

GRAPE GROWING IN COLORADO

By GEORGE BEACH



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Several facts have prevented successful grape growing as a commercial venture in Colorado. First of all, though wild grapes are native to the state, as they are all over the United States, Colorado does not lie within or even near any of the great commercial grape-growing regions. Nearly 75 percent of the grape vines in the United States are in California, and these are chiefly European grapes. Colorado cannot compete in this field. The nearest American grape-growing region is the West-Central section, where less than 5 percent of the vines (mostly Concord) of the United States are grown in Iowa, Nebraska, Kansas, Illinois, Missouri, and Arkansas.

Much of the demand for American grapes is satisfied by the crop of Concord that comes into Colorado a few weeks before local grapes are ripe. Large quantities of this fruit are used for home canning. Buyers will wait, however, for the local crop, as they do for strawberries and raspberries, if there is any advantage in doing so.

If, therefore, experience with the home vineyard indicates that commercial production here could equal or better the quality and price of the West-Central competition, then commercial planting should be profitable.

There are two classes of grapes—American and European. American grapes are used mainly for the fresh fruit, for preserving, and in the manufacture of unfermented juice. European grapes are raisin and wine grapes. A large quantity of the fresh fruit is used also for table grapes.

It cost the early Americans many years of painful effort and great expense to learn that European grapes could not be grown successfully in eastern America. Meanwhile the Spanish padres were successful with European grapes on the Pacific Slope. The Continental Divide puts Colorado on the edges of both eastern America and the Pacific Slope.

Practically all Colorado's grapes come from 10 of our warmer counties, as follows:

County	Pounds Harvested
Mesa	268,000
Delta	155,000
Garfield	96,000
Crowley	92,000
Otero	76,000
Montezuma	71,000
Fremont	57,000
Montrose	50,000

Boulder	36,000
Jefferson	33,000

(Total in 1929)..... 934,000 pounds

Figures taken to nearest thousand from 1930 census. An 8-year average of yearbook figures makes the annual total about three-quarters of a million pounds.

Most of Colorado's grapes are the American type. European grapes are grown in a small way on the western slope of Colorado, but even there they require special care and winter protection.

Grapes are normally long-lived. In congenial growing conditions they often outlive the men who plant them. When set 8 by 10 feet, a perfect stand averaging 15 pounds of fruit per vine will produce about 4 tons to the acre. Average annual production from mature plants of 1 to 2 tons per acre is poor to fair, and not a very profitable yield. Two to three tons is fair; 3 to 4 tons is often required to produce a profit; 4 to 6 tons are obtained by the better growers with the high-yielding varieties such as Concord.

Propagation

Few growers can afford to propagate grapes at the prevailing prices of first-class nursery-grown stock. One should know the methods used, however, to enable him to handle the plants in an understanding way.

Cuttings.—Most American varieties are propagated from hardwood cuttings of young, lead-pencil-sized wood about 8 to 12 inches long. Such cuttings are usually made from prunings. They are stored in sand, sawdust, or soil moist enough to prevent drying; they are kept in a cool cellar until spring, when they are planted about 3 inches apart in nursery rows, the cuttings standing vertically with only the top bud uncovered.

Graftings.—Many European varieties are propagated by grafting them on American roots. There are a number of reasons for grafting grapes. Some American varieties are grafted, but the chief reason for using this method is to give European grapes protection from a root-louse called phylloxera, which does little or no damage to American grapes.

Grafting has increased yields and quality in some cases but still is mainly a necessary evil practiced only in propagating varieties that do poorly on their own roots.

Layering.—Layering is a method useful for filling vacancies in an established vineyard. A cane of current season's growth is led

to the spot where a new plant is desired, and the end of the cane, except its last 2 or 3 buds, is buried 6 to 8 inches deep. Or the same kind of cane arising near the ground can be carried underground to the desired place and all new growth kept off except the new plant, which starts at the end of the cane so buried. (fig. 5.) Such a plant may be left attached to the parent for 2 or 3 years, thus enabling it to become established more quickly than is possible by other means of propagation.

A long cane left attached to the parent and buried a few inches deep, as described in the preceding paragraph, will give rise to several smaller new plants if no attempt is made to keep them from forming. These may later be separated and transplanted. This system of layering is used only commercially and with certain varieties, such as the Summer grape of the South, that are difficult to propagate by other means.

Where To Grow Grapes

Ideal grape soil is deep, well drained, porous, and warm. Gravelly clays or sandy and gravelly loams that are moderately fertile are preferable to clays or fine, sandy soils. All the most important commercial grape-growing sections of this country are near large bodies of water, such sites providing three important things: (1) Air circulation, as in-shore and off-shore breezes are usually blowing; (2) air drainage, which drains off frosty air; (3) even temperatures, as air temperatures change less rapidly near large bodies of water. Nearness to water is not absolutely essential, but the things that make it desirable should be kept in mind in choosing a site elsewhere.

Preparation of Soil.—Since a vineyard is likely to outlive the planter, it goes without saying that preparation of soil before planting should be especially thorough. The land chosen for a vineyard should have been in a cultivated crop at least 1 year. Well-rotted manure and a green manure crop, too, if possible, should be plowed under, and the field should be both fall- and spring-plowed. When vines are planted, the whole field should be in the same condition that a careful planter likes to have the soil he fills in around the roots.

Planting.—No. 1 is the best grade of plants, and 1-year-old plants usually are the best age. Nurseries catalog these as "one-year No. 1". Eight feet between rows is space enough in the home vineyard, but 10 feet is better if more than a few vines are grown. With 8 feet between vines in rows 10 feet apart, 545 plants are required to plant an acre.

Keep plants moist and cool until planted, and before planting cut off all broken roots and all those over a foot long, as well as

removing all the top growth except the two lowest buds on the best cane.

Recommended Varieties of Grapes for General Use in Colorado.

—For a new planting in an untried location we recommend for the blue-black varieties: Moore Early, Worden, and Concord. Moore Early is the earliest ripening of these three black varieties; Worden is next, and Concord is latest of the three. Worden is the best quality of the three but is more particular about soil than the Concord, which is next best of the three in quality. Niagara is a green grape, slightly less hardy than Concord, and is often called "green Concord". At elevations of about 5,000 feet where congenial soil can be found, these four will usually succeed. Beta is a still hardier grape to use where these varieties seem doubtful, although its fruit is small and lacks quality.

New Varieties.—A number of new varieties have been introduced in recent years, and many fairly hardy older ones have never been extensively planted in Colorado. To determine the merits of these varieties for average Colorado conditions, the Department of Horticulture, Colorado Experiment Station, has started a variety test at Fort Collins of over 40 varieties, including the previously recommended varieties for comparison.

The College Fruit Farm at Austin has grown European varieties for many years and does not recommend them elsewhere in the state.

Following are names of varieties tested at the College Fruit Farm at Austin:

American:

Eclipse	Sheridan
Campbell Early	Caco
Niagara	Dunkirk
Brighton	Golden Muscat
*Catawba	Kenka
Concord	Fredonia

European:

*Flame Tokay	Dizmar
Thompson Seedless	Maraville de Malaga
Black Mavoise	Ribier
Black Hamburg	Muscat of Alexandria

At the Rocky Ford Substation, although they have been growing only 3 years, European varieties thus far show much less promise than the American varieties. Varieties tested at the Rocky Ford Substation include all the above and the following American varieties in addition:

*Wine grapes. Many of the others are also used alone or blended, in making wine. Concord is the variety most widely used for unfermented juice.

Brocton
*Champagne
Fredonia

Portland
Ontario
Lucile

Delaware

Planted at Fort Collins, 1935:

Agawan	Hubbard
Bacchus	Ives
Barry	King
Beta	Lindley
Brighton	Lucile
Caco	Lutie
Campbell Early	Moore Early
*Catawba	Moyer
*Champagne	Niagara
Champion	Ontario
Clinton	Pocklington
Concord	Portland
Daisy	Regal
*Delaware	Salem
Diamond	Sheridan
Eaton	Urbana
Elvira	Vergennes
Fredonia	Wilder
Gaertner	Winchell
Goethe	Worden
Herbert	Wyoming

Fruitfulness

Most of the named varieties of grapes are self-fruitful, but there are a few that require other varieties to be interplanted with them to insure a full set of fruit. Catalogs mention the fact in describing such varieties and recommend interplanting with such strong pollenizers as Concord and Niagara.

One can tell whether a vine is self-fruitful or not by inspection of the flowers. The stamens of practically all self-fruitful grapes are upright and as long or longer than the pistil. Self-unfruitful vines have short, reflexed, or deformed stamens.

If all else goes well, grapes will of course bear fruit without pruning. But more vine growth than is needed, and less fruit than is profitable, are likely to be the result.

Fundamentally, the pruning of grapes is simple, but instructions to beginners are endlessly complicated by "systems", "types", and "methods", all of which strive for a common purpose: namely, so to balance the vine as to assure moderately large crops of good-quality fruit every year.

*Wine grapes. Many of the others are also used alone or blended in making wine. Concord is the variety most widely used for unfermented juice.

Uncared-for vines may produce a bumper crop of poorly ripened fruit one year and a few good bunches the next. Wise pruning can change such a situation to the production of moderately large, good-quality crops every year.

Pruning Grapevines

Grapes can be pruned at any time between leaf-fall and early spring, although handling frozen vines should be avoided. "Bleeding" is a common occurrence with spring-pruned vines, even when they are pruned before leaves start. Bleeding does less harm to the vine than one would suppose, but pruning is easier and pleasanter if done before sap flow starts.

The vine should be pruned to leave only two or three buds above the ground after the **first season's** growth.

By pruning in this same manner at the end of the **second season**, vines are strengthened in the roots, and future production is better assured than when less severe pruning is given. However, if good strong second-season growth is made, no harm is done by leaving several more buds this time.

After the **third season's** growth, the method of pruning depends on the type of trellis to be used for the training.

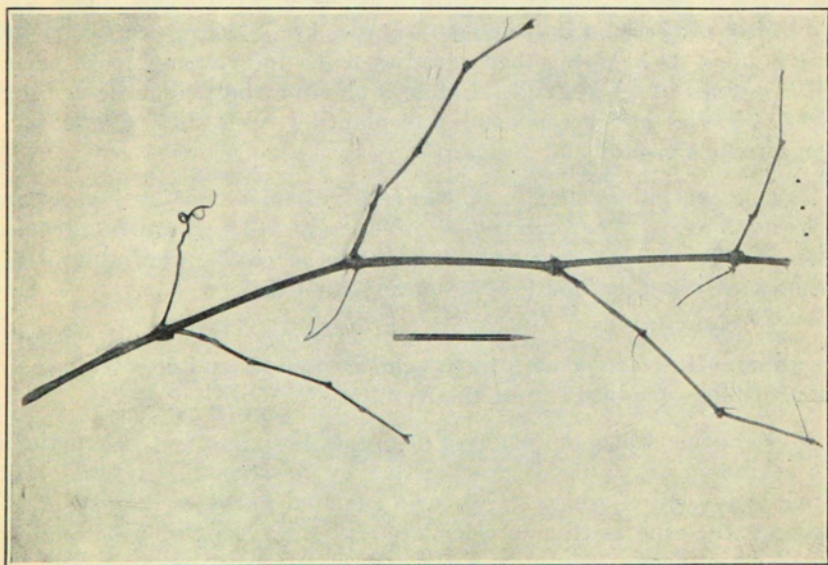


Figure 1.—The main stem shown here is a good fruiting cane. The side branches are too small. Fruit will be borne next season on the new shoots that start from the buds along this main stem.

Mature vines will support a total of from 20 to 60 buds per vine. A very vigorous vine, such as Concord, will support 60 or more buds when in its prime; a weaker grower, such as Delaware, will do better with 20.

The most fruitful parts of the vine are those in which the new wood is about the diameter of a lead pencil. (fig. 1.)

The 20 to 60 buds left after pruning should be on this kind of wood. If 40 buds are to be left after pruning, 10 may be left on each of 4 canes, or only 2 buds may be left at 20 different places. It makes no difference to the plant, though results will vary according to fruitfulness of the buds left.

The most common training system is called the 4-cane Kniffen. After pruning, a mature vine trained to this system will have a single trunk about 5 feet high (fig. 2) with 4 canes—2 on each side—tied to a wire trellis. This trellis has one wire $3\frac{1}{2}$ feet above the ground and the other 2 feet higher and directly over the first. Each upper cane will have about 12 buds and each lower one about 8, a total of 40 for the vine; or on a young vine recently trellised, about 6 on the upper and 4 on the lower wire, a total of 20.

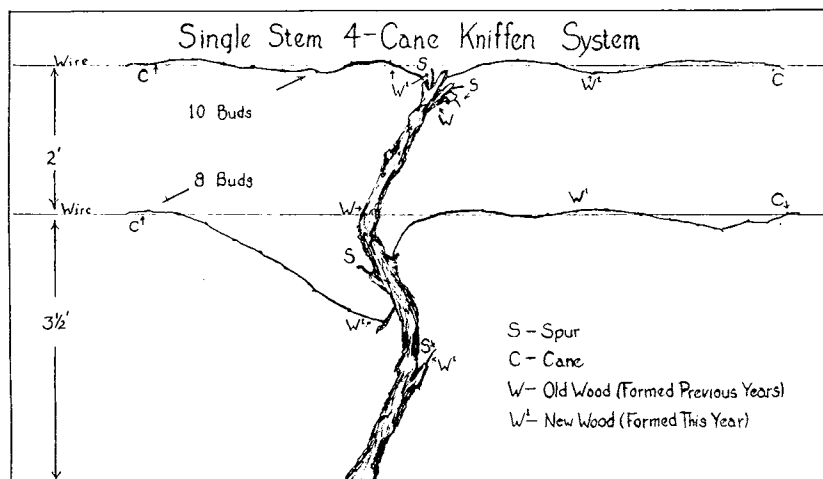


Figure 2.—The vine shown here has been pruned to remove most of the growth of the season just past. Figures 3 and 4 show about how much growth is usually cut away by such pruning.

After these have fruited once, new canes are selected to replace them. Four lead-pencil-sized canes arising as near the trunk as possible are chosen. These canes also should be as near as is convenient to the wires to which they are to be tied (fig. 2). Other growth is cut away entirely except a short 2-bud spur which is left near each

pair of side canes to provide new fruiting wood for the following year.

As the vines age, the fruiting wood gets farther and farther from the trunks, and the trunks themselves are sometimes broken or winter-killed. It is necessary, therefore, to watch constantly during pruning for strong new growths that show promise as replacements for damaged trunks, and also to watch for the gnarled spurs at the bases of the fruiting canes. A good new fruiting cane coming directly from the trunk is better than one coming from the end of



Figures 3 and 4.—Moore Early vine before and after pruning. This vine has been trained to the 4-arm Kniffen system. The lower right arm is only 2 or 3 years old. The other three arms are much older. Promising new canes arising from the trunk should be used to replace these old and many-spurred arms. (fig. 2)

a spur which has been formed by always selecting a new fruiting cane arising from the old one.

Winter Care and Trellising

Varieties recommended here (page 6) are likely to winter-kill in any but the more favored localities. To grow grapes elsewhere in Colorado than in the 10 counties mentioned on (pages 3, 4), and even at the higher elevations in these 10, vines should be laid on the ground and covered with soil in winter. Trunks should be renewed more often, or several trunks should be kept per vine, to reduce the loss due to breakage in burying and raising them.

A method of training often used where winter-killing is an important factor is called the fan system. (fig. 5.) Three or four new canes of desirable size coming from or near the ground are selected each year and cut back to leave the total number of buds desirable for the vine according to its age and condition. All other growth is cut away. These 3 or 4 canes, then, are all there is left to cover; no trunks, or only short, temporary trunks, ever are allowed to develop.

Pruning should be delayed in the fall as long as possible, since the first hard freezes will kill and shrivel the poorly-matured growths, enabling the pruner to pick the best wood to save.

Instead of a permanent wire trellis, some growers using this or a similar system use a 3- or 4-foot square frame with 3-foot legs at the corners. (fig. 6). Vines are trained over the frame to keep the

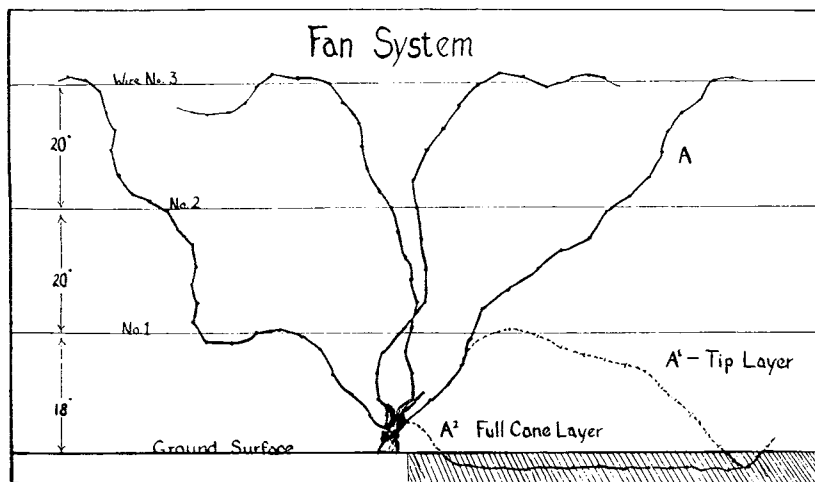


Figure 5.—A1 and A2 are positions in which cane A may be fastened for propagation. Where a longer cane is available, it can be led to an adjoining vacancy, propagating the new plant where it is to remain.

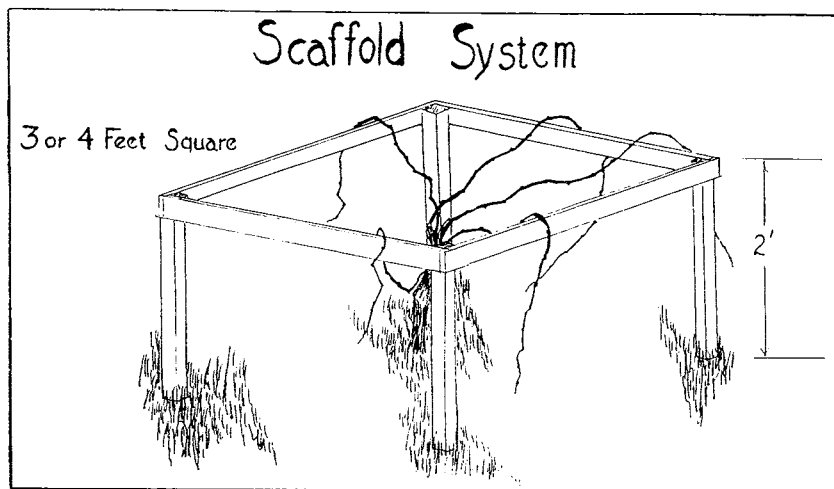


Figure 6.—A mature vine would have longer and larger canes, or greater numbers than shown here. Being portable, this trellis somewhat facilitates covering.

fruit off the ground. Such scaffolds, however, support only the fruit borne on the medium high buds, since both the low buds and those hanging over the support have their fruit on or near the ground.

When wire trellis is used, the wires are tightened each spring, and the fruiting canes and trunks are firmly tied to them before new growth starts. In the Kniffen systems, which are most used with Concord and similar vigorous varieties, new shoots are allowed to droop, and only the older wood mentioned above is tied to the trellis. For weaker-growing vines like Delaware, it is best to keep new shoots upright by tying them to the upper wires.

Selecting Wood at Pruning Time

A bearing grape vine can be compared to a pipe full of water under pressure. One or a few holes in the pipe will send out long and forceful streams, but if there are many holes, shorter and less forceful streams will result. The growth of new shoots on a vine is a similar case. If too few buds are left at pruning time, the shoots coming from these buds in spring will be too vigorous. If too many are left, the shoots will not be vigorous enough. The lead-pencil-sized wood previously mentioned, which is saved for the next year's fruiting, comes from buds producing shoots of medium vigor. These moderate-sized canes are the most fruitful wood on the vine.

Thus it is seen that the vigor of each individual vine is the determining factor in selecting new wood to save for next year's fruit.

If growth was too vigorous this season, save a few more buds at this pruning than were left a year ago. If growth lacked vigor, save fewer buds this time.

Just as pressure must be kept constant in the water pipe to avoid change in length of streams, so the rate of growth must be kept constant in the vine, or the capacity to produce shoots is changed.

Tillage

Cultivation is often recommended when grapes seem to need water. Where summer rainfall is 20 inches or more, irrigation is ordinarily unnecessary, but cultivation is necessary every season. The number of times to cultivate and the tools to use depend upon the soil and season, but ample cultivation is well rewarded. A common vineyard practice is to plow as early in the spring as possible and to use a disk or spring-tooth harrow for cultivation thereafter.

Grapes root deeply. Soil can be worked from 3 to 5 inches deep, but cultivation should be shallower, of course, close to the vines. Some growers throw a ridge "to" the vines in fall for winter protection and work it away again in spring. In years of large crops, cultivation should be continued later in the season than when the crop is small. Annual applications of 10 to 30 tons of manure per acre will be well repaid, not only in vigor of vines but in the improvement of soil structure and texture which make cultivation less laborious and more effective.

In years when a small crop is in prospect, it is wise to sow a cover crop in early August. At any rate, cultivation and irrigation should be discontinued early to prevent the late growth that so seldom matures properly. Growing a cover crop in the vineyard not only improves soil but tends to check late growth and to hasten maturity of vines. A cover crop planted during a season of good fruit yield competes with the ripening fruit and is likely to lower its quality. Clean cultivation year after year, with no fertilizer added, will soon impoverish the soil. On the other hand, well-kept vineyards are never allowed to remain in sod year after year. The cover crop should always be plowed under before the summer following the one in which it is sown.

Harvesting

The first grapes picked are those to be used for jelly. The second harvest is for table grapes and the third for juice stock.

Grapes are full sized and well-colored some time before they become fully mature. The sugar content in the fruit increases while

it hangs on the vine, but not in the picked fruit. The proper time to start picking may be determined in a number of ways: by the taste, color, aroma, changing in color of stems from green to brown, and the ease with which the berries separate from the stems. Grape shears, clippers, or knives are used to cut off the bunches.

The proper way to pack the fruit is to lay the bunches slanting in a basket, with the stems down. The fruit should never be picked when wet. Climax baskets of 2-, 4-, and 12-quart sizes are used. Most common to Colorado markets, especially for Concords, is the 4-quart size.

Pests

Insects are not of widespread importance on grapes in Colorado. If you have an insect problem, see your county agent or address an inquiry to the Department of Entomology, Colorado Experiment Station, Fort Collins.

Mildew is sometimes troublesome on grapes. It can be checked by dusting with sulfur or spraying with 4-4-50 Bordeaux.

Yellow Leaves

Yellow leaves indicate any of a number of unhealthy conditions in the vine. Heavy soils, when poorly supplied with organic matter, become hard and baked, or wet and cold, and do not drain properly. A tight subsoil, even at considerable depth, may have the same effect, since grapes root deeply. A young vine may do well for a few years and then suddenly become yellow when a number of its roots reach such an impervious layer. Conditions like these should be discovered before vines are planted, and remedied by plowing under heavy applications of manure and cover crops, and by blasting hardpan. Land that requires tile to drain it is usually undesirable for grapes. Unless the site can be put in good condition beforehand, the vineyard is likely to be short-lived, despite subsequent efforts to improve conditions.

Varieties differ in their adaptability to soils. Some, such as Concord, will do well on a wide variety of soil types. There is a difference in the depth and spread of roots of different varieties, so a soil which is ideal for one variety is not ideal for all. Sometimes a grafted plant will do well where the same variety on its own roots is a failure. Some varieties are less tolerant of chalky or calcareous soils than others. With so many possibilities of uncongenial conditions which cause unhealthy yellow leaves, it is evident that almost every case is an individual problem, and that no specific recommendation can be made that will satisfy all cases.