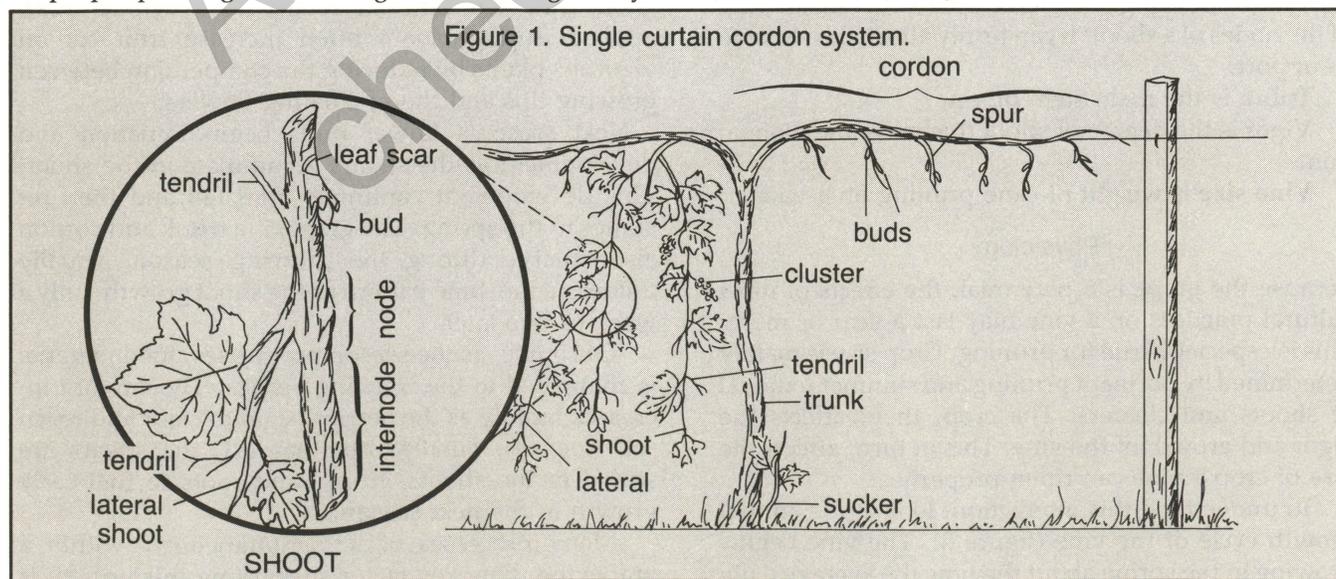
**Cane** is a mature, woody shoot after leaf fall.

**Canopy** is the entire shoot-leaf complex of the vine. It has height and width and can be undivided (single curtain) or divided (double curtain).

**Cordon** is an extension of the trunk, usually horizontal and trained along a wire. Fully developed cordons can bear spurs, shoots, and canes.

**Curtain** is a length of canopy that is shoot positioned.

**Full bloom** is the stage of flowering when the caps have fallen from approximately one-half of the florets (individual flowers) on the basal clusters of the



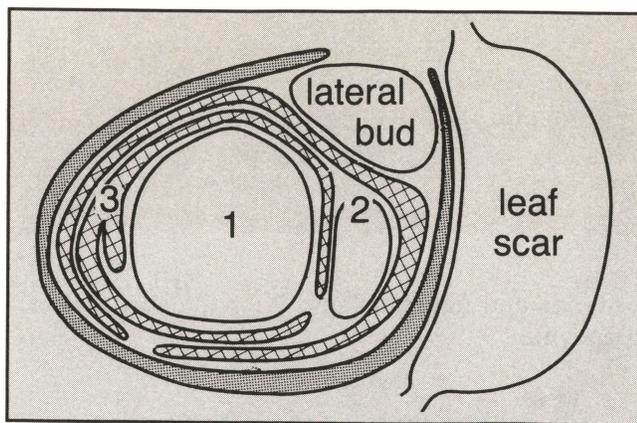


Figure 2. Cross section of a grape bud, showing the primary (1), secondary (2), and tertiary buds. (Adapted from Pratt, 1959.)

primary shoots. During warm, sunny, dry conditions, a grapevine can advance from pre-bloom to full bloom in as few as 48 hours, but usually the interval is three to seven days.

**Internode** is the portion of a cane or shoot between nodes.

**Lateral** is a branch of a shoot which may be very short or several feet long.

**Node** is the thickened part of the shoot or cane where the leaf and its bud are attached.

**Shoot** is an extension growth from a bud of a cane, spur, cordon, arm, or trunk. It bears leaves and tendrils, and in many cases, fruit.

**Shoot positioning** is the manual or mechanical moving of a growing shoot to a vertical position to increase exposure to sunlight. It is also called **combing**.

**Spur** is a cane pruned to four or fewer nodes.

**Sucker** is a shoot from a bud below ground.

**Suckering** is the removal of suckers. This term is also commonly used for the removal of unwanted adventitious shoots.

**Tendril** is a long, slender, curled structure at some of the nodes of a shoot. It can firmly attach the shoot to a support.

**Trunk** is the main stem of vine.

**Vigor** is the degree of shoot thickness and elongation.

**Vine size** is weight of cane pruning on a vine.

### Physiology

Because the grape is a perennial, the effects of most cultural practices on a vine may last a year or more. This is especially true for pruning. Crop size is mainly determined by dormant pruning and summer removal of shoots and clusters. The crop, then, affects the vigor and growth of the vine. This in turn, affects the size of crop a vine can ripen properly.

To understand this interaction, look at the annual growth cycle of the vine (figure 3). The vine begins growing in the spring about the time the average daily

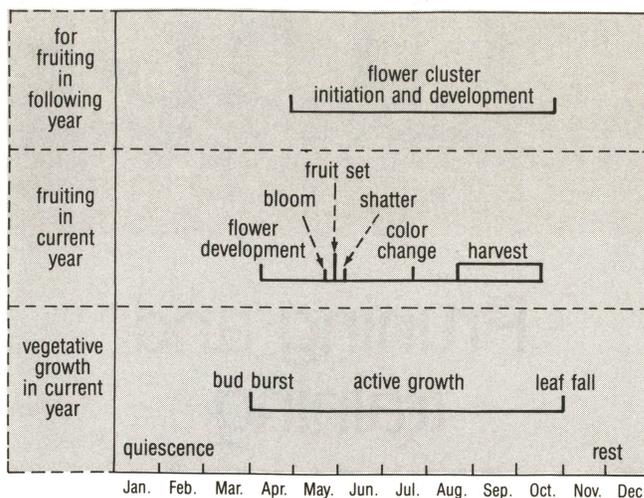


Figure 3. Annual cycle of growth in a grapevine. The three categories of events occur simultaneously.

temperature reaches 50 degrees F. The buds swell and shoot and root growth begins, slowly at first and then more rapidly. The first few weeks of shoot and root growth depend on the carbohydrates (sugars) stored during the previous season. Not until the leaves are fully expanded do they export food back to the vine.

Simultaneously with the shoot growth, the current season's flower buds rapidly reach full development. Shoot growth begins to slow down during bloom. The sugars produced by the leaves begin to be stored in the midsection of the new shoot and progress upwards and downwards during the remainder of the season.

The relative flow of sugars and the condition of the vine profoundly affect the berry set. Weak vines without much vegetative growth often set too much fruit because of the lack of competition for sugars from the growing tips. Overly vigorous plants may have a poor fruit set caused by excessive competition from the growing tips. A well-pruned plant with the proper number of growing tips and buds usually has a good fruit set. Growth retardants, such as Alar, applied during bloom often increase fruit set on vigorous plants by reducing the competition between growing tips and the pollinating flowers.

Next season's flower buds begin initiation and development as the sugars accumulate in the shoot. This development continues until fall and then resumes in the spring. The grapevine trunk and cordon also enlarge during the growing season, usually following the same pattern as the shoot growth, only a week or two later.

Of course, as the season progresses, food material is channeled to the ripening berries. The amount increases rapidly as the berries begin to color and reach full ripeness. Finally, after harvest, the sugars are stored in the shoots, trunk, and roots to fuel early growth in the next season.

Many processes occur simultaneously within a grapevine. One key factor supporting this growth is

the number of leaves exposed to light. The more leaf area exposed to sunlight, the larger the potential crop, if good fertilization, pest control, and adequate water are also present.

There is a strong relationship between vine growth and yield. The size and quality of the crop affects the quantity and quality of that year's vegetative growth and, thus, the crop potential for the following year. Overcropping the vine reduces the amount of vegetative growth because the sugars produced by the leaves must go to the ripening fruit at the expense of leaf and shoot growth. This reduction in sugars is not enough to replace the stored carbohydrates, so the vine will not be as winter hardy, will not develop as many fruitful buds, nor will it be as vigorous the next spring.

Undercropping a vine also leads to serious consequences. In this instance, the vines become overly vigorous. Leaves are large, shoot growth is excessive, and shading of the leaves usually occurs. This type of growth feeds itself, for extra sugar production goes to produce more leaves and shoots. The result is poor development of the current year's crop and the following year's fruit buds. Poor hardening off and subsequent winter damage also result.

The key to maintaining optimum vigor lies in **management**. Growers should know both the current and desired size and vigor of the vines and be aware of practices that will increase or decrease them. Growers can affect the vine's growth by controlling diseases and insects, regulating the crop, fertilizing, managing weed and sod competition, and watering.

## Training and pruning

Growers manipulate the vigor of vines by training and pruning. Training is the shaping of the vine or the arrangement of the vine on the trellis. The goals of training are

- to position annual shoot growth so that leaves receive optimum exposure to light;
- to position the fruit for ease of pest control and harvest;
- to minimize labor;
- to facilitate current pruning operations.

### Establishing the new vineyard

The first two years of training are the most important for the future success of the vineyard. A well-established plant more than likely will be capable of a reasonable yield in the third and fourth years, at least one year earlier than under the old training systems. This makes an earlier cash return possible, and that's essential in these days of high capital costs.

Most importantly, growers should purchase healthy, disease-free plants. Their cost is minimal in comparison to the cost of materials and the efforts needed to establish poor plants. A healthy, vigorous plant can be made to grow poorly through neglect, but a poor plant will never grow properly no matter how

much care you lavish upon it. Be sure to purchase plants from a reputable nursery. A list of nurseries is available from the state extension viticulturist.

Install the trellis before planting or in the first month afterwards. The top wire should be 5½ to 6 feet from the ground. Then, tie a nylon string from the top wire to a spur near the base of the new plant. Take care not to girdle the plant. A piece of stiff wire pushed into the ground and wrapped around the trellis wire also works well. When the new shoots begin growing, rub off all but the most vigorous one. This shoot is then trained up the string or wire. It is essential to keep the string taut and the shoot straight because this shoot will become the trunk. Crooked trunks get in the way of machinery and can harbor diseases and insects more easily than straight trunks.

Many hybrid grapes will produce fruit clusters on the main shoot. These **must** be removed. Allowing laterals to develop on the main shoot does not reduce the overall shoot growth. On the contrary, plants with the laterals left on have a much larger leaf area and greater subsequent carbohydrate storage than those where all the laterals are removed.

Cordon-trained vines (low wire, single curtain or double curtain) should be either bent and trained along the wire for one-directional cordons. Or they should be pinched and the subsequent lateral shoots trained along the wire, one in each direction. Wrap the shoots securely around the wire, and tie the ends to the wire. Be sure to remove all flower clusters. Kniffen or fan-trained grapes can be left to grow until pruning time. See Guide 6162, "Training Systems for Missouri Vineyards."

Once the shoots have filled the top wire, the cordon has been established. This may be accomplished on some cultivars the first year if there has been **excellent** disease and weed control and irrigation. Complete the cordon the second year if necessary. Then, follow the directions for second-year plants.

In the second year or when the cordon is complete, allow only two to three lateral shoots per foot of cordon to grow. Remove all excess shoots on the cordon and any that appear on the trunk. All flower clusters **must** be removed. Allowing fruit to set at this time weakens the vine and adversely affects future production. De-budding and cluster removal should be completed early. Remove all shoots and flower clusters that continue to appear.

The shoots that are allowed to grow must be positioned vertically downwards for the single or double curtain, or direct them upwards for the low wire system. Begin training them just when the tendrils are beginning curl, usually in early to mid-June. Growing shoots tend to grow along the wire, shading each other. Pull these shoots down either by hand or machine, gently breaking the tendrils' hold.

Some growers have devised a hand rake with widely spaced teeth for shoot positioning the vines.

### Pruning

Pruning is the major method of crop adjustment. It is also the most important, costly operation requiring the greatest skill. Pruning is the act of removing parts of a plant. Grapes must be pruned annually to reduce the number of growing points to achieve the optimum leaf/fruit ratio.

The number of growing buds determines the crop size. Fruit buds develop in the axil of each leaf (figure 1). Within each bud are primary, secondary, and tertiary buds (figure 2). The primary bud has two to three fruit clusters in American grapes, such as Concord, Catawba, Niagara, and Delaware. The secondary and tertiary buds have very few developed flowers. Normally, these secondary and tertiary buds will not grow unless the primary bud is damaged.

The French-American hybrid grapes, such as Seyval, Vidal, Chancellor, and DeChaunac, are different. With these varieties, the secondary and often the tertiary buds have developed flowers. These buds grow under normal conditions. Thus, if the grower leaves 20 buds on a Chancellor plant, it is likely that 40 to 60 fruiting shoots will develop. These extra shoots must be removed. (See "Bud Thinning.")

The weight of the pruning wood is an indication of the vine size and vine growth. Research in New York has shown that there is an optimum weight of cane prunings per foot of canopy:

- low vigor: 0.2 pounds per foot or less;
- optimum vigor: 0.3-0.4 pound per foot;
- high vigor: 0.5 pound per foot; and
- excessive vigor: more than 0.5 pound per foot.

Another indication of vigor is the amount of trellis covered by one to one and one-half layers of leaves at harvest time. The optimum is 85 to 90 percent of the trellis filled.

### When to prune

Prune grapes throughout the dormant period, from the first hard freeze of the fall until bud break.

However, vines pruned early are more likely to suffer cold damage than those pruned in February or later. The acreage of grapes to be pruned determines how early to start. It takes an experienced pruner about 25 to 30 hours to prune one acre of grapes. Since varieties differ in hardiness, prune the hardiest grapes first and the most tender last. Even though some plants may *bleed* profusely when pruned in the spring, research has not shown this to be damaging. Leave extra buds on vines pruned early to protect them from winter damage.

### Choosing good wood

Choosing buds to leave when pruning is very important. Buds differ greatly in their fruitfulness. It is wiser to leave good buds or canes wherever they are located than to leave poor buds or canes in a good location.

Buds on canes exposed to sunlight during the growing season are the most fruitful. Dark colored canes with short internode lengths are indications of superior light exposure. Choose the largest, best developed canes. Large canes with light color and long internodes were probably shaded and should not be left.

### Training systems

This guide sheet does not include an exhaustive list of training systems, only those most adaptable to Missouri conditions. (The advantages and disadvantages listed for each system do not necessarily carry the same weight.)

## Summary

It is essential to understand the physiology of grapevines to manage them properly. Once growers understand the factors affecting vine growth, they are better able to choose the correct training system. See Guide 6162 for explanations and evaluations of five training systems for use in Missouri vineyards.