

Establishing a vineyard in Missouri

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Decide to establish a vineyard two years before your proposed planting date. Two years gives you time for adequate evaluation and preparation of the site, ordering plants, and finding a market for the grapes. All of these are important for a successful vineyard. In fact, failure to plan properly often has caused growers to abandon a vineyard long before its financial potential can be realized.

With proper care, a well planted vineyard should last at least 25 years. Choose the best possible site because you will have to live with that choice for the life of the vineyard.

Site

An elevated, frost-free site is the most desirable. Grapes are perennial plants that begin growing early each spring. This early growth is susceptible to spring frosts. Frosts not only set the plants back but kill the emerging flower clusters and reduce the crop. The best sites are on ridge tops or gently sloped hillsides with plenty of open land below so that cold air can drain. Placing a site 50 feet higher might add 5 degrees of warmth on a frosty night. On clear cold nights, heavier cool air flows downward, while warm air rises. Avoid poor sites such as small hollows, secondary bottoms, or forested sites. They do not allow cool air to drain. Wooded hilltops can be used if wide swaths are cut through the low areas on the hill. These swaths would provide natural air drainage pathways.

Contact your area horticulture specialist, state horticulture specialist, or state viticulturist before choosing a site. Have one of them visit the site to help you evaluate its suitability for grapes.

Soil

Soil drainage is important for grapes because their roots need oxygen from the soil to function properly. Any soil that remains waterlogged for more than a day at a time will probably not support a long-lived grape planting. Wet soils can be tile drained. But it is usually less expensive to find another site. The local Soil Conservation Service can provide maps of area soils and usually can tell whether you will have a drainage problem.

The soil depth also is important. Grapes need at least 24 inches of unobstructed soil depth to grow properly. Many Missouri soils have a compressed clay or chert layer, called a fragipan, which prevents root penetration. Naturally rocky soils do make preplant cultivation and preparation more difficult. Trickle irrigation has proven to be an economic benefit on shallow soils.

Grape vines need the proper soil fertility and alkalinity or acidity (pH) to grow well. It should be adjusted one year or more before planting. Take a soil test before preplant preparation. A good test consists of at least 10 random samples from each 10 acres or less. Use a soil probe or a shovel to take these samples. Be sure to dig below the surface ground cover, and sample at least the top 12 inches. Mix the 10 samples in a bucket or bag, then remove about one pint. Place the 1-pint sample in a paper bag or box and take it to your local extension center. Specialists will test the soil to recommend the amounts of fertilizer or lime to apply. A pH between 5.5 and 6.5 is suitable for grapes.

Applying organic matter, a cover crop, or both will improve most sites. This is especially true of those soils with less than 3 percent organic matter. Any organic matter, from manure to sawdust, will improve the physical characteristics of the soil. Organic matter makes the soil easier to work, able to absorb more water without runoff, prevents clumping and crusting, allows more soil aeration, and promotes extensive root growth. Organic matter also reduces compaction and reduces the fluctuations in soil moisture and temperature. Proper moisture and temperature promote better vine growth and make certain nutrients such as potassium, calcium and magnesium more available. These benefits are especially important during the first few years of the vineyard because the

vine is establishing its root system. That system will support the vine for the life of the vineyard.

There are two ways to prepare the soil for planting. One is for level sites. In the spring, after the soil test, broadcast the recommended amounts of lime and fertilizer on the site. Also spread the available organic matter. Be sure to add about 50 pounds of actual nitrogen for each ton of dry organic matter. These guidelines are not true for fresh manure, though, which has available nitrogen. Plow and disk the soil to work in the lime, fertilizer and organic matter. After frost dangers are past, plant a fast-growing cover crop of a sudan-sorghum hybrid such as sudex. This green manure crop should be mowed about three times during the summer. Disk the residue into the soil around the end of August or the first part of September. Use a serrated disk for best results.

If the grapes are to be planted the following spring, the permanent sod must be established in the fall. The best sod is bluegrass because it goes dormant during the heat of summer yet grows vigorously during the cool rainy spring and fall. Drill 15 pounds of bluegrass and 15 pounds of perennial rye per acre in September.

The second soil preparation method is for hilly, erosive sites or those in permanent pasture. Spread the needed lime. Then mark off your rows at whatever spacing you have decided on. Apply Roundup[®] herbicide in 3-foot bands down the center of each row. To be effective, Roundup must be applied to actively growing green plants, so the grower usually must wait until mid-May. Roundup is translocated through the whole plant, including the roots. It is excellent for removing deep-rooted perennials such as blackberry, multiflora rose, and fescue. It becomes inactive on the soil surface immediately, so new plants may be sown one week after application.

When the herbicide-treated strips turn brown (in one week or 10 days), apply the recommended fertilizer and organic matter to the strips only. Then, plow and disk the strips, and plant your cover crop as recommended above. Mow the strips through the summer, and disk them in the fall. Plant a fall cover crop in late September such as wheat or rye.

Roundup can be used as a spot spray during the summer to take care of problem weeds. It will kill grapes or any other green plant, so be sure to protect valuable plants. Read the label carefully before using it.

Trickle irrigation

A uniform supply of soil moisture is conducive to productive vineyard growth. Studies in northern Arkansas have shown that trickle irrigation can consis-

tently increase yields an average of 1 to 1½ tons per acre. Observations in Missouri have corroborated the fact that irrigated vineyards produce more and higher quality grapes year in and year out. A trickle irrigation system will pay for itself many times over during the life of the vineyard.

Plan the trickle irrigation system the year before planting. Often specialized materials must be ordered in advance. The irrigation system should be installed before planting, so the newly planted vines can be watered.

Well water is the best source for trickle irrigation because it is cleaner than surface water. However, surface water can be used if it is filtered properly. Contact your extension agricultural engineering specialist for more information. Many times a good house well that delivers 15 to 20 gallons per minute can adequately irrigate up to 5 acres of grapes by running the water only at night. Generally a minimum of 5 gallons of water are needed per plant per day.

Trickle irrigation is the most efficient means of maintaining optimum soil moisture without wetting the foliage or disturbing the soil surface. However, the correct amount of water must be applied at the right intervals to maintain the best growing conditions. Several devices on the market measure soil moisture to determine the right time to water. Tensiometers are the easiest to use and are accurate for commercial field use. Usually two tensiometers are used in each block or site. One is placed 2½ to 3 feet deep and the other at 6 inches to one foot. Apply water until the lower meter registers close to 100 percent. Water is next applied when the upper meter begins to drop below 50 percent available moisture. Be sure to use some moisture measuring device with any irrigation system.

In some areas, growers install overhead sprinkler irrigation. This system can be used to protect against spring frosts. Overhead irrigation can protect plants down to about 23 degrees F. This may be the best solution to poor air drainage on marginal sites. It may also be used for cooling during very hot summer weather.

There are several major objections to overhead sprinkler irrigation. The first is the large amount of water and the high pressure needed for good coverage. Most systems are designed to use ½ to 1 acre inch (27,500 gallons) per acre per hour. However, frost control nozzles use only 0.1 acre inch per hour. The next objection is the potential for disease on wet foliage. Finally, overhead irrigation can cause erosion and poor soil permeability. The options and final decision should be made by the grower, consulting engineer, and state extension viticulturist.

The irrigation system should be designed by a competent engineer. Call your local agricultural engineering extension specialist or the state agriculture engineering specialist at the University of Missouri-Columbia for help in properly designing the system.

Plants

Deciding which grape cultivar to plant will affect the marketability of your crop throughout the life of your vineyard. To make the best decision visit wineries, talk to other growers, and the state viticulturist to find out which grapes are being grown. The grape industry in Missouri is currently in a state of flux. Many of the standard cultivars such as Concord, Catawba, and Niagara are being replaced by French-American hybrid wine and seedless table grapes.

The cultivars to be planted depends on the intended use of the grapes: for the table, juice, or wine.

Always order plants from a reputable nursery. Consult with the state horticulture extension specialist or the state viticulture extension specialist for recommended nurseries. Many of the best nurseries sell out early. Be sure to order your plants at least one year in advance but preferably two years to insure that you will receive exactly what you want. Order one-year-old, extra heavy or one-year, number one, dormant-rooted cuttings. For the best growth, do not order culls or two-year-old plants. These do not grow as well.

Some nurseries sell potted plants. They are usually cuttings put in pots in late winter and available in mid-May. This type of plant is common in the hardwood nursery industry and has proven very successful. Since they are already growing and have a well developed root system, potted grape plants start quickly and grow fast. In many cases, they would be preferable to dormant plants. However, potted plants must be taken care of properly. They must be kept moist and cool until planting. Irrigation must be available immediately after planting to insure rapid adaptation to the field.

Be sure the nursery will deliver your plants as near as possible to the time of planting. The plants should be checked immediately upon receipt and moistened if necessary. Plants can be kept for several days in a cool, moist place. If they must be kept longer, line them out in a trench.

The roots of dormant plants and potted plants must be kept moist even while planting. Wet burlap has been used to cover the roots. Other growers keep bare, rooted plants soaking in a slurry of soil and water to keep the roots moist while planting.

Laying out the planting

If possible, plant the rows running north and south. This allows maximum exposure to the sun. However, many slopes prohibit such a row orientation. Soil erosion is a major factor on steep slopes, so rows should be planted perpendicular to the slope on erosive sites.

Row and plant spacing depends on the site. The highest yields per acre are made with very narrow rows and close plant spacing. Modern equipment has

been designed to fit easily down an 8-foot row. Many plantings go in at 9 or 10 feet to allow extra space, but this is not necessary.

Plant spacing in the row depends on the cultivar, the soil, irrigation, and the training system. Spacings in Missouri's successful vineyards range from 6 to 16 feet between plants. Generally, a closer plant spacing insures a full trellis. Yields are proportional to the amount of leaf area on the trellis. This decision should be discussed with the state extension viticulturist.

Long rows make vineyard operations most efficient. Each row should have at least 30 feet of space at the ends to allow room for equipment to turn. Short rows require a disproportionate amount of land for turning space.

There are three popular ways to mark a field. One, if rows are to be laid out along a drainage grade, the curved rows are already marked.

Two, a transit is helpful in obtaining straight parallel rows, especially if the rows are long or involve uneven land. A method of obtaining straight, equally spaced rows is to drive a long white stake at each end of an outside row of the proposed vineyard. Next, drive additional stakes to mark the rows at whatever intervals were chosen across each end of the field along lines perpendicular to the staked row.

Three, the rows may be easily marked by a homemade tractor-mounted, telescoping row marker. Use 2½ to 3-inch pipe with a cultivator shovel at the chosen row spacing. A series of low stakes is set exactly straight in the first or second row. Then, the tractor is driven down the row of stakes with the cultivator teeth marking a row on each side.

Trellis

A strong, long-lasting trellis is essential for a successful vineyard. Ancient grapevines evolved by climbing trees to get the sunlight they needed. Modern horticulturists have developed a number of ways of training the vining habit of grapes. Almost every method involves a wire trellis. Grapevines, like all plants, depend on sunlight for their growth. A good trellis allows the leaves to be exposed to sunlight. Sunlight produces healthy, hardy plants and ripe, high quality grapes.

The trellis should be established before or immediately after planting so the young grapevines may be trained correctly. The trellis should be built to last as long as the vines. It is not economical to use untreated posts or cheap materials. The labor needed to replace posts in an established vineyard usually is more than the cost of treated posts.

The standard trellis is a two-wire vertical trellis with posts set 16 to 24 feet apart, depending on vine spacing and the training system. It is about 5 to 6 feet tall with posts set at 24 feet, and with three vines between each post.

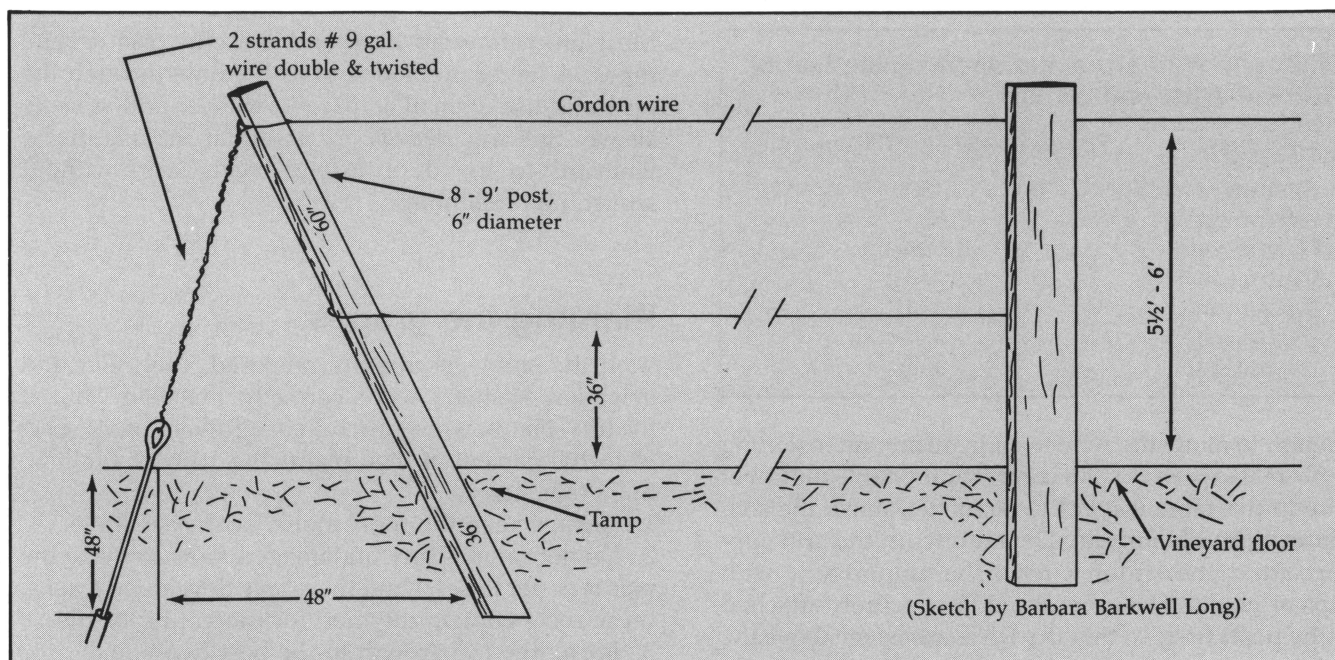


Figure 1. Specifications for a recommended end-post anchoring system.

The new single-curtain, cordon system puts the total crop weight on the top wire. With this system the posts must be set closer to prevent sagging and set 6 feet out of the ground for the best sun exposure.

Line posts should be 8 feet long. For a wooden post, the minimum top diameter should be 3 inches. They should be driven or set 2 feet into the ground for the recommended 6-foot trellis. End posts should not move when the trellis is subjected to high crop loads, wind, or wire tightening. End-posts usually measure 5 to 6 inches at the top and are set 3 feet or more into the ground. (See figure 1.) They must be properly anchored to maintain wire tension and must prevent trunk sagging. All wood posts should be commercially pressure treated with either chromated copper arsenate (CCA) or pentachlorophenol. Be sure the posts were dried properly before pressure treating. Green posts do not absorb the preservatives and will rot more quickly than dried ones. Posts treated with penta should be aged for six months after treatment. If not, the vines should not be closer than 1 foot to the posts to prevent damage.

End posts may be anchored in a variety of ways. The best is to angle the post away from the trellis and anchor it. Many types of anchors have been used successfully: a commercial, screw-in anchor; a metal plate welded to a steel shank; a concrete deadman, attached to a shank; some buried railroad ties; or old oil or gas pipeline. The commercial, screw-in type can usually be put in with an adaptor to a post hole auger. Anchors that require augering or digging should be installed in the fall and the ground allowed to settle until spring. Then, attach the guy wire or shank to the post.

Wire is the second part of a quality trellis. Most growers use number 9, black annealed wire. Many

vineyards have successfully used old telephone wire, which is sold for only a few cents a foot. This wire must be doubled in order to support the weight of the crop without stretching or breaking. Recently a new lighter weight wire has been developed in New York specifically for use in vineyards. It is a number 11, crimped, high-tensile (200,000 psi) steel wire, with class III galvanizing. Regular wire stretches with heat and crop load, then shrinks in winter, and often loosens posts. The new wire retains its tension without annual tightening. It also can support the heavy loads of the single-curtain cordon or Geneva double-curtain systems. The slightly higher price of this wire more than pays for itself with decreased maintenance costs.

Most training systems use two wires. The upper wire is for the cordon or arms of the vine, and the lower is for a training wire or for trunk and trickle irrigation tube support. The lower wire can be smaller than the upper and does not need to be crimped. Usually galvanized number 11 or 12 fence wire is used.

The amount of wire needed per acre depends on the number of rows and the type of training system. A 10-foot row spacing would need about 4,400 feet of wire for top and bottom, a 9-foot spacing about 4,900 feet, and an 8-foot spacing about 5,500 feet for each wire. The wire should be installed 6 feet above the ground. (See Table 1.)

Single-curtain cordon or the kniffen systems. On well drained soils where heaving is not a problem, staple the wire loosely to the top of the post with 1¼- to 1½-inch staples. In areas where heaving and subsequent repounding of the posts is likely, staple the wire in a groove in the top of the post or below the top on the windward side. The staples should be loose

Table 1. Wire sizes and approximate feet of wire in a 100-pound roll.

Size of wire	Approximate feet/100 pounds
12 straight	3,436
11 straight	2,632
11 crimped	2,584
10 straight	2,079
10 crimped	2,000
9 straight	1,730
8 straight	1,443

enough to allow the wire to slide during retensioning or normal expansion and contraction. Staple the lower wire in the same way, 24 to 36 inches above the soil.

Geneva double curtain. Depending on the arm support, attach the cordon wires to the support arms with clips or hooks. The arms should be securely attached to the posts first, so that the wires are 6 feet above the soil. Loosely staple the trunk-support wire to the posts just below the point of the arm attachment.

The wires must be tightened after they are strung. Most growers use rope and pulley or bumper, jack-type *come alongs*. Taut wires prevent sagging trunks and cordons, which are more likely to be damaged by equipment. Avoid applying too much tension; about 250-300 pounds is adequate.

A simple method of measuring wire tension uses only a bucket and chain. (See figure 2.) The bucket and chain should measure 6 inches less than the wire height. Figure the weight of the bucket by this formula: $Weight = \frac{2T}{L}$ where T equals the desired tension, and L equals the spacing between the posts.

For example, if the desired tension is 250 pounds and the distance between posts is 24,

$$W = 2 \frac{(250)}{24} = \frac{500}{24} = 20.8 \text{ pounds}$$

Fill the bucket to that weight (about 21 pounds). Then, hang the bucket exactly between two posts. Tighten the wires until it just lifts off the ground.

After tightening, attach the wire to the end post.

Most growers wrap it around the end post several times. A better method is to drill a hole through the post and use a small crank or a washer and splicing sleeve. Splicing sleeves are essential for use in the vineyard to mend or extend trellis wire without stretching or slipping.

Planting the grapes

If the site was properly prepared, the trellis and irrigation systems were correctly installed, and if healthy plants were purchased, growers can expect 95 to 100 percent of their plants to survive by following a few steps.

1. Always keep the roots moist, or they will die.
2. Do not remove any undamaged roots to make the plants easier to set. Until they have developed leaves, these roots contain the food for the young plants.
3. Prune the top growth to the best two buds.
4. Set all plants at least 10 inches deep, and pack the soil firmly around them.

If the trellis has not been installed, many growers cut a deep furrow down the row to plant vines by hand. Be sure to plow the furrow from the same direction each time or the rows will be different widths apart. The fastest way to plant is to use a mechanical transplanter. Sometimes used, inexpensive ones are available from nurseries, foresters, or field vegetable growers. These devices have built-in water trays to keep the roots moist. Some one should follow the transplanter and make sure the vines are properly set and tamped.

If the trellis is already installed, a shovel or a post hole auger can be used to plant grapevines. Research and practical experience have shown augering to be a poor method without using some modifications. Augers glaze the side of the hole, producing a smooth surface between the soil in the hole and the rest of the field. So the roots will tend to circle inside the hole and not penetrate this surface. The hole also will act like a flower pot in rainy weather, preventing drainage and suffocating the roots. The solution is to score the sides

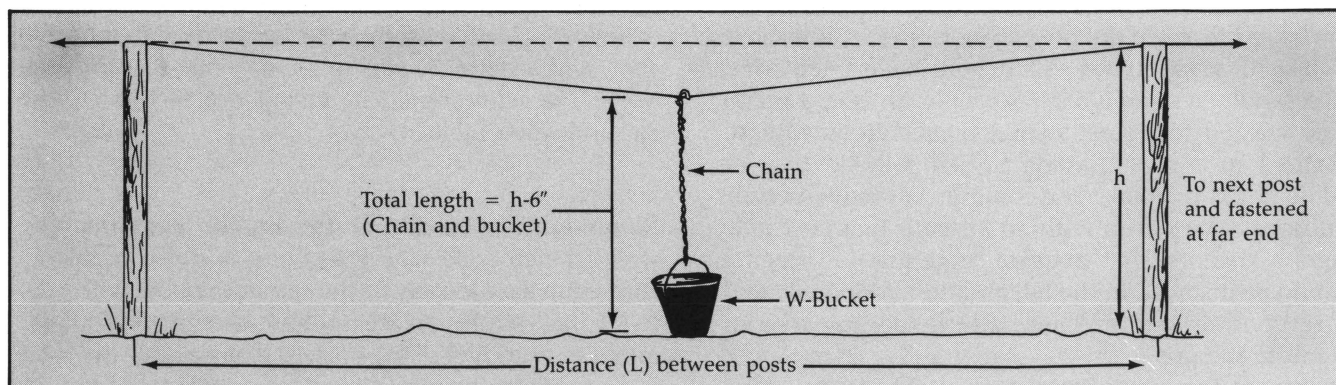
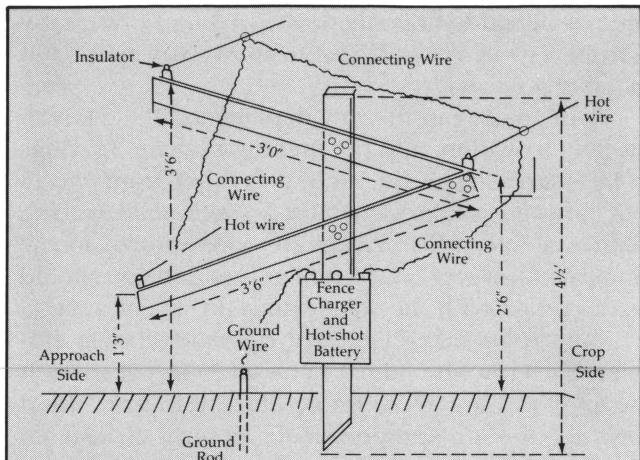


Figure 2. Use a bucket and chain to measure wire tension.



This electric fence is designed primarily for summer use. During the winter, the bottom strand of wire may become buried in snow. When this happens, shut off the electricity in this wire. If there is a permanent fence or stone wall, the electric fence should be placed 15 to 20 feet outside the permanent fence on the approach side or 25 to 30 feet inside (crop side). Weeds and grass must be cut or killed with herbicides to prevent them from touching the low wire because this will cause grounding which shuts off the electricity at that point.

Figure 3. One of the best methods of controlling deer is the electric fence.

of the hole with a pick or shovel to roughen the surface. Also, be sure to auger at a time when the soil is fairly dry, such as the fall.

The young vines must be protected, especially from weeds and deer. More young vineyards have been lost to these two pests than any other. Several

good herbicides are safe for young vines and do a good job of preventing weed growth. A heavy surface mulch will reduce weed growth and keep the soil more moist. However, it will not prevent all weed growth. Consequently, hand hoeing or herbicides must be used at the same time. Cultivation can be used on flat sites with little potential for erosion. But again, hand hoeing will be necessary.

Paper guards made of quart milk containers will prevent rabbits from chewing the trunk and allow growers to use contact herbicides near the plant for spot weed control.

Deer are a major problem in wooded areas of Missouri. The two best methods of controlling deer are electric fences (see figure 3) and repellents. Several repellents show promise. Simply spraying the vines with rotten eggs mixed with water will repel deer. Several commercial repellents have had good reports. Repellents must be used **before** deer become a problem for best results. Otherwise a deer's taste for grapes may outweigh the stench of the repellent. Second, all new growth must be covered with the repellent. This means you will have to make applications every seven to 10 days.

Diseases and insects also can be a problem. Refer to the *Missouri Commercial Grape Spray Schedule* (MP 263) for recommendations. In a young vineyard, applying the proper materials every two weeks is usually adequate.

Of the many steps to establishing a vineyard, the key is careful planning. Meet with your local and state extension personnel for help in deciding on a site and in finding the right materials. Visit other growers and ask questions; they are usually more than happy to help. A well established vineyard can be a successful financial and personal investment if properly organized and maintained.