

# Starting the Vineyard

## Purchasing Grapevines

To obtain the desired cultivars, grapevines should be ordered the season before you intend to plant the vineyard. This is especially important for new cultivars and high quality cultivars that are in high demand and bringing the best prices. Cold hardy northern cultivars are typically propagated from cuttings collected during the dormant season, planted in the nursery in the spring to root and grow, and a dug in the fall for sales the following spring. Therefore, nurserymen have a good idea how many grapevines of a cultivar they will have available for sale by mid-summer. By ordering early, your chances for obtaining what you want is greatly improved.

Dormant rooted grapevines are sold based upon their grade which is determined by the plant age in the nursery, and the amount of root and top growth present on the plants (**Table 23**). When purchasing dormant rooted grapevines, you are paying for the root system, so it is best to purchase the better grades (1-X, 1-1). These plants have greater stored reserves in their roots and will get off to a better start in the vineyard.

**Table 23.** Description of the grades use to identify the quality of dormant, rooted grapevines.

Grade	Description
1-X	Grown in the nursery for 1 year. Vines produced at least 1 foot of top and root growth with a dense root system.
1-1	Grown in the nursery for 1 year. Vines produced at least 1 foot of top and root growth.
1-2	Grown in the nursery for 1 year. Vines produced 6-12 inches of top and root growth.
1-3	Grown in the nursery for 1 year. Vines produced less than 6 inches off top and root growth. Typically replanted in the nursery and grown for another year
2-1	Grown in the nursery for 2 years. Vines produced at least 1 foot of top and root growth.

Another option is to purchase green, potted plants. These are plants propagated from cuttings collected during the dormant season and rooted in containers placed in a greenhouse to get them to root and grow sooner, and are sold that spring when it is warm enough to plant them outdoors. These plants do not have the root system of dormant rooted plants, and require special care when planted in the field. This option should only be used if it is the only way to obtain a newly released cultivar, but it may take an extra year to bring them into production.

In some cases, grapevines are propagated on a rootstock to overcome an adverse condition such as grape phylloxera tolerance for *V. vinifera* cultivars, or tolerance to high soil pH conditions. Scion material (canes of the desired cultivar) are collected in the dormant, grafted onto the rootstock during the dormant season, planted in the nursery in the spring, dug in the fall and sold the following spring. They are graded similar to dormant rooted cutting, and orders should be placed early. To overcome an adverse soil condition for a specific cultivar, it may be necessary to enter into a custom contract as early as 18 months before planting.

### Vineyard Best Management Practices – Starting the vineyard

Rate your vineyard establishment practices:

Management Area:	Best Practices	Minor Adjustments Needed	Concern Exists: Examine Practice	Needs Improvements: Prioritize Changes Here
<b>Purchasing grapevines</b>	Ordered 1-1 or 1-X grade dormant vines the season before planting.	Ordered 1-1 or 1-X grade dormant vines the winter prior to planting.	Ordered 1-2 grade dormant vines or greenhouse-rooted green plants.	Ordered grapevines a few weeks before planting.

## Soil Preparation for Planting

Ideally, soil preparation should begin at least one season before planting. This allows time to eliminate weed and grass competition, improve the soil physical characteristics and optimize its nutrient content. Collect soil samples at this time to determine suitability and if adjustments need to be made to create a soil appropriate for grapes. Your county agent or University Cooperative Extension Service can provide you with instructions and materials on how to take samples and where to send them for analysis (*See* the listing of *Soil and Plant Analysis Laboratories* in the “**Resources**” section of this publication). Soils should be tested for soil pH, organic matter (OM), phosphorous (P), potassium (K), magnesium (Mg) and zinc (Zn) as described in the *Soil Chemical Properties* section of the **Considering Growing Grapes** portion of this publication. Prior to planting, adjust the soil pH if needed and apply any required P, K and Mg and incorporate as deeply as possible (*See* section on Fertilization and Nutrition for additional information). This is a good first step in preparing your site for planting.

### Deep Tillage

The first step in preparing the new vineyard is to plow the site. If the site is in pasture or CPR, using a moldboard plow to turn under the vegetation would be appropriate. If the site is currently in annual crop production, chisel plowing would be sufficient. It is best to do this a year before planting. This allows some additional time for the sod to rot and for frost action to break up clods. In the spring, the plow furrows can be disked over. If sod exists, consider applying glyphosate (Roundup® or generic equivalent) the fall before cultivation.

On former agricultural land, a hardpan or plow pan layer is often present. If it is shallow, it can be broken up with a chisel plow. Many of our northern soils have glacial fragipans that are deeper than plow pans and a sub-soiler is needed to get down deep enough to break them up. These can often be rented on a one-time basis from your county agent. Breaking up these compacted layers allows the vine's roots to penetrate deeper into the soil, improves drainage, and makes subsoil moisture and nutrients more available to the vine. If required, subsoiling should be performed when the soil is dry. This is normally in the fall when existing crops have depleted the soil moisture. This should be done in two directions diagonal to each other with the tractor traveling as fast as possible.

Once the initial plowing, subsoiling, and disking or rototilling has been completed in the spring, the main pre-plant activity would be weed control. It is critical, that weeds be well controlled to insure a new planting gets off to a good start.

### Pre-plant Weed Control

Weed competition in new vineyard plantings can slow the establishment of the young vines and even reduce their chances of survival. Pre-plant weed control is extremely important because it eliminates weed infestations the season before the vineyard is planted. The result is an attractive, relatively weed-free environment in which the young vines can begin their growth. Both chemical and nonchemical methods of pre-plant weed control have been used with success in Minnesota. A combination of the two methods often produces the best results.

### Chemical Control

The addition of glyphosate to the list of approved herbicides for use in horticultural crops has expanded the potential for effective pre-plant weed control by chemical means. Glyphosate is a broad-spectrum, non-residual, systemic herbicide. It is taken up by the plant's foliage and translocated to the roots where it is extremely effective. When used according to label instructions, glyphosate is highly effective in eliminating most annual and perennial weeds and grass.

Proper timing of glyphosate applications is quite important. When attempting to control quackgrass, applying

## Starting the Vineyard

glyphosate in the fall allows the chemical to be absorbed into the root system as the grass enters dormancy and is highly effective. Cultivation of glyphosate-treated quack grass sod the following spring will then produce good results. Glyphosate will control young weeds that are in a phase of rapid growth. It is most effective in controlling perennial weeds when the sugars manufactured during photosynthesis are being translocated down to the roots. This begins shortly after bloom or later during the growing season. In some cases more than one application may be needed for complete control. . If there are no grapevines planted in the vicinity, herbicides containing 2,4-D, dicamba and related chemicals can also be used, and are more effective in controlling broadleaf perennial weeds than glyphosate.

Glyphosate can be applied either with a low-pressure herbicide sprayer for broadcast applications, or with a hand-held compression sprayer or wick applicator for spot treatments. Spray does not need to drench the entire weed to be effective. The wick application eliminates the potential problem of glyphosate particle drift onto grapevines. Grow tubes or vine guards help protect vines from accidental contact, but the bottoms of the tubes must be buried in the soil to prevent up-drafts from drawing the glyphosate particles into the tubes.

### **Nonchemical Control**

Mechanical cultivation and the use of cover crops can be used as a complete pre-plant weed control program or to supplement a chemical weed control program. After tilling over the plow furrows in the spring, regular mechanical cultivation with a disk or rototillers can be continued throughout the summer. Cultivation every week or ten days will kill a large number of weeds as they germinate, but consumes time and fuel. An annual cover crop can be sown after the first month or so of cultivation. Buckwheat, sorghum-Sudan grass and sweet clovers are all easy to grow as pre-plant cover crops and are quite effective in smothering out any weeds germinating after the last spring cultivation. They will provide significant organic matter for the site when tilled in just before planting.

Buckwheat is especially useful on poor soils, as it is very tolerant to acid soils, withstands drought, and is rather undemanding of soil nutrients. Buckwheat should be sown when the weather has warmed up in early June, at a rate of 3 lbs per 1000 square feet or 50-100 lbs/acre. It germinates within a week, and matures to blossom within 45 days. The blossoms are an excellent nectar source for bees and other beneficial insects such as ladybugs and green lacewings. The stand of buckwheat should be mowed before it sets seed and then tilled in, otherwise, it can become a weed in the vineyard. Tilling-in buckwheat adds a modest amount of organic matter to the soil. Often a second crop of buckwheat can be grown the same season.

Sorghum-Sudan grass is best suited to relatively good soils, as it requires a good nitrogen supply and adequate moisture, but can be effective in depleting and excess nitrogen reserves present in the soil from its previous cropping history. Sow at a rate of 1-2 lbs per 1000 square feet or 35-50 lbs per acre in June when warm weather has arrived. Sorghum-Sudan grass produces an extremely thick stand of grass that can reach 6' in height. Under adequate rainfall, several mowings may be needed during the season, yielding an abundance of organic matter for the soil. After the last mowing, the stubble and accumulated grass debris can be tilled into the soil.

Sweet clovers (annual white and biennial yellow) may help correct several soil problems prior to planting the vineyard. First, they are prolific fixers of nitrogen adding back nitrogen to a severely depleted soil. Secondly and perhaps more importantly for grape culture, sweet clovers can help "open up" compacted soils by virtue of their long (up to 24") thick taproot. Sweet clovers should be sown at a rate of ½-1 lbs. per 1000 square feet or 12-20 lbs. per acre after the weather warms in the spring. For acidic soils, (pH under 6.0), modest application of lime (1 ton/acre) prior to sowing sweet clovers will result in more vigorous growth. Finally, if pre-plant culture begins two seasons prior to planting the vineyard, it may be advantageous to use a mix of annual white and biennial yellow sweet clovers. The annual white will grow nicely the first year, nursing along the biennial yellow. The biennial yellow clover will begin growth early, growing vigorously during the second season. Biennial yellow sweet clover often grows up to 4' tall with heavy stems,

## Starting the Vineyard

so occasional mowing is necessary. Biennial yellow sweet clover dies after the second season and can then be disked into the soil. A significant amount of organic matter can be added to the soil this way. Annual sweet clover would be beneficial for soils that are low in fertility (< 2% organic matter content), but are not recommended on soils that have a high organic matter content (>3%) because excessive grapevine vigor is often an issue on these soils.

As a final step in soil preparation, many growers will sow their permanent ground cover in the fall before planting. Most ground cover species used in northern climates establish best when sown in the fall. In addition, presences of a sod groundcover in the spring will allow you to get on the land sooner to begin planting the grapevines. Refer to the ***Sod Alleys*** section in the **Weed Control in Established Vineyards** portion of this publication for ground cover species to plant.

The other alternative is to sow a final cover crop of cereal ryegrass in the fall at a rate of 100 lbs per acre. The rye will grow to a height of 4-6” before winter comes, and begin to tiller in the spring. In the spring prior to planting grapevines the ryegrass should be mowed and killed with a contact herbicide and left on the soil surface. Cereal ryegrass has allelopathic properties that will inhibit the germination of weed seeds.

### Vineyard Best Management Practices – Starting the vineyard

Rate your vineyard establishment practices:

Management Area: <b>Soil preparation</b>	<b>Best Practices</b>	<b>Minor Adjustments Needed</b>	<b>Concern Exists: Examine Practice</b>	<b>Needs Improvements: Prioritize Changes Here</b>
<b>Optimizing the nutritional status of the soil</b>	Amended the soil based on soil test results the season before planting.	Amended the soil based on soil test results in the spring prior to planting.	Amended the soil based on soil test results after planting.	No soil amendments were applied.
<b>Deep tillage</b>	If a fragipan or other restrictive layer is present, subsoiled in the fall prior to planting, otherwise chisel plowed to break up any plow pan.	Subsoiled because it is a good practice.	Chisel plowed to break up any plow pan that might be present.	No attempt was made to break up and restrictive layers or compaction in the soil prior to planting.
<b>Problem perennial weeds and grasses</b>	Took measures to control them the season before planting.		Took measures to control them in the spring prior planting.	Made no attempt to control them prior to planting.

### Vineyard Layout and Row Spacing

When possible, layout the vineyard to accommodate the equipment available for management purposes. Row spacing and distance between plants depends upon the vigor of the cultivar, the training and trellis system used and the width of equipment to be used in the vineyard. Between row spacing of 6-9 ft for backyard plantings and 9 to 12 ft for commercial plantings based upon the training system are usually convenient. For single curtain systems such as the high-wire cordon, 10 ft between rows is typically used. On a mid-wire system with VSP, the canopy is narrower and a 9 ft row width can be used. In contrast, with a double curtain system such as the Geneva double curtain or Lyre system, cross arms support the trellis wires as much as 48-52 inches apart, and a 12 ft row spacing is often required. Most cold hardy northern cultivars like Frontenac, La Crescent and St. Croix are vigorous to very vigorous and 8-10 ft between plants within the row is suggested, or using a double curtain training system to accommodate the high vine vigor. Closer spacing of less than 8 feet between vines can be used for less vigorous cultivars or on less fertile sites. If possible, arrange rows in a north-south orientation for maximum sunlight utilization. However, the cost of trellis materials often dictates the row direction because it is much more expensive to establish many short rows that it is to establish longer rows because end posts are much more expensive than line posts. When planting on steep slopes the rows should be laid out across the contour of the land to reduce erosion, and it is best to add an additional foot to the width of the rows because implements towed

## Starting the Vineyard

behind a tractor tend to drift downhill.

When considering a layout for larger commercial vineyards, maintain a 30-40 foot headland (distance between property line and beginning of planted row). This will allow adequate room for turning a tractor and implements at the end of each row. Sections of trellis should be segmented into units no longer than 600 feet (unless using a horizontal braced end post) for proper trellis anchorage and trellis wire support.

### Vineyard Best Management Practices – Starting the vineyard

Rate your vineyard establishment practices:

Management Area: <b>Vineyard layout and spacing</b>	<b>Best Practices</b>	<b>Minor Adjustments Needed</b>	<b>Concern Exists: Examine Practice</b>	<b>Needs Improvements: Prioritize Changes Here</b>
<b>Between-row spacing</b>	Training system, width of the equipment and degree of side slope were considered in selecting the row spacing.	Training system was considered in selecting the row spacing.	Only equipment was considered in selecting the row spacing.	Training system, equipment size and degree of side slope were not considered in selecting the row spacing.
<b>In-row vine spacing</b>	Cultivar vigor was considered in selecting the in-row spacing	All cultivar were planted at a wide in-row spacing suitable for very vigorous vines		All cultivar were planted at a narrow in-row spacing suitable for moderately vigorous vines
<b>Row direction</b>	Rows were oriented in a N-S direction to optimize sunlight utilization.	Rows were oriented in a E-W direction to save on trellis materials costs		
<b>Headland</b>	Adequate headland was left at both ends of the vineyard to allow equipment to turn without problems.		Headland on one end of the vineyard are marginal for equipment to turn.	Headland on both ends of the vineyard are marginal for equipment to turn.

## Planting

The vines can be planted when the soil is workable in the spring. The soil should not stick to tools, and should not “ball up” when squeezed and rolled in your hands. Avoid planting when the soil is too wet. As a rule, order nursery stock to be delivered around May 1. If the vines are potted and have already sprouted, they should not be set out until all danger of frost is past, usually after mid-May. The vines should be planted in good-sized holes to accommodate the root system. For grapevines propagated from rooted cuttings, the lowest bud can be set either just above or below the soil surface. For grafted grapevines, the graft union should be placed above the soil surface.

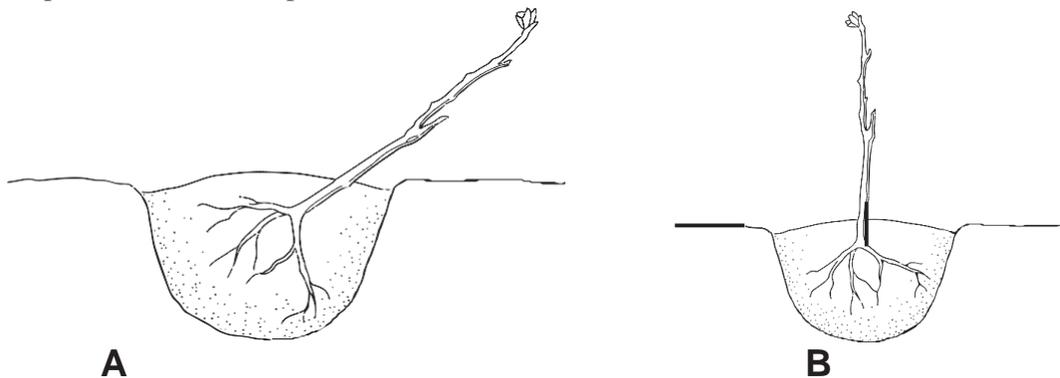
Although burying of cold tender vines is becoming rare with the advent of fully hardy cultivars, tender vines that are to be trained for winter protection should be planted at a 30° or 45 ° angles (**Figure 10A**). Hardy cultivars may be planted upright (**Figure 10B**). Keeping the vines aligned across rows will also allow cross-cultivation with a tractor during the first year or until the trellis is built. The roots of the young bare-root vines should never be allowed to dry out and should be protected from direct sunlight. Keep them moist until planted. Never soak bare-root vines in water more than 3 or 4 hours since roots need aeration and stored nutrients can leach out. Prune only the broken or dead roots. Dig holes large enough to adequately accommodate the roots. If an auger is used for digging the holes, at least a 12-inch, preferably a 14- to 16-inch diameter one should be used. Never stuff large root masses into small holes but spread the roots. Augers are prone to compacting the sides of the hole, particularly when the soil is too moist. Avoid planting when the soil is too moist (when it “balls up” when squeezed in your hand). Even when soil conditions are optimum for planting, it is a good practice to break in the sides of the hole as you plant the vines. Place the vine in the hole, fill the

## Starting the Vineyard

hole with soil and tamp to eliminate air pockets. Leave a depression around each vine at the soil surface to hold water. Water the vine well at this time. Young vines need  $\frac{1}{2}$  to 1 inch of water per week. Five gallons of water applied on a 3 x 3 foot area is equivalent to about an inch of rainfall. Stop watering mid- to late-season to promote deep root growth.

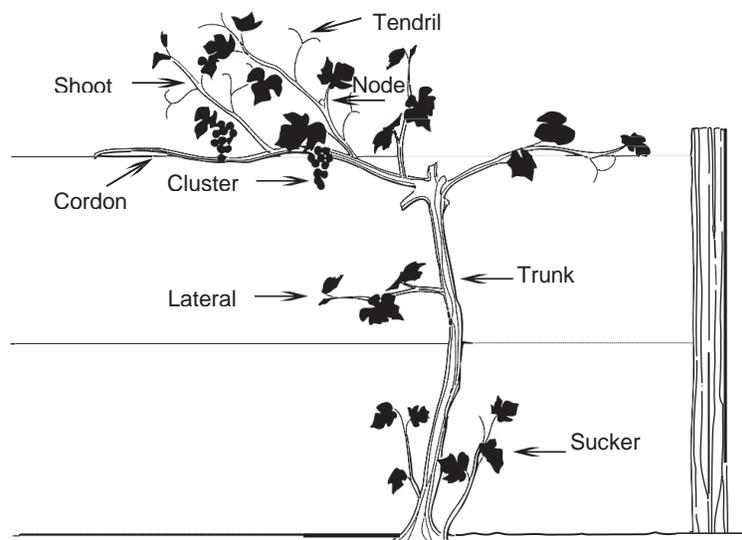
Special care must be taken with greenhouse rooted green plants because of the environment they have been growing in. Their leaves are tenders because of the different light spectrum, and need to be acclimated to outdoor conditions before planting or initially provided with some protection from direct sunlight when planted in the field. They typically have a very limited root system for the amount of shoot growth present and need to be watered frequently until their roots grow into the soil.

Grow tubes have proven to be valuable in the growth and survival of young vines. If used, they should be set around the vines at planting time, and supported by a stake or bamboo pole pushed securely into the soil. About 1" or so of soil should be pushed up around the bottom of the tube to seal it. This grow tube will act as a little greenhouse, allowing heat to accumulate, causing the new buds to push earlier and allowing the new shoots to develop rapidly. In a cold spring the difference in growth compared to newly planted, unprotected vines can be dramatic. Grow tubes also offer protection from contact herbicides applied after planting, and feeding by deer and rabbits. Grow tubes should be removed early August to allow the shoots to mature and properly harden off. Once the grapevines are dormant, they can be re-set to provide some winter protection from rabbits and voles.



**Figure 10.** Planting Rooted Cuttings. Horizontal planting for cultivars needing winter protection (A), and vertical planting for cold hardy cultivars (B).

**Figure 11** illustrates the parts of a grapevine and the following insert defines the terms.



**Figure 11.** Parts of the grapevine.

## Parts of the Grapevine (Illustrated in Figure 11)

**Arm** – a short branch of old wood extending from the trunk or cordon on which canes or spurs are borne.

**Apical dominance** – ability of shoots near the tip of a cane or spur to produce hormones that retard growth of more basal buds or shoots.

**Basal** – in the direction for the roots or base of the vine.

**Basal shoot** – shoot arising from a bud at the base of a cane or spur.

**Bud** – a compressed, dormant undeveloped shoot. Buds form at the base of each leaf petiole on developing shoots, lie dormant during the winter and begin growing the following year.

**Cane** – a shoot after it lignifies (turns brown) and becomes woody.

**Canopy** – above ground parts of the vine composed of many canes, shoots and leaves.

**Cluster** – a group of flowers (spring) or grapes that develop at certain nodes on a shoot.

**Cordon** – a horizontal extension of the trunk usually trained on wires.

**Distal** – end of a stem towards the growing tip, or end of a cane or spur.

**Head** – the top portion or crown of the trunk(s) where canes are selected to produce the current season's crop.

**Hedging** – trimming off the ends of shoots in a vertical shoot positioning (VSP) training system.

**Internode** – the portion of a shoot, cane or spur between nodes.

**Lateral** – vegetative growth developing sideways from the main shoot or cane.

**Node** – thickened portion of a shoot or cane where a leaf is or has been attached and a bud was formed. (Internode is the portion between two nodes).

**Petiole** – the stem of a leaf.

**Renewal spur** – a cane pruned to one or two nodes, generally on an arm or cordon to develop a cane for fruiting the following year.

**Shoot** – current season growth that emerges from a bud on a cane and bears leaves, fruit and new buds.

**Skirting** – trimming the ends of shoots in a downward shoot-positioning system such as a single curtain bilateral cordon.

**Spur** – a cane pruned to five or fewer buds.

**Sucker** – a shoot that develops from the lower trunk or from underground.

**Tendrils** – a narrow curly growth from stems that coils around objects, supports the shoot and helps the vine to climb.

**Trunk** – the permanent, above ground upright part of the vine.

**Water sprout** – unwanted shoot arising from adventitious buds on the trunk or cordon.

## First Season Care

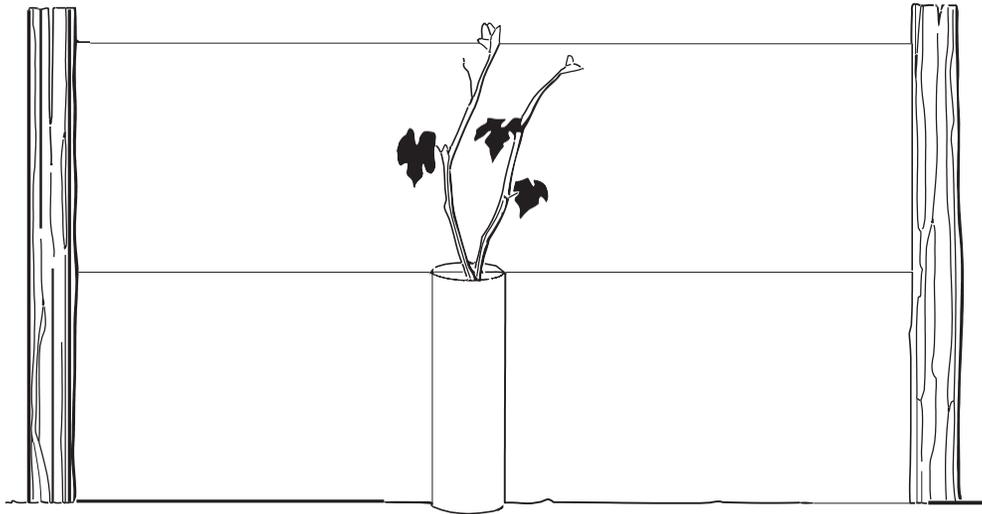
The main goal during the first season is development of the vine's root system. Competition from uncontrolled weeds reduces growth and can even kill young vines. Thus, good weed control the first year is extremely important. Close to the vines, and under the trellis, weed control can be accomplished by hand hoeing, mechanical tilling or herbicides. Oryzalin (Surflan®) is a pre-emergent herbicide that is registered for use on first year vines. A common weed control practice is to apply oryzalin to keep new weeds from germinating and glyphosate to kill existing weeds and grass. This combination applied immediately after planting and before new buds begin to emerge will often control weeds for much of the first summer. If vines have broken dormancy, extreme care must be taken to prevent herbicide contact. If grow tubes are used, they will not only help new vines to get off to a good start but will protect new shoots from glyphosate or other contact herbicides. If emerging grasses become a problem, post-emergence grass herbicides such as Poast® (sethoxydim) and Fusilade (fluazifop-p) can be used.

A second goal during the first season is to begin the process of training shoots to develop into the trunks of the vines. As the new shoots develop, a few simple steps should be followed to begin the training process. For hardy cultivars without using grow tubes, train several developing shoots up to the trellis wires on a bamboo stake or strings attached to the base of the stake to maximize leaf area and root development. Tie no more than two shoots to a stake, otherwise shading will delay the maturation of the shoots. Use Max Tapener tape, T-bands™ or similar products to tie the strongest and straightest shoot to the training stake and trellis wire when it becomes long enough (**Figure 12A**). If using grow tubes, tie the shoot(s) that come out of the top of the tube onto the trellis wires above or to the pole supporting the grow tube to keep it off the ground. These methods will ensure that most of the growth of the vine will be directed into a main shoot (**Figure 12B**). For hardy cultivars, the shoots can be trained vertically. If you are growing cold tender cultivars that will have to be covered during the winter, a bit more care is needed to achieve the desired “J” shape (**Figure 12C**). As the shoot grows, it should be pinned to the ground with U-shaped wire hoops for the first 18-24” of its growth. At that point, the shoot can be tied to a piece of twine and encouraged to follow a gentle J-shaped curve up to the lower trellis wire.

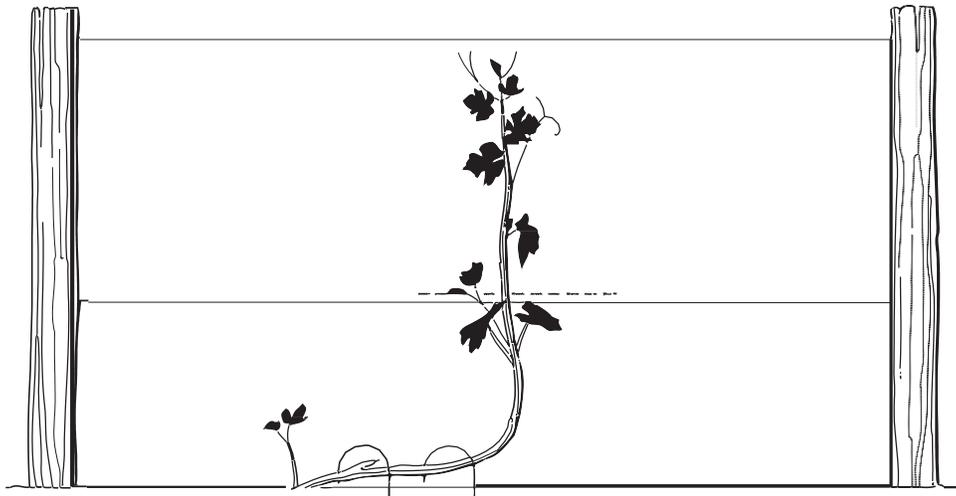


**Figure 12A.** Training a new trunk for hardy cultivars- straight trunk.

## Starting the Vineyard



**Figure 12B.** Training a new trunk for hardy cultivars with a grow tube.



**Figure 12C.** Training a new shoot to a trunk for tender cultivars- Mini J.

Cold hardy vines do not require winter protection. However, cold tender cultivars need protection. A mound of straw or soil around the base of the vine is advisable to help protect the all-important root system. If there was vigorous growth and the entire trunk was formed, cover the entire trunk of tender cultivars with mulch such as straw, snow, burlap, or for best protection, buried in soil. Do not be discouraged if new shoots partially or entirely die back over the winter. New shoots (suckers) will appear from the root system when growth appears in the spring. Again select a strong new shoot and resume the training process.

## Second Season Care

In addition to continued careful weed control, 50 lbs. /A of N fertilizer (adjusted for soil organic matter) can be applied in the second year. This will encourage a vigorous start. Cultivars especially susceptible to disease may require a more rigorous spray schedule for controlling diseases that affect the shoots and foliage. In many cases vines will form a few fruit clusters this season. It is recommended that these be pinched off since the vine's energy is best directed toward growth of roots and canes.

## Starting the Vineyard

Normally, the second season is the time when the full vine trunk is formed and shoots are trained onto the trellis wires. Due to many factors, first year vine growth varies widely from vine to vine. Some may make as much as 6-8 feet of growth and more the first year, forming the entire trunk. More commonly, first year growth nurtured during the first season is cut back to a point where the cane is alive with no sign of winter injury (green with no blackish streaks) and at least ¼-inch in diameter. The same training rules described above for first season vines apply as well to the second year's effort to train a shoot into a permanent trunk. When the new, rapidly growing shoot has passed the lower wire, a decision must be made about where to "head" the vine. If a low training system (i.e. a VSP or Fan) is to be used, the new trunk must be topped and tied to the lower wire. If one of the high training systems (i.e. a bilateral high cordon, Kniffin or a Munson system) is to be used, the shoot can be allowed to grow up past the top trellis wire. Then it is topped and secured to the top wire. Topping should be done when the shoot is at least ¼-inch in diameter at the level of the wire to which it is to be secured. Make the topping cut through the node just above the top node to be retained on the trunk. This will provide plenty of room to tie the new trunk tightly to the wire without damaging the top bud on the trunk.

Topping the new trunk in this manner forces the growth of lateral shoots along the new trunk. These lateral shoots will form the first set of fruiting canes and spurs on the young vine. The remainder of the second season is simply devoted to positioning and tying these lateral shoots so that they grow into the desired form. If possible train two lateral shoots in both directions along the trellis wire(s).

Vines that may have died-back to near the ground or cane diameter was less than ¼-inch will need to be cut back to a few buds and started over. On these vines, train 3-4 shoots up the support stake and strings as during the second growing season to establish the trunk.

## Third Season Care

Continue to control weeds under the vines, and apply nitrogen fertilizer at about 40-50 lbs. /A (adjusted for soil organic matter). If the trunk was established during the first growing season and canes were established on the trellis wires during the second growing season, the vines are ready to produce a partial crop during the third growing season. With a partial crop, disease control will need to be stepped up to control those diseases that affect the fruit.

**Cane-pruned training systems:** select canes to tie to the trellis wires for fruiting retaining about 30 buds per vine. Prune the other canes back to 2-3 bud renewal spurs.

**Cordon training systems:** select canes to form the cordon. These canes should exhibit moderate vigor and be about ¼-inch in diameter at about the fifth or sixth node. It is best to cut these canes back so that they occupy about half to two-thirds of their allotted space on the trellis. This is done to assure that shoots develop uniformly along their length of the cane, otherwise apical dominance to the distal (end) shoots can inhibit the emergence of shoots near the basal end of the cane. If lateral canes formed along the primary canes, they can be pruned back to a single bud if they are at least ¼-inch in diameter, otherwise they should be removed.

**Vines had to be cut back to re-establish the trunk:** select canes to form the trunk and head them back just below the trellis wire if this was not done during the growing season.

**Bull canes:** When selecting canes to form the trunk or cordon, avoid using "bull" canes. These are canes that are very thick (>1/2-inch diameter) and have very long internodes that can exceed 6-inches, and tend to have a more oval rather than circular cross-section. They are less cold-hardy and less fruitful than normal canes.

## Starting the Vineyard

### Vineyard Best Management Practices – Starting the vineyard

Rate your vineyard establishment practices:

Management Area: Planting and care	Best Practices	Minor Adjustments Needed	Concern Exists: Examine Practice	Needs Improvements: Prioritize Changes Here
<b>Soil condition at planting</b>	Soil could be tilled without sticking to tools.	Soil at the bottom of the planting hole was somewhat sticky.		Soil near the surface sticks to tools.
<b>Size of the planting hole</b>	Large enough that the roots could be spread out & root pruning was minimal	About 1/3 of the root system had to be pruned for the vine to fit the hole when the roots were spread.	About 1/2 of the root system had to be pruned for the vine to fit the hole when the roots were spread.	Roots had to be wrapped around and stuffed in the hole.
<b>Watering</b>	Water is applied after planting to settle the soil and as needed during the growing season.		Water is applied after planting to settle the soil and rainfall is relied on during the growing season.	Water is not applied after planting or during the growing season.
<b>Green plants</b>	Acclimated to sunlight before planting and watered frequently after planting until the roots grow into the soil.		Not acclimated to sunlight before planting and watered frequently after planting until the roots grow into the soil.	Not acclimated to sunlight before planting or watered frequently after planting until the roots grow into the soil.
<b>First season</b>	Controlled weeds to optimize shoot growth and trained shoots to form the trunk.	Controlled weeds to optimize shoot growth but did not train shoots to form the trunk.	Trained shoots to form the trunk but did not control weeds.	Did not control weeds or train shoots to form the trunk.
<b>Second season</b>	Continue to control weeds, formed the trunk and began training shoots onto trellis wires.	Continue to control weeds, and had to re-train shoots to form formed the trunk.		Did not control weeds, and had to re-train shoots to form formed the trunk.
<b>Third season</b>	Continue to control weeds, if canes were established on the trellis wires in the 2 <sup>nd</sup> season, begin pruning for a partial crop.	Continue to control weeds, if canes were not established on the trellis wires in the 2 <sup>nd</sup> season, continue to train shoots on the wires.		Did not control weeds, and trunk was not formed during the 2 <sup>nd</sup> season.