

**PRODUCTION AND
MARKETING GUIDE
FOR
MUSCADINE GRAPES
IN FLORIDA**



*Compiled by the
Center for Viticulture and Small Fruit Research
Florida A&M University*

*Approved by the
Florida Viticulture Advisory Council*



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INTRODUCTION

Reasons and Basis of Recommendation

The reasons and basis of making recommendations with regard to best management practices are:

- To provide grape growers and potential investors the necessary guidelines to assist them in making more effective decisions in production, marketing and vineyard management practices that have a significant impact on the overall profitability, economic viability and sustainability of the vineyard operation.
- The Single Wire Trellis system is recommended because it is the most economical, simplest and most commonly used system in Florida and southeastern states.
- Grape growers and potential growers should use the Best Management Practices as recommended guidelines. The circumstances and situations facing individual growers and potential growers vary considerably and discretion should always be used when following the guidelines.

Many of the recommended best management practices for production and vineyard management practices for muscadine grapes in this publication are based on research findings and practices used by the Center. Some of the recommended practices are from selected publications and some from grower recommendations. It is not the intent nor within the scope of this publication to cover all areas on muscadine grape growing, but rather seek to address those areas that are most commonly referred to the Center for information, comments and assistance to establish a vineyard or to improve their current vineyard or marketing operation. The Center has embarked on several research projects that, hopefully, in the near future will provide additional information that will continue to improve the technical and economic efficiency of muscadine grape production and marketing for Florida grape growers.



MARKETING CONSIDERATION

Why Marketing is Important

Before establishing a vineyard, it is essential to address several issues as part of the planning process. One of the first questions to be asked is where the grapes will be marketed or what will the grapes be used for. The answer will determine the appropriate cultivar(s) to be planted in the vineyard.

Best Management Practices

- Determine whether the grapes will be sold in the fresh market or as winegrapes, or a combination of the two.
- Conduct a market research to determine who will buy the grapes and if the proposed market outlet is feasible and viable. Evaluate the size of the proposed market(s) and market prices for the grapes.
- It is extremely important to plant the appropriate cultivar(s) for the desired market to secure the most competitive prices for the grapes.
- A marketing contact is a good market alternative for those who are venturing into grape growing and needs time to understand and develop their own alternative market. A marketing contract will provide a ready market when the grapes are ready for harvesting and reduce some of the marketing and business risk associated with grape growing.
- If the vineyard is in operation, market preparation should be finalized by spring to ensure a smooth marketing operation when the grapes are ready. This includes:
 - o Determine the harvesting method to be used.
 - o Determine if transportation is need for the grapes.
 - o Prepare packaging or packing containers.
 - o Plan and prepare the necessary promotion material, if needed.
- If a grower intends on setting up a winery, then the process of securing the necessary permits from the respective federal, state, and local authorities should start as early as possible, at least one year before the planned production.

CULTIVAR SELECTION

Once the vineyard is established, it is very costly to replace the cultivars or to make structural changes to the trellis/ production system, so it is important to know what market outlet or alternative will be used. After deciding the primary uses for the grapes, determine what cultivar(s) should be planted to cater to that market. It is, therefore, very important that the “right” cultivar(s) be selected for the desired or primary market. Plant fresh fruit cultivars for the fresh market and wine cultivars for the processed or wine market and not vice versa. This will help to minimize market problems and also to get the best prices for the grapes.

A grower has the choice of using standard muscadine cultivars and or patented cultivars. Standard cultivars are available from many nurseries. Patented cultivars are available only from *Ison Nursery and Vineyards*.



A selected listing of the commonly grown muscadine cultivars is listed below.

<u>Standard Cultivars</u>	<u>Fruit Color</u>	<u>Recommended Usage</u>	<u>Market</u>
Alachua	Black	Fresh Fruit	U-Pick
Carlos	Bronze	Wine	Commercial
Cowart	Black	Fresh Fruit	Home Garden
Florida Fry	Bronze	Fresh Fruit	U-Pick
Fry*	Bronze	Fresh Fruit	Commercial
Higgins*	Bronze	Fresh Fruit	U-Pick
Hunt*	Black	Wine	Home Garden
Jumbo*	Black	Fresh Fruit	U-Pick
Magnolia	Bronze	Wine, Fresh Fruit	Home Garden
Noble	Black	Wine, Jelly	Commercial
Nesbitt	Black	Fresh Fruit	Commercial
Southland	Black	Fresh Fruit	Home Garden
Summit*	Bronze/Red	Fresh Fruit	Commercial
Tara	Bronze	Fresh Fruit	U-Pick
Triumph	Bronze	Fresh Fruit	U-Pick
Welder	Bronze	Wine, Juice	Commercial

Patented Cultivars

Majesty*	Black	Fresh Fruit	Commercial
Darlene*	Bronze	Fresh Fruit	U-Pick
Early Fry*	Bronze	Fresh Fruit	U-Pick
Late Fry	Bronze	Fresh Fruit	U-Pick
Pam*	Bronze	Fresh Fruit	U-Pick
Supreme*	Black	Fresh Fruit	Commercial
Black Beauty*	Black	Fresh Fruit	U-Pick
Black Fry*	Black	Fresh Fruit	U-Pick
Dixieland	Bronze	Fresh Fruit	U-Pick
Dixie Red	Red	Fresh Fruit	U-Pick
Granny Val*	Bronze	Fresh Fruit	Commercial
Ison	Black	Fresh Fruit, Wine	Commercial
Janebell	Bronze	Fresh Fruit	U-Pick
Janet*	Bronze	Fresh Fruit	U-Pick
Pineapple	Bronze	Fresh Fruit	U-Pick
Rosa*	Pinkish/Red	Fresh Fruit	U-Pick
Scarlet*	Red	Fresh Fruit	U-Pick
Sugargate*	Black	Fresh Fruit	U-Pick
Sweet Jenny*	Bronze	Fresh Fruit	U-Pick

* A female cultivar is sterile and has pistillate flowers that require a pollinator.



Best Management Practices

- It is recommended that not more than four or five cultivars be planted in a commercial operation. It is advisable to discuss the proposed cultivars with the appropriate or potential buyers, before planting the vines.
- For fresh market, plant those cultivars recommended for fresh fruit - large berries, high sugar content and a high percentage of dry scars where the berries separate easily from the stem (pedicel) without tearing.
- For the wine market, plant those cultivars recommended for wine- high sugar content, even ripening and high yield.
- If mechanical harvesting is contemplated, it is essential that the selected cultivars ripen at about the same time.
- After determining the cultivars to be planted, make arrangements to purchase the vines from a reliable nursery, preferably, one year before planting. This is to ensure that the vines will be available when the area is ready for planting.

Pollinators

Many muscadine cultivars for fresh fruit are *females* (self-sterile) and require a pollinator to produce fruits. A pollinator is another muscadine cultivar that has perfect flowers, that is, pollen to pollinate the *female* muscadine flowers. If a grower wants to plant a cultivar that is *female*, then a pollinator cultivar must be included in the vineyard as well. For example, the cultivar *Fry* is a *female* and will require a cultivar such as *Cowart*, *Triumph*, *Carlos* or *Noble* to pollinate its flowers. If the vineyard is planted with cultivars that have perfect flowers such as *Carlos* or *Noble*, then there is no need for a pollinator.

Best Management Practices

- The ratio of pollinators to female cultivars should be about 1:2 that is, a row of pollinators is planted between two rows of female cultivars.
- Among the standard muscadine cultivars, *Fry* is the most common while *Carlos* and *Noble* are commonly grown for making white and red wine, respectively.
- If a pollinator is needed, plant the first row with a pollinator (cultivar with perfect flower), followed by two rows of female cultivars, repeat this sequence until the whole vineyard is planted. If only three rows of vines will be established, then plant the center row with a cultivar with perfect flowers, and the female cultivars on each side.



Economic Consideration

- Muscadine cultivars recommended for wine such as *Carlos* and *Noble* do not fetch competitive prices as fresh fruit. Similarly, fresh fruit cultivars such as *Fry*, *Triumph*, and *Summit* do not fetch competitive prices as winegrapes.
- One of the best fresh fruit cultivars that have performed well at the Center is *Supreme*. The cultivar *Fry* tend to have a relatively high percentage of wet scars and may have to be harvested in clusters.
- The fresh fruit price, particularly, from U-Pick operation is always higher than the processed fruit price, but the marketable volume is usually much smaller.
- Location plays a very important role in U-Pick operations. Vineyards for U-Pick should be located along a heavily traveled road and located close to an urban or city center.



PROJECT PLAN

Once the decision has been made to grow grapes, it is essential to develop a project and business plan for the proposed vineyard as early as possible. This involves gathering the necessary information and discussion with county extension agents, experienced grape growers and researchers at the Center for Viticulture and Small Fruit Research, University of Florida/IFAS and Florida Grape Growers Association for information and advice to start the vineyard on the right footing. The necessary information should be carefully analyzed and used in the decision making process.

When completed, the project plan will act as a road map in identifying the various operations that need to be carefully considered and done correctly so as to avoid the pitfalls that many newcomers experienced without careful planning.

Developing the Project Plan

- Survey the proposed area. Collect and analyze the necessary information to determine the suitability and feasibility of establishing a vineyard and to minimize any constraints that may limit vine growth and productivity. The following information should be included in the project plan:
 - Agricultural history of the proposed area.
 - Determine what kind of crops have been grown in the area and if there is a history of soil borne diseases and poor growth.
 - Acreage/ size and shape of land for vineyard.
 - For commercial purposes, the vineyard should have the necessary economic acreage to expand if and when necessary. A square or rectangular shape is ideal for a vineyard.
 - Topography of land and type of vegetation on land.
 - Determine if the geographic features such as the slope of the land is suitable for establishing a vineyard.
 - Availability of water for irrigation.
 - Determine if there is sufficient water for the vineyard. The water source could be from a lake, pond or well. A mature vine needs about 20 – 30 gallons of water per week, depending on soil type and weather condition.
 - Soil type and nutrient status of soil.
 - Determine if the soil type is capable of supporting a healthy vine growth and if there is any soil remediation or improvement to be done in the area.
 - Agricultural, environmental and ecological constraints of proposed area.
 - Determine if there are major environmental and ecological constraints that must be addressed when the area is cleared and developed.



- Location of proposed vineyard relative to proposed markets.
 - Determine the location of current and proposed market alternatives and the economic feasibility of shipping the grapes to market.
- After the necessary information has been collected and analyzed, develop a schematic vineyard map that will include:
 - Location and size of vineyard plots.
 - Identify the location of the vineyard plots. The size of the plots will depend on the overall acreage of the vineyard but it should be such that it will facilitate the vineyard operation. For example, if the total vineyard is 5 acres, then a half acre or one acre plot divided by field roads will make it easier to compute the spray volume and fertilization rate as well as the total quantity to apply in each plot.
 - Cultivars to be planted in the respective plots/field.
 - Identify the cultivars to be planted and where they will be planted.
 - Location and size of field roads and perimeter roads.
 - Identify the field roads and perimeter roads around the plots. The roads should be wide enough to enable vehicles and tractors, including mechanical harvesters, to safely move around the vineyards.
 - Location and size of drainage ditches and source of water.
 - Identify the location of any drainage ditches/canals to be constructed in the area. Avoid making any roads across low lying areas without the proper drainage.
 - Location and types of proposed farm buildings.
 - Identify the number and types of buildings to be constructed and where they will be constructed.
 - Farm/sales office with storage facilities.
 - Packing/utility building.
 - Storage building with cooling facilities.
 - Rest area for customer with restroom facilities.
 - Parking area for vehicles.
 - Residential building for caretaker.
 - Check local zoning regulation.



BUSINESS PLAN

- Develop a project budget and a brief financial analysis to determine the financial viability and profitability of the proposed project.
 - Determine source of investment funds.
 - Investment capital requirement for vineyard development.
 - Investment capital requirement for buildings.
 - Working capital.
 - Cash flow.
 - Return on investment
- Develop financial projections and break even analysis for the proposed project.
 - Determine when project will be profitable.
 - Level of production and market price to break even.
 - Level of production and market price to be profitable.
 - Determine if the proposed project is able to service all debts.
- Seek professional help when needed to prepare a reliable business plan.
- Make arrangements with a reliable nursery to supply quality vines.
 - Confirm date of delivery one month before date.
 - Obtain certificate or letter of authenticity.
 - Check with other grape growers for references.

Best Management Practices

- After the project and business plans have been developed, consult with an experienced grower or personnel from the Center for Viticulture and Small Fruit Research or County Extension Agent for a second opinion and to review the plan and vineyard maps.
- Locate sources for suppliers to get competitive prices for desired items and services.
- Implement the project plan, but be flexible to adapt to changing economic and market conditions.
- Include a project schedule that will list all the necessary operations that needed to be done and the approximate time to complete them.



Example of Project Schedule

Operation	Month														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Marketing Consideration															
Collect market information	*****														
Determine market alternatives															
Select and order cultivars	*****														
Area Survey															
Survey area															
Soil samples for analysis	*****														
Secure necessary permits if necessary															

Vineyard Development															
Land clearing	*****														
Leveling and preparation	*****														
Field roads and perimeter roads	*****														
Drainage system	*****														
Vineyard plots	*****														
Soil remediation	*****														
Trellis system															

Irrigation system															

Plant vines															



SITE SELECTION

Site selection is an important consideration in the project plan. The proposed site should be suitable for growing muscadines. That is, the area is able to support a healthy vineyard that is capable of producing quality grapes without incurring high capital investment and production costs. An area that is not viticulturally suitable for grapes should not be converted into a vineyard as it will not produce a viable and economical crop.

Unlike vinifera grapes, the minimum number of chilling hours required for a productive yield for muscadines has not been established, but does not appear to be a problem for most parts of Florida, except south Florida. The whole of the panhandle area to the Highlands county line are considered suitable for muscadines.

Best Management Practices

- The proposed area could be flat but not low lying. A gently rolling area with less than 10 degree slop is preferred.
- Check the soil type of the proposed site with the U.S. Natural Conservation Service or the county extension service. Check for hardpan or clay pan that will restrict root growth.
- It is very important that the selected area has good internal drainage. That is, the area should not have standing water after a heavy shower. All rain water should drain within a 24 hour period, after a heavy shower.
- The water-table should not be less than two feet from the surface to prevent *wet-foot* condition. Avoid low lying areas that have a tendency to flood.
- Provide an easement reserve/ conservation area between the vineyard and any adjacent low lying area to prevent and minimize erosion runoffs and any pollutions getting into the water or wetland area.
- Muscadine grapes grow over a wide range of soil types but they prefer loamy soils with pH 5.5 - 6.5. Acidic soils with pH 4.5 – 5.5—may cause nutrient deficiencies and other physiological symptoms in the vines. Soils that are not within the recommended pH should be limed before planting the vines. Avoid planting on clay and highly acidic soils with pH less than 4.5.
- The area should be in the open for the vines to receive maximum sunlight for production of quality grapes.
- The selected area should be at least 100 feet from any wooded area and clear of trees to promote good air circulation to minimize disease and pest incidence.



Economic Consideration

- For fresh fruit U-pick operation, the site for the vineyard should, preferably, be near a heavily traveled road and or close to an urban, metropolitan center or city.
- For processed market, the site should not be too far from a processing facility, such as a winery, to minimize the cost and time of transportation. Preferably, the vineyard should be less than 100 miles from the processing facility.
- There should be an adequate and economical source of water such as a large pond lake, or a deep well to irrigate the vineyard.
- The proposed vineyard area should not need extensive drainage as it is expensive to construct and maintain a drainage system.
- Vine health and profitability is directly related to the vineyard site.



SITE PREPARATION

Site preparation is undertaken after all the necessary preparation has been completed. The goal is to prepare the area so that the vineyards could be established as planned and provide the grapevines with the best growing environment as well as maximize its production and operational efficiency of producing high quality grapes every year.

Best Management Practices

- Take the necessary soil sample to determine soil nutrient availability and soil acidity and correct any soil deficiencies before planting.
- If the area is an old or abandoned vineyard, check for root borers and other soil borne pests and eliminate the pest problems before establishing the vineyard.
- Secure the necessary permits for land clearing and burning from the local authorities, if necessary. Check for any environmental requirements relating to land clearing and development for the area and comply with all legal and environmental requirements.
- Clear the area of timber, tree stumps, brush, and burn them. Do not leave patches of weeds in the area. Conservation areas and wind breakers should be kept as far as possible from the vines.
- A subsoiler or chisel plough should be used to break any claypan or hardpan to promote good root development, drainage, and aeration. After sub-soiling, the area should be disc harrowed to break up the soil clumps.
- Where necessary, the land should be leveled with a heavy log dragged behind a tractor. A grader blade may also be used to level the area.
- Construct necessary drainage ditches and install culverts where necessary. Always use a culvert when constructing field roads crossing streams. Do not divert or block any streams.
- Do not push trash, stumps, roots or any vegetation into waterbodies when clearing the area.
- If liming is necessary to correct for high soil acidity (low pH), it should be done after the second harrowing and leveling. A third harrowing is necessary to mix the lime with the soil. Dolomite or magnesium bicarbonate is recommended for liming. Make sure the dolomite is well mixed with the soil and the land is well prepared before setting up the trellis system. The amount of lime and any micronutrients to be applied will be recommended after the soil analysis is completed. When in doubt consult the county extension agent or the Center for Viticulture and Small Fruit Research.



Economic Consideration

- Prepare the site well to provide optimum growing conditions for the vines and minimize the necessity of doing corrective actions at a later date. It is often cheaper when done right the first time.
- It is often more economical to remedy deficiencies or undertake any corrective action before establishing the vineyard or as soon as they are identified.
- Determine which field operations could be more economically done by a contractor and which could be done by self. If uncertain about how to do a certain operation, let the experts do it.



VINEYARD LAYOUT

When the proposed site has been cleared and prepared, the next operation is to mark the location of the plots, roads, vineyard rows, irrigation lines and buildings to ensure that the necessary infrastructures and field amenities are appropriately located such that they facilitate all field operations and provide optimum use of the vineyard resources. The goal is to provide the vines with the best viticultural environment for them to maximize fruit production at minimum cost to the grower.

Best Management Practices

- Determine if the trellis rows will be straight or to follow the contour.
 - For straight line trellis, establish a baseline along one edge of the vineyard as the first row and then measure the appropriate distance for the rest of the vineyard.
 - For contour trellis, establish the trellis across the slope of the land to minimize erosion. Mark and space the trellis rows accordingly. Provide adequate space along the contour for tractors and vehicles to travel through the vineyard.
- The between rows width should be at least 10 feet wide, preferably 12 feet, and be able to accommodate the width of a tractor and its implement for straight line as well as for contour planting.
- Where possible, the trellis rows should be positioned North-South for the vines to receive maximum sunlight.
- Mark the location of the vineyard rows, posts, roads, and other infrastructures that will be constructed, including erosion control strips, if necessary.
- The row length should be as long as possible but not exceeding 300 feet to facilitate field operations and also to avoid a drop in water pressure when irrigating the vineyards.
- The in-row posts should be spaced not more than 24 feet apart for vines planted 12 feet apart (Figure 1A). Greater post spacing may cause the trellis wire to sag or snapped when there is a bumper crop. For vines planted 16 feet apart, we recommend that the posts be also spaced at 16 feet apart (Figure 1B).
- Permanent access roads between blocks should be 30 feet and not less than 20 feet to facilitate vehicle movement.
- Leave at least a 30 feet space (headland), 40 feet is preferred, at the end of the trellis row for vehicles and tractors with implements and mechanical harvester to safely turn the corner (Figures 1 A and 1B).
- Leave space for perimeter road around the vineyard for movement of vineyard vehicles, tractor with equipment and semi tractor trailer.



Figure 1A. Layout and spacing requirement for 12 x 12 spacing.

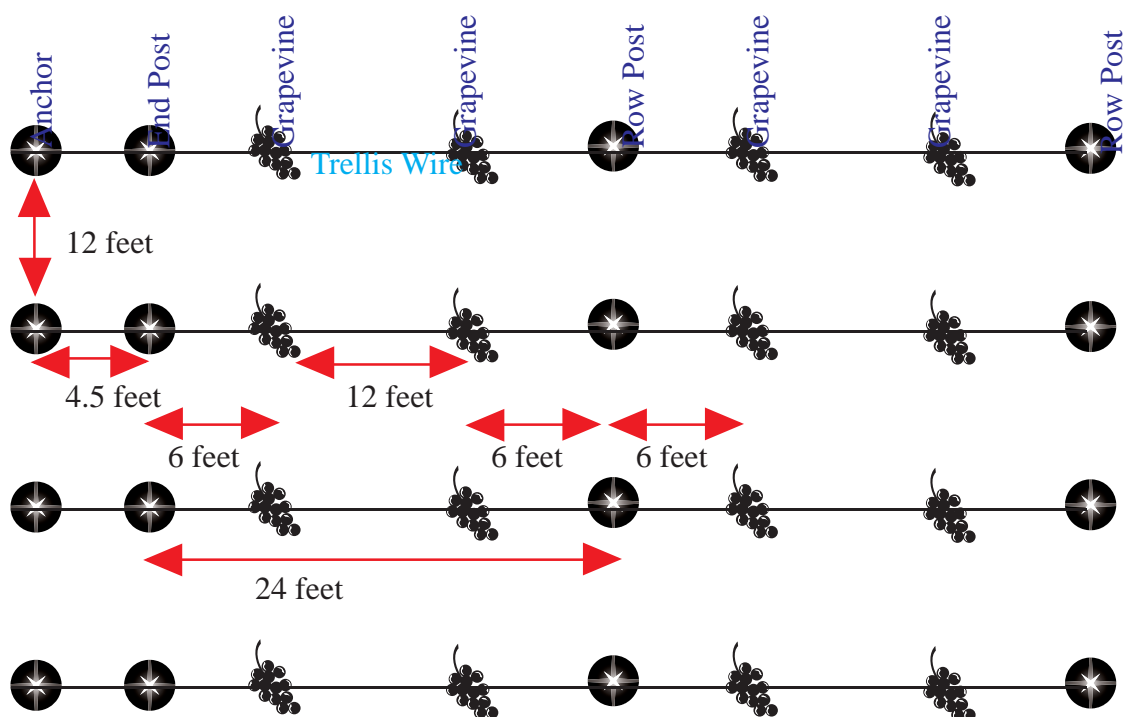
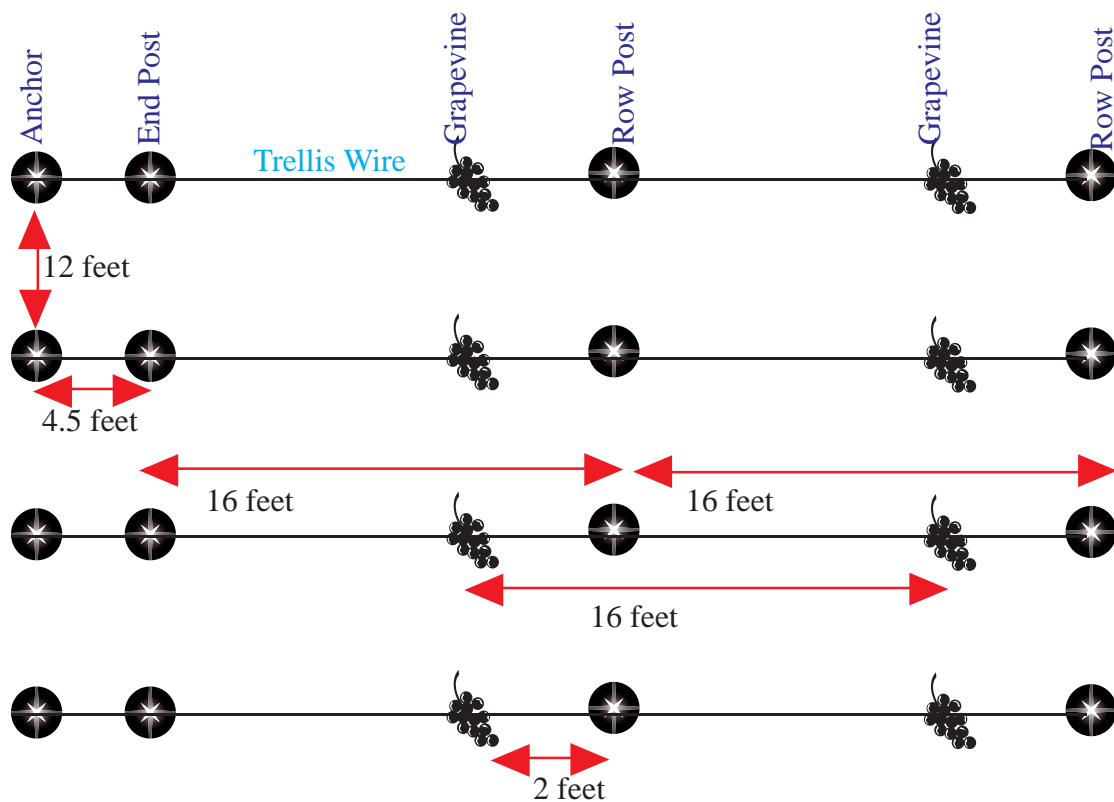


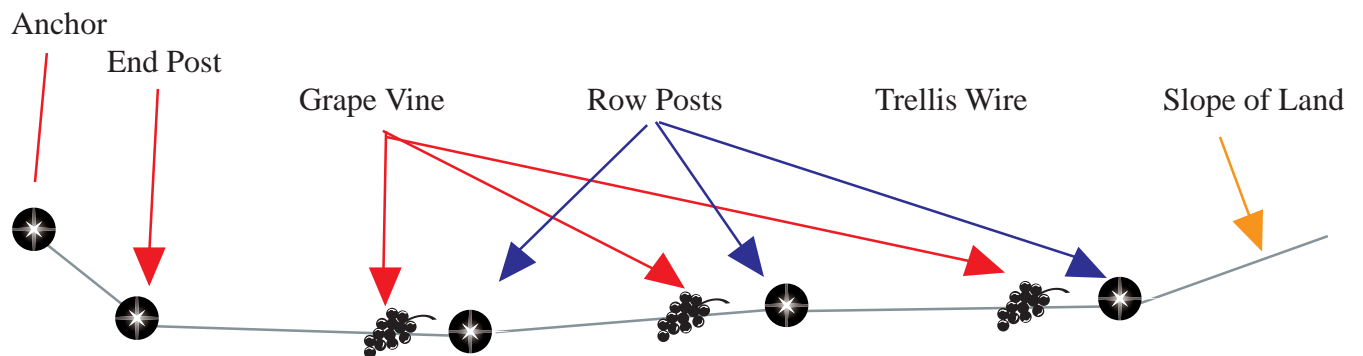
Figure 1B. Layout and spacing requirement for 12 x 16 spacing.



Establishing the Trellis Row

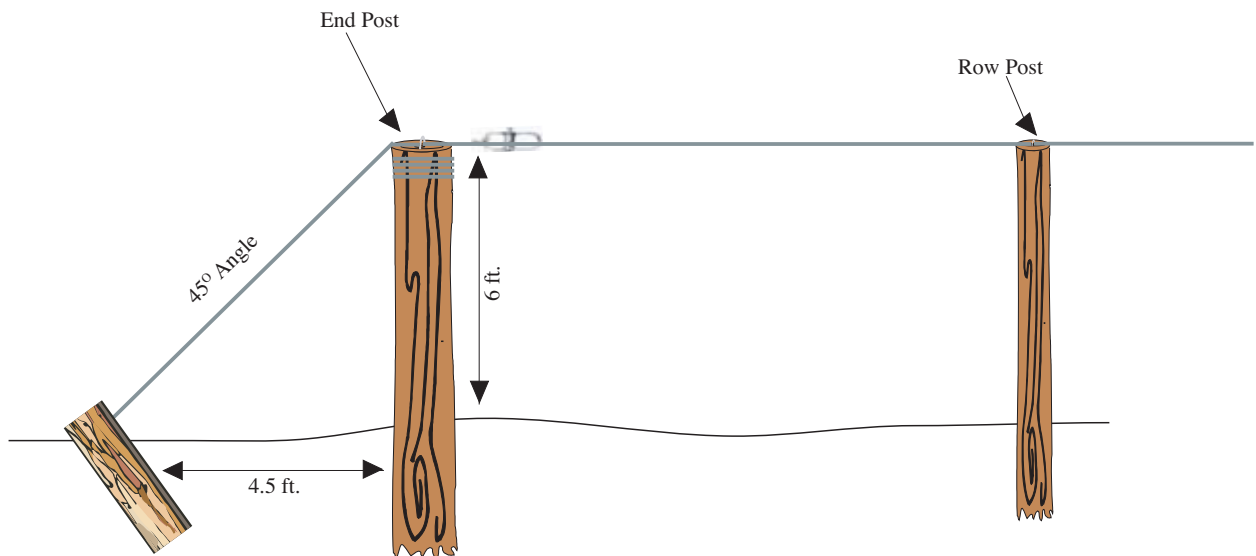
- Determine the shape of the vineyard to be established, and direction and length of the trellis rows.
- Determine if the trellis rows will be straight or will follow the contour of the land.
- For a straight line row, establish a base line along one edge of the vineyard, using a measuring tape or string. For contour planting, follow the slope of the land (Figure 2).
- Place a stake at the beginning and at the end of the line.
- Mark additional rows parallel to the base line row at the desired row width.
- Repeat this process until all the rows are completely marked.

Figure 2. Layout of trellis rows (12 x 16 spacing) following contour of land.



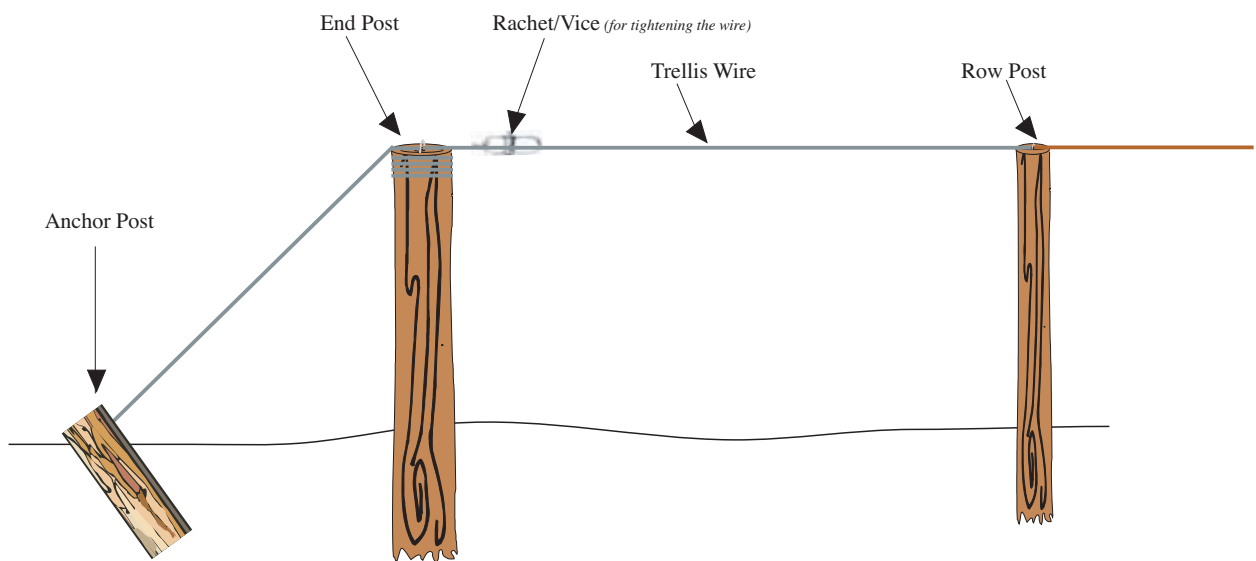
Establishing the End Posts and Row Posts

- Return to the base line row (first row) and mark the location of the end post and row posts.
 - o Mark the location of the anchor to be buried. Measure 4.5 feet and mark the location of the first end post that will be 6 feet high. (This measurement will provide a 45° slope between the top of the end post and the anchor.) Then measure 24 feet for the location of the row post. Repeat the 24 foot measurement for the subsequent locations of the row posts.



- o Follow the same procedure for the 16 foot row posts.
- o After the last end post has been marked, measure 4.5 feet from the end post for the location of the anchor.
- o An auger for tying down mobile homes is suitable as an anchor for the end post. Burying a cinder block or installing a brace post is another approach.
- Repeat the process until the location of all end posts and row posts have been marked.

Figure 3. Trellis system showing end post and anchor for securing the trellis wire.



TRELLIS SYSTEM

The Single-Wire Trellis System is recommended because of:

- o simplicity of establishing and maintaining the vineyard,
- o flexibility and ease of adapting to a wide range of mechanized operations,
- o lower establishment and maintenance cost than any other system, and
- o good track record of vine growth and yield performance in Florida.

Note: The Geneva Double Curtain Trellis System is sometimes used by growers for fresh fruit production. This system is capable of producing 25% higher yield than the Single-Wire Trellis System but require 20-25% higher investment and also a higher maintenance and harvesting cost. For more information, contact the Center for Viticulture and Small Fruit Research.

Best Management Practices

- The end post should be pressure treated and 8-10 inches in diameter and buried at least 3 feet deep with 6 feet above ground. It is recommended that the end post be buried at a slight angle and then anchored to the ground using a screw auger. Use a 10 foot end post with a minimum life-span of 25 years (4A). Other techniques to anchor the end post, such as the H-brace, concrete block and steel auger can also be used. See Figures 4B and 4C.

Figure 4A. Diagram showing position of end post with screw auger as anchor.

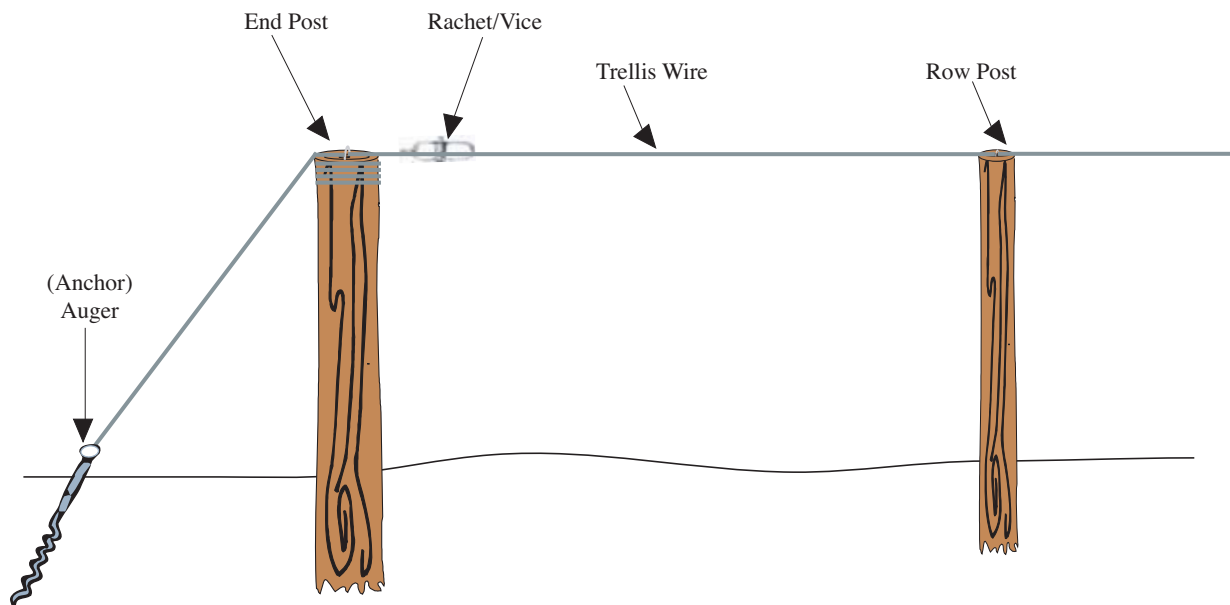


Figure 4B. Diagram showing H-brace used as anchor for end post.

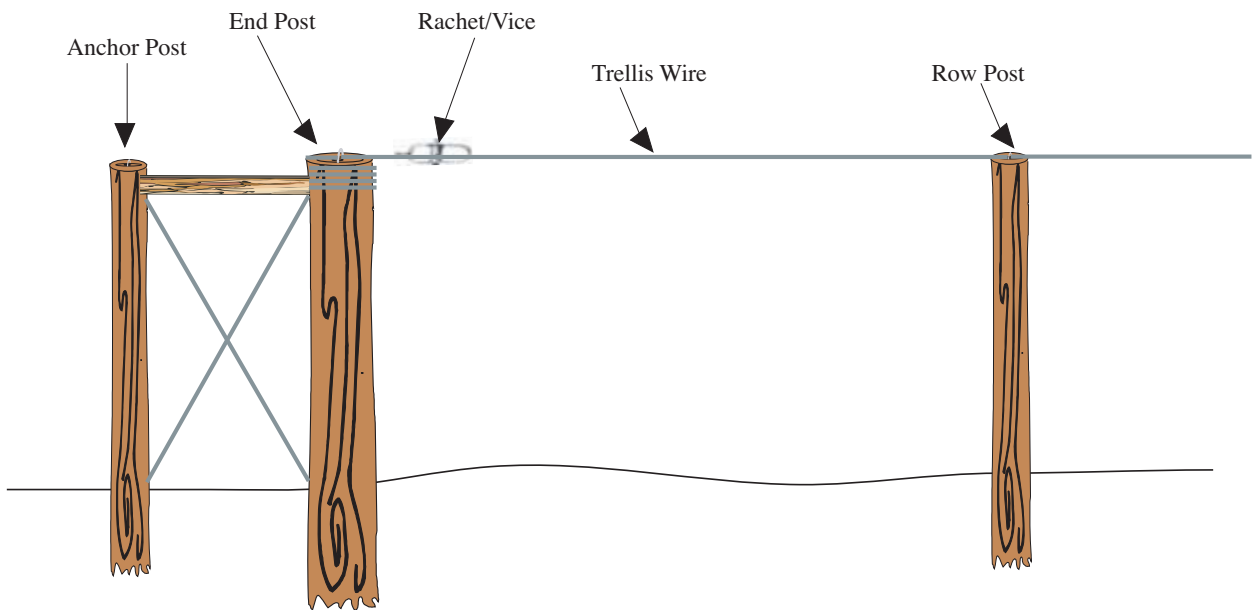
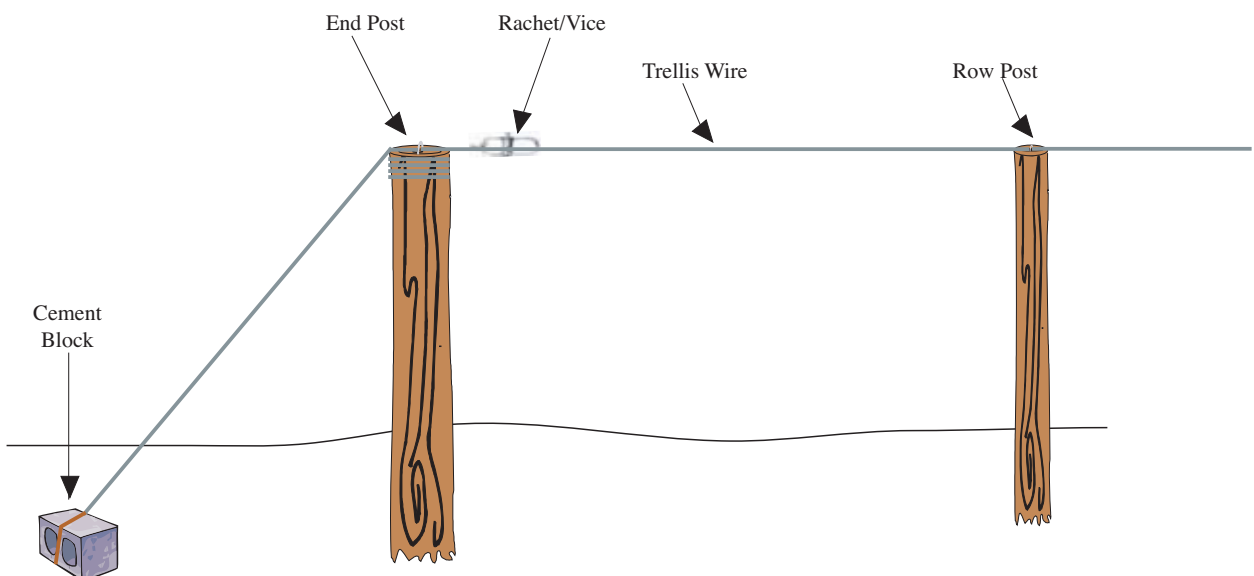
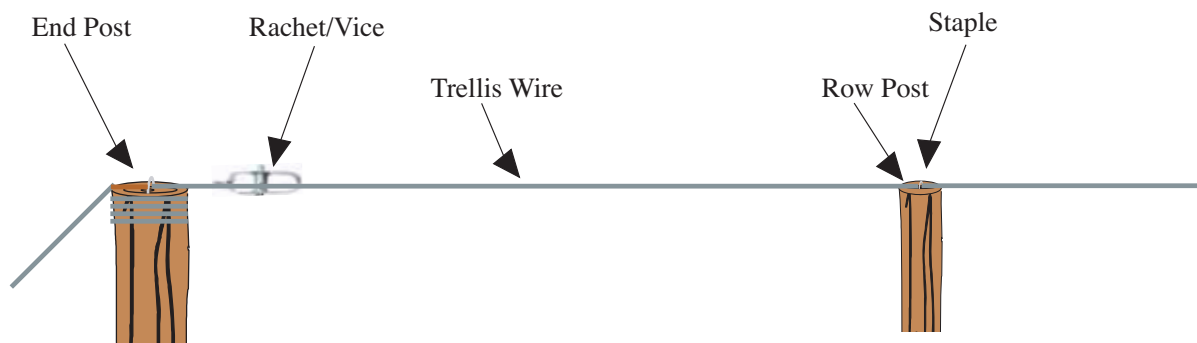


Figure 4C. Diagram showing concrete block used as anchor for end post.



- To strengthen the end post, it is often necessary to attach a brace wire from the top of the end post to the anchor, located about 4.5 feet from it.
- The row posts should also be pressure treated and 4-6 inches in diameter and buried at least 2 feet deep with 6 feet above ground. Use an 8 foot row post with a guaranteed life-span of 25 years.
- The trellis wire should be a 9 gauge galvanized wire or a 12 gauge high tensile steel wire. Do not over tighten the wire.
- Use 2 inch staples to guide and hold the trellis wires over the row posts but do not nail the staples completely down to the post. There should be sufficient gap under the staples to allow the trellis wire to be tightened when necessary (Figure 5).
- A ratchet should be installed at one of the end post to tighten the wire when necessary and before the next growing season to prevent sagging cordons.

Figure 5. Diagram of trellis wire secured on top of end and row posts.



Economic Consideration

- Purchase good quality materials, particularly, the end posts and trellis posts that are expected to last at least 25 years in the vineyard. The construction cost of the trellis system is the most expensive component of the vineyard establishment cost.
- Select the single-wire trellis system to use in the vineyard because it is the most economical system. It is expensive to modify a trellis/ production system once the vineyard is established, and sometimes impractical to do so.
- A thinner (higher gauge) wire will not be able to withstand the weight of the fruits and canopy when the vines are matured. This will result in a greater frequency of wire snapping and will result in a higher vineyard maintenance requirement.

IRRIGATION SYSTEM

A good irrigation system is indispensable for a healthy and productive vineyard that pays for itself in the long run through higher yields of quality fruits. Vines with irrigation grow faster and are more vigorous than non-irrigated vines. As a result, they are also better able to tolerate pests and diseases. Established vines too respond to irrigation, in many cases, there is an increase in yield and fruit quality, particularly, during the berry development stage. When the drip system is used, water losses due to surface runoff, evaporation losses and percolation are minimized.

It is recommended that an irrigation specialist be consulted to design an irrigation system for the vineyard that should take into consideration the following factors:

- o Availability and adequacy of irrigation water to all areas of the vineyard.
- o Cost efficient system that is reliable and easy to operate.
- o Integrated system for delivering water, fertilizers and chemicals.
- o Minimize uneven distribution of water resulting from low water pressure and other technical constraints relating to water use in the vineyard.

Best Management Practices

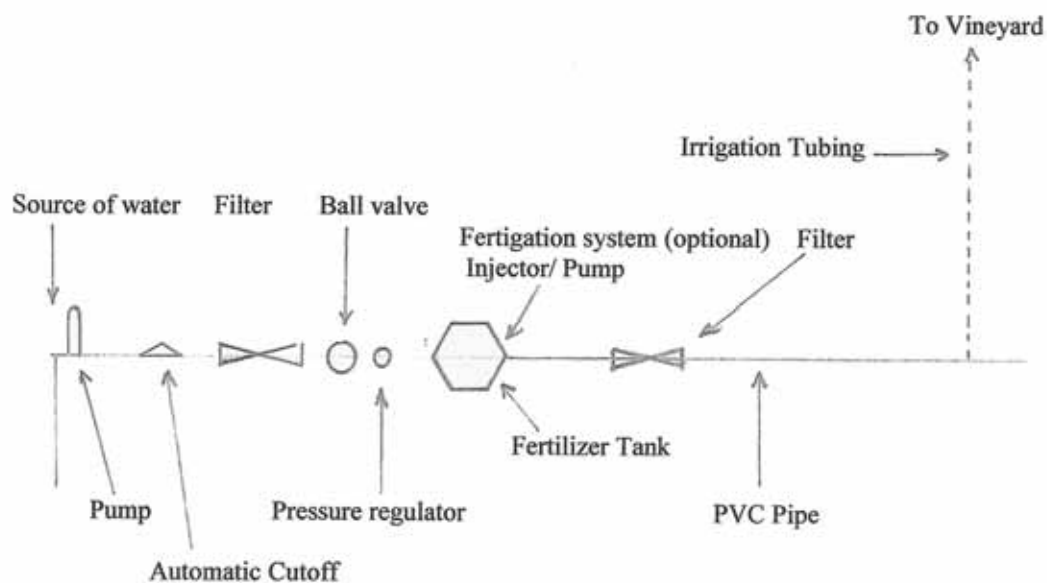
Installing the Irrigation System

- Construct the well at an appropriate site so that the irrigation water could be easily piped to all areas of the vineyard. Check with the drilling company to ensure that the well depth is adequate to provide the necessary volume of water for the vineyard.
- The drip or trickle system is the most common and efficient system for grapes in Florida. However, in very sandy areas, the microjet system may be more efficient. Overhead sprinkler irrigation is not recommended for vineyards. Include a fertigation system with a flow meter in the design. This will be useful for adding liquid fertilizers and other chemicals, if desired, to the irrigation water and be able to monitor the volume of water delivered (Figure 6).
- Include a backflow prevention valve and a filter near the pump.
- Install the irrigation system after the trellis system has been established but before the vines are planted in the vineyard.
- Hang the irrigation tubing about two feet from the ground. Use a 12 gauge galvanized wire to attach the irrigation tubing. If the length of the vineyard is 300 feet or less, use a half inch tubing to provide water. If the length is more than 300 feet, check with an irrigation specialist.
- There should be one emitter per vine. The number of emitters could be increased to two, but often times, it is not necessary. The desired volume of water can be obtained by varying the operating period. The emitter should be able to provide at least one gallon of water per hour per vine. Use pressure compensated emitters.



- Bury all PVC pipes and irrigation valves about a foot below ground to prevent and minimized accidental damage. Also, below ground pipes will be better protected from hard freeze damage.
- Maintain and update the irrigation map of the vineyard showing type, size, and location of the pipes. Keep this as a permanent record. This will facilitate repairs as well as prevent accidental damage to the underground pipes and valves.

Figure 6. Example of layout of irrigation system.



Operating the Irrigation System

- Operate the irrigation system at the recommended pressure for maximum efficiency.
- Start the irrigation in early spring as growth begins. Continue the irrigation if the weather is dry until about harvest time.
- The quantity of water to be applied should be based on vine need. Provide one gallon per vine per day in summer for newly planted vines and increasing to 2-3 gallons per vine per day for mature vines, depending on soil type and weather condition. Excess water contributes to leaching of plant nutrients into the groundwater. At the Center, mature vines received up to 5 gallons of water per day during hot summer days. In very sandy areas, the amount of water may be higher, depending on weather conditions. For more information, please see *Irrigation and Mineral Nutrition* by John Clarke and James Spiers.
- The amount of water needed per acre per minute from the water supply can be calculated as follows:

$$(\text{Flow rate of emitter/hour} \times \text{Number of vines/acre}) / 60 \text{ minutes.}$$

- Check the emitters, periodically, to ensure that they are not clogged and are delivering the desired quantity of water.
- Use a tensiometer to determine the moisture level in the soil and to help determine if the vineyard should be irrigated. Install a rain-shut off device to prevent irrigation during a heavy rain shower.
- Many irrigation timers have a rain-shut off feature that could be easily operated with a sensor.
- The system should be flushed during the spring time to clear any algae and mineral clogging of the emitters. A mild bleach solution could be used to clean the system. Other cleaning agents are also available from several companies.
- Use a timer for the system to operate in the morning or late afternoon to minimize evaporation. During the hot summer days, night irrigation is an option.

Stop Irrigation

- The irrigation should be discontinued after harvesting, this is to slow the growth and allow the vines to gradually hardened and prepare for the winter.

Economic Consideration

It is often advantages to have a deep well to provide 50% more water than the projected requirement of the vineyard.

- Install a reliable system. It is often expensive and time consuming to repair or to replace an irrigation system.
- Use the thickest (schedule 40) PVC pipe available to minimize line breakages and extend the operating life of the system.



PLANTING THE VINES

Best Management Practices

Planting Potted Vines

- Plant vines that are healthy and vigorous looking. Do not use potted vines that are more than two years old as they are always root bound.
- Mark the planting holes to ensure that they are properly spaced and aligned within the row, before digging. The recommended spacing is 12-16 feet apart between vines, depending on soil fertility. At the Center the vines are planted 12 feet apart and 6 feet from the row posts (Figure 7).
- For growers using mechanical harvesters, it is recommended that the vines be planted 16 feet apart, and 1 foot from the post. This will minimize mechanical injury to the vines during harvesting (Figure 8).
- The planting holes should have at least a 10 inch diameter or about twice the size of the pot and be about 12 - 18 inches deep. The hole should be larger than the vine and potted soil and there is at least a one inch space around it (Figure 9).
- Enrich the planting hole with peat moss, compost or other soil enhancer.
- Put 2 - 3 tablespoons (3 oz) of slow-release fertilizer (10:10:10) or (13:13:13) into each planting hole and mix it with the soil.
- Untangle and prune any pot-bound roots before planting.
- After planting, select a main vine and pruned all other side branches and shoots.
- The vines should be watered as soon as possible after being planted and should receive about a gallon of water every other day for two weeks and then every three or four days, depending on weather condition for two months.
- Support the vine with a guide string or bamboo stick to keep it straight and help it reach the trellis wire.
- Use a grow tube to promote vertical vine growth. Vines with grow tubes generally reached the trellis wire within a year, when planted in spring.



Figure 7. Planting the vines using 12 x 12 spacing.

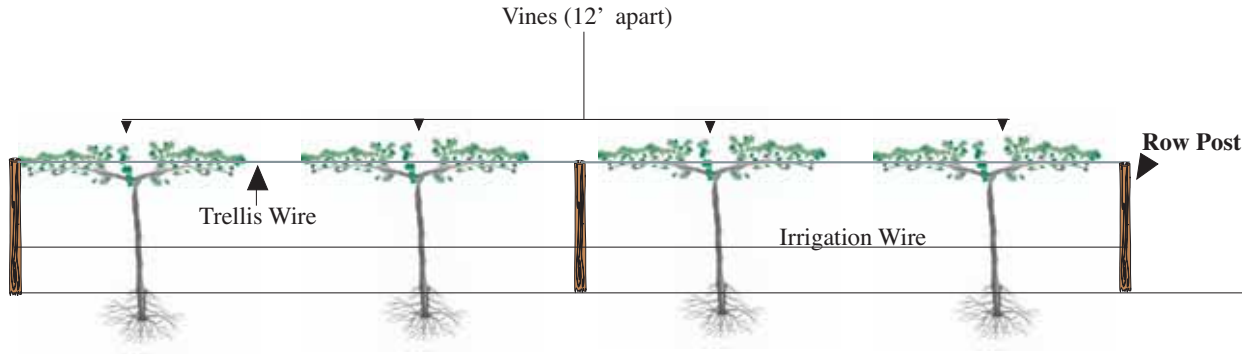


Figure 8. Planting the vines using 12 x 16 spacing

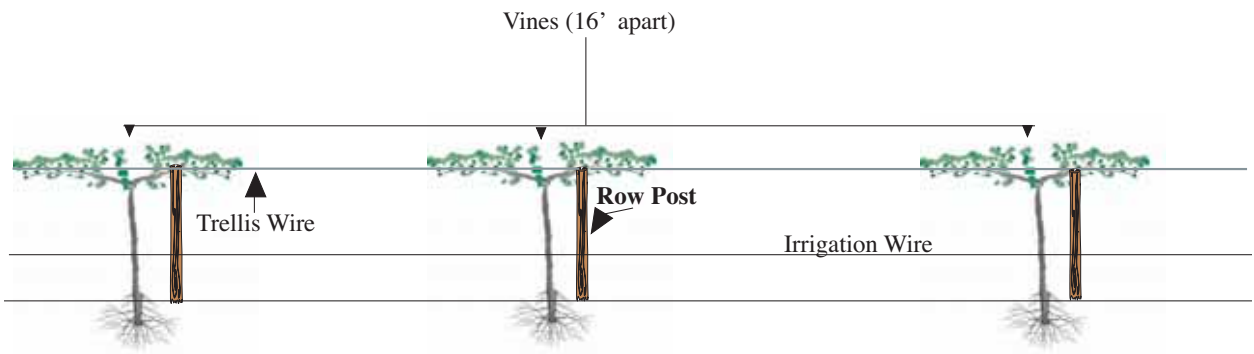
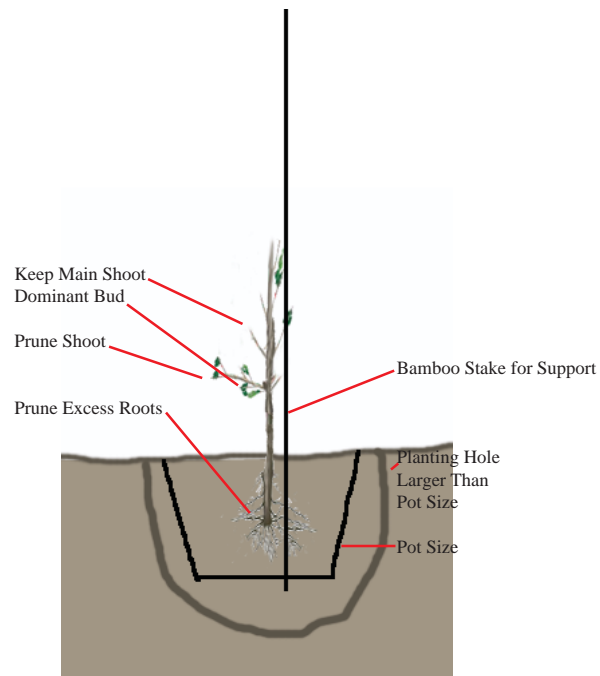


Figure 9. Planting potted vines.



Economic Consideration

- For a large vineyard, it may be necessary to place the order with a reliable nursery or grower one year in advance, to ensure that the vines will be available at the desired time.
- Potted vines are often more expensive than bare root vines and are also impractical and uneconomical to be shipped in large quantities from out-of-state nurseries.

Planting Bare-Root Vines

- Bare root vines may be planted in the vineyard during the winter months (December – March).
- Plant the bare root vines as soon as possible. If it is not possible to plant all the vines, stack them up and cover the roots with sand or dirt to keep the roots wet and cool. The vines may also be kept in a cool room, if it is available.
- The planting holes should be about 10 inches wide and 18-24 inches deep. The vines should be planted immediately after the holes are dug to prevent the soil from drying up.
- Bare root vines should be pruned so that they fit into the planting holes. Retain about a foot of stem with 3 - 4 buds. Check and remove diseased and damaged roots. Remove excessive roots and side branches (Figure 10).
- After pruning the excess roots, dust them with a rooting hormone before planting. A rooting hormone containing 0.8% Indole-3-butyric Acid (IBA) (# 3) has been found to be helpful in promoting root growth. A simple way is to put the bare roots in a plastic bag with the rooting hormone and shake the bag.
- If possible, mix peat moss, compost, or any soil enhancer with the soil in the planting holes before planting the vines.
- Put about 2-3 tablespoons (3oz) of slow-release fertilizer (10:10:10) in each planting hole to be mixed with the soil before planting. Plant the vines no deeper than 12 inches in the hole.
- After planting, the soil around the vine should be lightly compacted and watered as soon possible with about one gallon of water every other day for two weeks and then every three or four days, depending on weather condition for two months.
- After planting, support the vine with a guide string, preferably a bamboo stick, to keep the trunk straight as it grows toward the trellis wire.
- Use a grow tube to facilitate vertical growth and the vine will reach the trellis wire within a year (Figure 11).



Figure 10. Planting a bare-root vine.

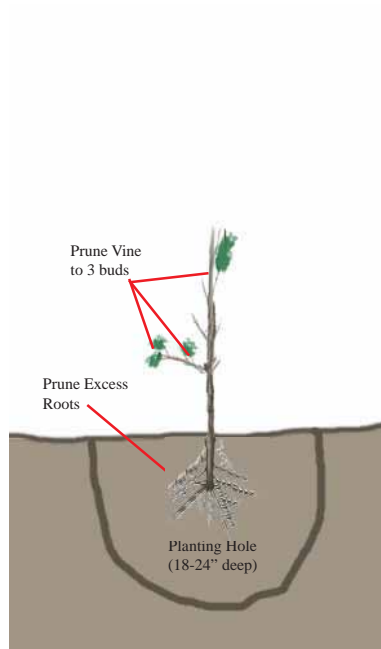
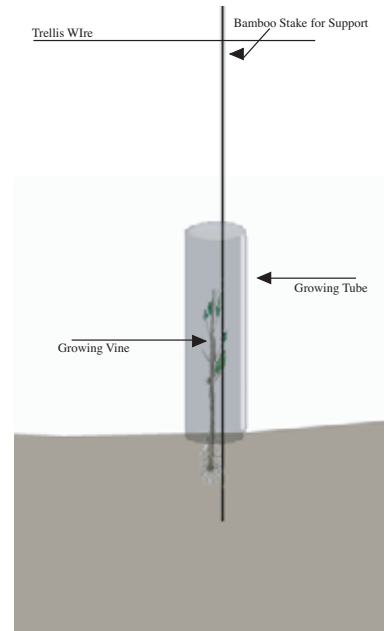


Figure 11. Vine with a grow tube.



Economic Consideration

- For a commercial vineyard, place the order with a reliable nursery or grower one year in advance, to ensure that the vines will be available at the desired time.
- Bare-root vines should be planted between January and March and are not suitable when the weather gets hot. When planted at the appropriate time and properly cared for, bare-root vines have a good rate of success of 95% or better.
- Use bare-root vines for large scale planting. It is uneconomical and often impractical to use potted vines to establish a large vineyard.

Planting Pollinators

The pollinators should be planted at the same time and in the same manner as the other vines.

- Pollinators should be planted in the same cultivar row. That is, do not plant different pollinators in the same row to facilitate harvesting and marketing.
- Commonly used pollinators are: Alachua, Noble, Carlos, Doreen, Magnolia, Nesbitt and Triumph.
- Establish the first row as the pollinator row, followed with two rows of female muscadines and then a pollinator row. Repeat this process until the whole vineyard has been planted.
- If the selected muscadine cultivar(s) to be planted is self-fertile, then no pollinators need to be planted in the vineyard.
- Many of the patented muscadine cultivars are females and require pollinators. If uncertain, check with the county extension agent or the Center for Viticulture and Small Fruit Research, to determine if pollinators are required for the desired cultivars to be planted. Some examples of standard female muscadine cultivars that need pollinators are Fry, Jumbo, Higgins, Hunt, Jumbo and Summit

Figure 12. Layout showing location of pollinators and female cultivars in the vineyard.



Economic Consideration

- Plant pollinators such as *Carlos* or *Noble*. The grapes from pollinators may be sold as winegrapes but check with the wineries for cultivar preference.



VINEYARD MAINTENANCE

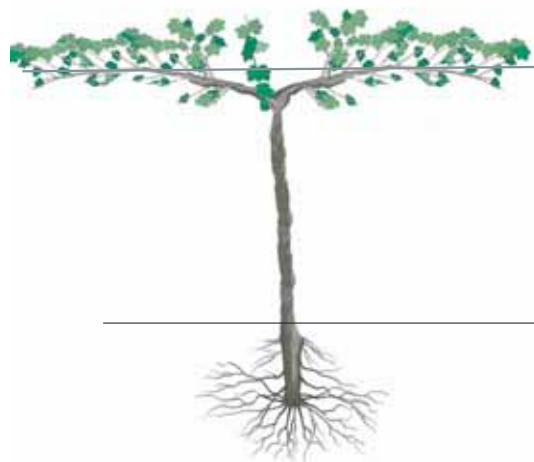
Training the vines

It is extremely important to train the newly planted vines to ensure that they reach the trellis wire as soon as possible for them to produce economic yields. In most instances, the vines will begin to produce economic yield in the 3rd year.

Best Management Practices

- Maintain a single stem or trunk and prune all side branches to encourage vertical growth, until the vine reached the trellis wire.
- Use a grow tube to promote vertical growth. Vines with grow tubes usually reached the trellis wire within a year.
- Check the vines on a regular basis (once a month) and remove any side branches or lateral growth to ensure that the trunk is growing straight.
- Allow the vine to grow 3 -6 inches beyond the trellis wire and then cut or pinch the shoot (tip) back to the wire and allow 2 buds to produce the trellis arms (cordons).
- Allow the two cordons to grow into the fruiting arms. One on the left and one on the right of the main trunk on the trellis wire (Figure 13).
- Keep the two cordons no longer than 6 feet long on either side of the main trunk if the vine is spaced 12 feet apart and. If the vines are spaced 16 feet apart, keep the cordons to 8 feet on either side of the main trunk.

Figure 13. Training the vines to develop proper cordons.



Economic Consideration

- It pays to use grow tubes since the vines reach the trellis wire sooner and will come into fruition much earlier. The grow tubes also protect the vines from herbicide spray.

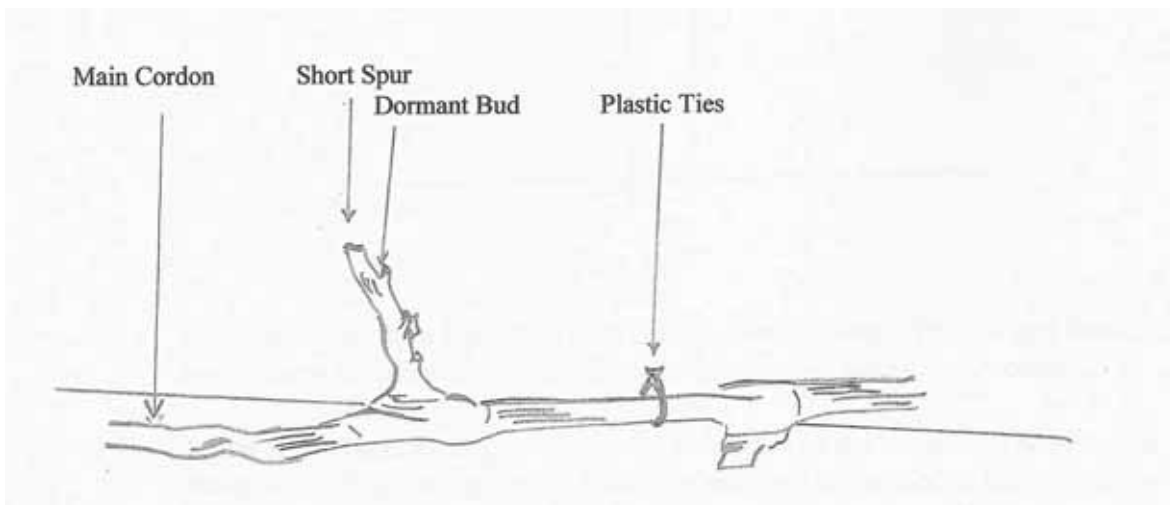
Dormant Pruning

Dormant pruning is done during the winter months when the vines are in dormancy. During the first year, pruning is done to train the vines to make sure that it reaches the trellis wire and facilitate the development of desired vine canopy that will impact future fruit production. For mature vines, pruning is done to remove the previous year's growth, including diseased and damaged cordons, removal of old spurs that are no longer productive, and removal of tendrils. The goal is to remove unwanted plant material in order to maintain the desired canopy shape that will promote vine growth, facilitate disease management to ensure the continued production of high quality fruit.

It is recommended to keep 3-4 buds per spur (short spur). Long spurs (4-10 buds per spur) are not recommended for muscadines (Figure 14). When mechanical pruners are used, it may be necessary to follow-up with hand-pruning to ensure that the spurs are properly pruned to the desired length and numbers.

Use good quality pruners and loppers for a more efficient job.

Figure 14. Example of short spur pruning.

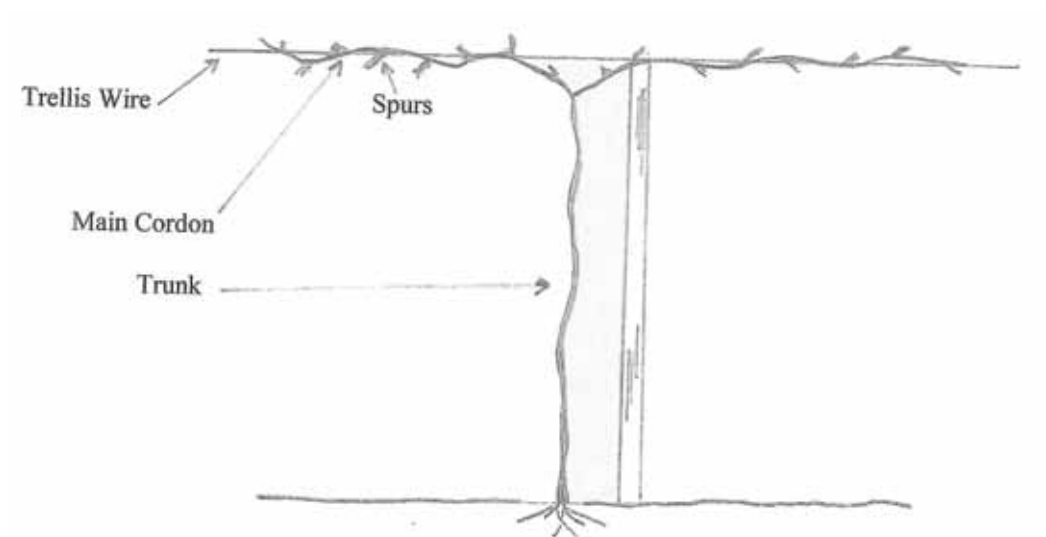


Best Management Practices

Year 1

- Keep the main trunk free from lateral branches and shoots to encourage vertical growth. There is no need to remove the leaves on the stem.
- If the main trunk has reached the trellis wire, cut it and leave 2 buds to form the fruiting arms, one on either side of the main trunk (Figure 15).
- If the main trunk has not reached the trellis wire by fall, should be pruned back to 2 buds and retrained to the wire in the spring.

Figure 15. Pruning a young muscadine vine – Year 1.



Year 2

- Keep the main stem free from side branches and shoots. Pruned any branches that may appear on the main stem. Repeat this process every few months.
- Allow side branches to grow from the two arms of the cordon. These lateral stems or canes growing on the main cordons will be pruned at the beginning of the 3rd year. Try to space the canes about 4 inches apart on the main cordons. If too many canes are left, it will create a thick and dense canopy that will not be desirable.
- Some flowering may occur but there is no necessity to remove them if the vines are healthy and growing well. If the vines are not vigorous, removing the flowers may be a desirable option.

Year 3

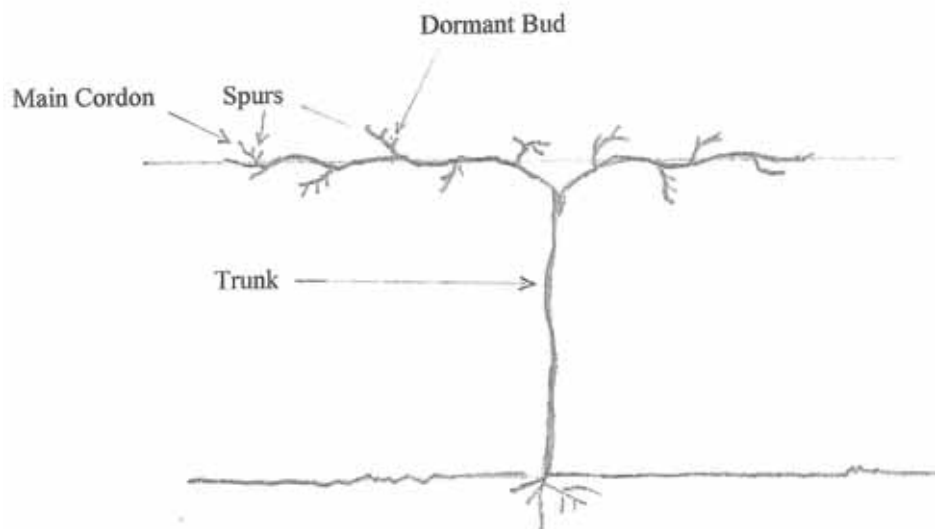
- At the beginning of the 3rd year, prune back the canes on the main cordons, leaving about 3-4 buds per spur. In the spring, these buds will produce new shoots and flowers. There is no necessity to remove these flowers.
- Maintain about 3-4 spurs per node on each cordon. Excess spurs will provide for a dense foliage and canopy will present a challenge if left unmanaged. The excess spurs will produce higher total yield in the short run, but of lower quality in terms of berry size, sugar content and soluble solids content.
- Keep the two main cordons to no more than 6 feet long on either side of the main stem, for vines spaced 12 feet apart and not more than 8 feet long for vines spaced 16 feet apart.
- Keep the space between the nodes to about 4 inches apart. Pruned the excess growth between the nodes.



Years 4-5

- At the beginning of the 4th year, pruned the long canes from the previous year's growth to 3 – 4 bud spurs. Keep only the healthy spurs.
- Remove diseased and dead canes and spurs on the vines.
- Keep the two main cordons to no more than 6 feet long on either side of the main stem.
- Keep the space between the nodes to about 4 inches apart. Pruned the excess growth between the nodes (Figure 16).
- Thin the spurs on the canes to prevent excessive spurs from overcrowding the cordons. Excessive spurs tend to produce excessive foliage that will lead to a dense canopy that is not desirable.
- Spur thinning is important, particularly, on marginal soils for selected muscadine cultivars, to avoid yield reduction. Yield from *Carlos* has been reported to decline because of excessive previous year's growth.
 - o Leaving excessive spurs on the vines will lead to over-cropping. The extra spurs will produce a bumper crop. Although the yield is higher, but the quality of the berries are lower. The heavy fruit load is bad for the vines because the yield in subsequent years will decline until proper pruning is done to correct the problem.
 - o Excessive spurs will also lead to a dense canopy that will be conducive for fungal diseases to spread and infect the berries.
- During the pruning process, remove the tendrils on the cordon and canes to prevent girdling.

Figure 16. Dormant pruning of mature muscadine vine.



- After the pruning operation is completed, check the trellis system to make sure that the trellis wires are in place.
- Replace or connect all broken wires and tighten them during the winter months (December – February), including the irrigation system, immediately after dormant pruning.
- Straighten the row posts, and replace damaged posts.

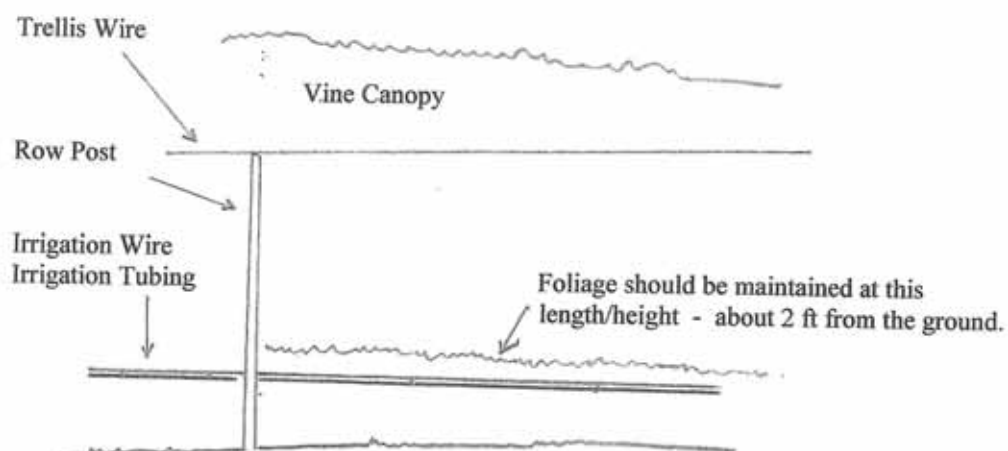
Summer Pruning

Summer pruning may be necessary, depending on the growth status and condition of the vines. For some vigorously growing muscadines, the branches or canes from the fruiting cordon may grow more than five feet long and in many cases even reached the vineyard floor like a curtain that restricts air circulation and light penetration. The dense foliage encourages pests and promotes diseases. The overhanging vines also make weed control under the canopy difficult. The canopy should be managed in accordance with good vineyard management practices. The goal is to create a microclimate within the canopy that will minimize diseases and facilitate the production of quality grapes. Contrary to some misperceptions, summer pruning does not reduce yield or damage the vines.

Best Management Practices

- Trim all overhanging vines below the irrigation wire (about 2 feet from the ground) with a hand pruner or a mechanical trimmer (Figure 17).
- Pruned vines (canes) should be collected and discarded from the vineyard.

Figure 17. Summer pruning of overhanging vines to promote air circulation.



Safety and First Aid

Farm chemicals are hazardous and should be treated with care by all persons coming into contact with them. Failure or abuse may cause injury or death to the persons who are applying the chemicals and endanger the environment. For more information on how you can protect yourself and the environment, please read *A Guide on Hazardous Waste Management for Florida's Agricultural Pesticide Users*. Do not apply **restricted pesticides** unless you have a license, otherwise use the services of a licensed applicator.

Recommended safety standards for grape growers:

- Read and follow all recommendations and safety tips listed on the label, including the **Worker Protection Standard (WPS)** listed on it. It is recommended that all growers be knowledgeable and familiar with the safety standards and requirements involved in pesticide application. A summary of the **WPS** listed on the Environment Protection Agency (EPA) website (www.epa.gov/agriculture) is reproduced below and a grape grower must be knowledgeable and comply with the requirements:
 - **Protection during applications** — Applicators are prohibited from applying a pesticide in a way that will expose workers or other persons. Workers are excluded from areas while pesticides are being applied.
 - **Restricted –entry intervals** – Personal protective equipment must be provided and maintained for handlers and early-entry workers.
 - **Notification to workers** – Workers must be notified about treated areas so they may avoid inadvertent exposures.
 - **Decontamination supplies** – Handlers and workers must have an ample supply of water, soap, and towels for routine washing and emergency decontamination.
 - **Emergency assistance** – Transportation must be made available to a medical care facility if a worker or handler have been poisoned or injured. Information must be provided about the pesticide to which the person may have been exposed.
 - **Pesticide safety training and safety posters** – Training is required for all workers and handlers, and a pesticide safety poster must be displayed.
 - **Access to labeling and site specific information** – Handlers and workers must be informed of pesticide label requirements. Central posting of recent pesticide applications is required.
- The **WPS** was introduced to protect all vineyard workers involved in the use of pesticides or come in contact with them. Grape growers and family members who use pesticides must comply with all the requirements relating to the need of personal protective equipment (PPE) and re-entry interval (REI) restrictions listed on the label. More information can be obtained from *Interpreting PPE Standards on Pesticide Labels* by O. N. Nesheim.
 - Wearing long sleeved shirt and pants, including shoes, gloves and socks that are chemically resistant when applying herbicides and pesticides.
 - Workers should wear coveralls and full-face respirator if recommended by the manufacturer.



- Wash hands, face and head with soap after all field operations and discard all coveralls that are contaminated.
 - If any farm chemical comes into contact with the skin, wash the area with soap and water.
 - Have a decontamination site, including, an eye-wash and first-aid kits in the vineyard for emergency.
 - All personal protection equipment such as goggles and coveralls should be properly washed and cleaned before storing them for future use.
 - Do not eat, drink or smoke when spraying the pesticides.
 - Never siphon any chemical by mouth.
- Call the poison center or doctor in an emergency. Have the telephone numbers posted at the work site.

Re-Entry Restrictions

Before spraying, check the label to determine if there is any re-entry restriction for entering the vineyard. There is usually a 24 hour re-entry restriction for most pesticides. No person is allowed into the sprayed area within the restricted period unless appropriately dressed in personal protection equipment (PPE) listed on the label. For more information contact the EPA.

For more details on the major laws and regulations governing the registration, storage, handling and application of crop protection chemicals and fertilizers, the reader is recommended to refer to *Section E, Regulatory Compliance, Crop Protection Handbook 2005*.

Pest and Disease Management

Record Keeping Requirement

It is necessary to protect the vines from pests and diseases if they are to produce the maximum yield and quality fruits. This often entails the use of fungicides and insecticides to control the diseases and pests and should be carefully monitored and recorded. Misuse and abuse of pesticides is a legal offense as well as hazardous to consumers and the environment.

The 1990 Farm Bill requires that all persons, including grape growers who want to purchase and use **restricted pesticides** must be licensed and required to keep detailed records as listed in “*Record Keeping Manual for Private Pesticide Applicators*.” The information must be recorded in the manual within 14 days of pesticide application and kept for 2 years. The manual must be made available to USDA authorized representatives, state authorized representatives or health care professionals with valid reasons. A grower or farmer in Florida will need a license from the Florida Department of Agriculture and Consumer Services to purchase and use restricted pesticides.



For unrestricted pesticide use, there is no legal requirement to maintain a record keeping manual, but, it is a good practice to do so. To get a copy of the record keeping manual contact the Pesticide Record Branch or any of the county extension office:

Pesticide Records Branch
Agricultural Marketing Service, USDA
8609 Sudley Road, Suite 203
Manassas, VA 20110
Tel: (703)330-7826

Disease Management

The muscadine grape is a hardy plant but not resistant to all diseases. The vines and grapes are still susceptible to several fungal pathogens that, if left unchecked, can sometimes inflict severe crop losses. The hot and humid summer days and warm nights provide an ideal condition for fungal diseases to spread, and it is a good practice to do preventive spraying to keep the diseases in check before any outbreak occurs. The following diseases are commonly found in the vineyard (See *Symptoms of Muscadine Grape Diseases in South Carolina* and *Spots, Rots and “Why are my muscadines falling off?” Identification and Control of Muscadine Grapes*).

Angular Leaf Spot —*Mycosphaerella angulata* – Angular lesions on the leaves. Causes yellowing and leaves to drop.

Black Rot - *Guignardia bidwellii* – Infected leaves have brown spots with black pimples on them.

Ripe Rot —*Glomerella cingulata* – Infected berries appear to have sunken or flat rotted areas on the surface. Pink or light brown colored spores often appear on the surface of rotten berries. The fungus also attacks berries.

Bitter Rot —*Melanconium fuligineum* – Infected berries start with brownish, water-soaked spots. At a later stage, the spots enlarge and the berries turn black and shrivel. The disease also appears on leaves, stems, blossoms and flower buds.

Macrophoma Rot —*Botryosphaeria dothidea* – Infected berries have depressed rotten spot surrounded by a greenish colored ring surrounding it.

Powdery Mildew —*Unicinula necator* – Infected leaf surface shows presence of grayish, powder-like moldy fungus on the surface of the leaves and berries. The fungus also infects the berries and cover them with white powdery mildew.

Eutypa Dieback — *Eutypa lata* – Often found in older vineyards. Infected vines are stunted with small, chlorotic, distorted leaves that are often seen in spring (very much like a herbicide injury). Berries from infected vines do not develop. A classic symptom of the disease is a V-shaped canker in the cross-section of the infected vine. The infected vine becomes twisted and distorted as it dies on the trellis. Recommended control measures include: (2006 *Southeast Regional Muscadine Grape Integrated Management Guide*).



- Remove infected vines from the vineyard and destroy them. Cut the vine below the infected wood.
- Sanitized and disinfect all pruning tools to prevent the disease from spreading to other vines.
- Practice good vineyard husbandry and pest management to minimize disease incidence.

Try to delay pruning the vines to as late as possible to minimize the chances of infection as the spores are released during winter and early spring. There are no fungicides currently available to effectively control *Eutypa* and *Botryosphaeria* dieback. However, a good spray program will greatly help to minimize their occurrences.

Best Management Practices

- Check the vineyard for signs of disease and start spraying the vineyard with fungicide before bloom.
- Spray the vineyard about 2-3 weeks later, that is after bloom.
- Continue spraying the vineyard once every four weeks, thereafter.
- If the weather has been raining, spraying may have to be done every two weeks.
- Use sufficient water (100-150 gallons of water) to thoroughly wet the leaves and berries.
- Use a motorized sprayer with appropriate nozzle orifice to spray. Check manufacturer's recommendation.
- Spray in the morning when it is calm. Do not spray when it is windy.
- Take precautions and follow Workers Protection Standard when spraying.
- Clean all spray equipment after use.

Pest and disease management program used at the Center:

Spring and Summer Schedule

- First spray – Nova 40W + Manzate 200DF
- Second spray – Manzate 200DF + Captan 50-WP
- Third spray – Nova 40W + Captan 50WP
- Fourth spray – Abound
- Fifth spray – Topsin M70WSB + Captan

Fall Schedule

- Fall spray – Manzate 200DF + Captan 50WP
– Copper Sulfate (Dormant Spray)

Application Rate and Worker Protection Standard

Fungicide – Nova 40 W (myclobutanol)

Control Black Rot, Bitter Rot, Angular Leaf Spot, Powdery Mildew

Rate/ac 3-5 oz

PHI 14 days



PPE	Long sleeved shirt and long pants, waterproof gloves, shoes plus socks, protective eyewear, chemical resistant apron when cleaning equipment, mixing or loading.
Early PPE	Coveralls, waterproof gloves, shoes plus socks, protective eyewear, chemical resistant headgear for overhead exposure.
REI	24 hours
Maximum	18 oz per season.

Fungicide – Captan 50 WP

Control Black Rot, Bitter Rot, Angular Leaf Spot

Rate/ac	4 lb
PHI	1 day
PPE	Long sleeved shirt and long pants, waterproof gloves, shoes plus socks, protective eyewear, chemical resistant apron when cleaning equipment, mixing or loading, approved respirator.
Early PPE	Coveralls, waterproof gloves, shoes plus socks, protective eyewear.
REI	4 days

Fungicide – Manzate 200DF (mancozeb)

Control Black Rot, Bitter Rot, Angular Leaf Spot

Rate/ac	2-4 lb
PHI	66 days
PPE	Coveralls over long sleeved shirt and long pants, waterproof gloves, shoes plus socks, protective eyewear, chemical resistant apron when cleaning equipment , mixing or loading.
Early PPE	Coveralls over long sleeved shirt and long pants, waterproof gloves, shoes plus socks.
REI	24 hours
Maximum	24 lb per season

Fungicide – Topsin M70WSB(thiophanate-methyl)

Control Black Rot, Bitter Rot, Angular Leaf Spot, Powdery Mildew

Rate/ac	1-1.5 lb
PHI	14 days
PPE	long sleeved shirt, long pants, water proof gloves, chemical resistant footwear plus socks, chemical resistant apron when cleaning, mixing or loading, approved respirator.
Early PPE:	coveralls, waterproof gloves, chemical resistant footwear plus socks.
REI	12 hours
Maximum	4 lb per acre per season. Should not mixed with benzimidazole fungicide.



Fungicide: – **Abound (azoxystrobin)**

Control Black Rot, Bitter Rot, Angular Leaf Spot, Powdery Mildew

Rate/ac 11-12 fl oz

PHI 14 days

PPE Long sleeved shirt and long pants, waterproof gloves, shoes plus socks.

Early PPE Coveralls, waterproof gloves, shoes plus socks.

REI 4 hours

Maximum 4 applications per acre per year. Do not apply more than 2 sequential sprays.

Fungicide: – **Copper Sulfate (Basic)**

Control Black Rot, Powdery Mildew

Rate/ac 2 lb / 100 gallon water

PHI 14 days

PPE Long sleeved shirt and long pants, waterproof gloves, shoes plus socks, protective eyewear.

Early PPE Long sleeved shirt and long pants, waterproof gloves, shoes plus socks, protective eyewear.

REI 24 hours

Note: PHI = Pre-harvest interval. Minimum number of days before harvest is allowed.

PPE = Minimum personal protection equipment to be used by applicator.

REI = Re-entry interval, the number of hours to be restricted for anyone to entry the area unless with appropriate protection equipment.

Early PPE = Anyone entering a restricted area before the REI is completed must wear the appropriate personal protection equipment.

Source: Insect and Disease Control Guide. Vol. 1, Meister Publishing Co. 1999.

2006 Southeast Regional Muscadine Grape Integrated Management Guide.



Insect Pest Management

Insect pests are not a major problem for muscadine grapes in Florida except for the Grape Root Borer (GRB) that is able to inflict major damage in selected areas. Although several insect pests such as the glassy-winged sharpshooter, grape leaffolder, grape curculio, grape flea beetle, and grape phylloxera are commonly found in the vineyards, they often do not cause substantial economic damage to the vines or berries as to warrant control measures. (Photographs of pests can be seen in *Insect Pests of Grapes in Florida*). However, if leaf damages are observed, it may be necessary to spray the vineyard with insecticides such as malathion or sevin to control the pests, except for the Grape Root Borer.

Best Management Practices

- Scout the vineyard and look for pest damages.
- If significant damages are observed, then spraying the vineyard is justifiable.
- Take precautions, and observe Workers Protection Standards.

The pest management program used at the Center is a flexible one. Sevin is used to control the insect pests on a as per need basis. For phylloxera and grape flea beetle, it may be necessary to use other insecticides. Check with the Center for Viticulture and Small Fruit Research or your county extension agent for more information.

Application Rate and Worker Protection Standard

Insecticide – **Sevin 80WSP (carbaryl)**

Rate/acre	1 lb
DBH	7 days
PPE	Long sleeve shirt and long pants, waterproof gloves, shoes plus socks, chemical resistant headgear for overhead exposure.
Early PPE:	Coveralls, waterproof gloves, shoes plus socks, chemical resistant headgear for overhead exposure.
REI	12 hours

Insecticide – **Malathion 57EC**

Rate/acre	3 pints/ acre
DBH	3 days
PPE	Long sleeve shirt and long pants, waterproof gloves, shoes plus socks, chemical resistant headgear for overhead exposure.
Early PPE:	Coveralls, waterproof gloves, shoes plus socks, chemical resistant headgear for overhead exposure.
REI	12 hours

Source: Insect and Disease Control Guide. Vol. 1, Meister Publishing Co. 1999.

Information on other pesticides for grapes can be obtained from *2006 Southeast Regional Muscadine Grape Integrated Management Guide* and *Insect Management in Grapes*.



The Grape Root Borer

The female grape root borer lays her eggs on the trunks and leaves. The eggs fall to the ground and hatched within 2-3 weeks. The newly hatched larvae (most vulnerable stage) then burrows into the ground and feed on the roots, going from larger to larger roots as they grow. After one or two years, the larvae move toward the surface and enter into a pupal stage to become a moth. The moth breaks free and leaves the shiny, paper-thin, brown pupal casing behind near the base of the vine (Dutcher, 2001, Webb, 1991; Liburd and Seferina, 2003). When symptoms of grape root borer attack are observed it is often too late to save the vine. Infected vines have small yellowish leaves, lack vigor and look weak. The berries often failed to develop. Vines attacked by root borers tend to produce above ground roots to sustain themselves but often die back gradually.

It is important to note the periods when the grape root borers are usually most active and abundant in the vineyards when planning control measures to obtain maximum control (Webb et al., 1992, Adlerz, 1986; Weihman and Liburd, 2005).

North Florida: July – end of September

Central Florida: Mid August – mid November

The only insecticide recommended for control of grape root borer is Lorsban 4E at the rate of 4.5 pints/100 gallons water. Spray the ground around the vine or apply about 2 quarts of the mixture around each vine. Only one application per year is permitted and there is a minimum of 35 days before harvest interval requirement. It will be necessary to count back the days from the first anticipated date of harvest to apply the insecticide. It is best to apply during the peak season of emergence since the chemical is effective for about four weeks (Weihman and Liburd, 2005). Randomly check 100 vines in each block and treat the vines if +2% of them are infested or damaged (*2006 Southeast Regional Muscadine Grape Integrated Management Guide*).

Application Rate and Worker Protection Standard

Insecticide – **Lorsban (Chlorpyrifos 4EAG)**

Rate/acre 4.5 pints/ acre

DBH 35 days

PPE Coveralls over short sleeve shirt and short pants, chemical resistant gloves, chemical resistant footwear and socks, protective eyewear, chemical resistant apron when cleaning equipment, mixing and loading, chemical resistant headgear for overhead exposure.

Early PPE Coveralls over short sleeve shirt and short pants, chemical resistant gloves, chemical resistant footwear and socks, protective eyewear, chemical resistant apron when cleaning equipment, mixing and loading, chemical resistant headgear for overhead exposure.

REI 24 hours



Best Management Practices

- Keep the vineyard clean and free of weeds, especially, the area under the canopy and around the trunk area to minimize harborage for adults grape root borers to lay eggs.
- Chemical control methods are not very effective, unless the pesticide is applied at the time when the larvae are on the soil surface. When the larvae are in the ground, it is very difficult to kill them.
- Use Integrated Pest Management Strategies to control the grape root borers as recommended by Weihman and Liburd (2005).
 - Use the Universal Moth Trap baited with pheromone to attract the male grape root borers. Set up 2-3 traps per acre to determine the approximate grape root borer population and the severity of the infestation, if any.
 - Use leopard moth pheromone twist ties to disrupt mating. Loosely fastened one tie per vine at the beginning of the flight season (July – August).
 - The twist ties should be replaced each year to be effective.

Fertilization

It is essential that the vines received adequate nutrients during the growing season for growth and berry development. Under fertilized and over fertilized is bad. Most soils have adequate nutrients to support a satisfactory vine growth but for increased yield and quality fruits, it may be necessary to provide supplementary amounts of fertilizers.

To determine the appropriate amount of fertilizer to apply, it will be necessary to conduct a soil analysis of the vineyard as well as tissue analysis of the vines. Soil analysis should be done once every three years and tissue analysis should be done on an annual basis to determine any nutrient deficiencies in the vines. Magnesium and boron deficiencies are often reported for muscadines and should be carefully monitored because they can affect vine growth and productivity.

Soil Analysis

Soil analysis is done to determine the availability of plant nutrient, including soil pH, in the soil. This is usually done five to six years after the vineyard has been established. There is no need to do an annual soil analysis. The vineyard should be divided into several plots based on soil characteristics and topographical features, and soil samples taken from each plot. If the soil type is uniform and the area is topographically the same, there should be less variation in the results. Randomly, collect 10-20 samples per acre from two soil depths. The first sample should be taken from 0-8 inches and the second sample from 8-16 inches (*The Mid-Atlantic Winegrape Growers Guide*). The county extension office in the area will be able to provide valuable advice and assistance in collecting the soil samples and sending them for analysis as well as interpreting the results.



Tissue Analysis

Tissue analysis provides a reliable means of determining the nutrients in the vines. Based on the tissue analysis report, the appropriate fertilizing program could then be formulated for the vineyard. The recommendation is usually made by the lab that did the analysis, but, some fertilizer companies will formulate the desired fertilizer if the tissue analysis report is presented to them. The accuracy of the recommendation will depend on the procedure of collecting the tissue samples.

The procedure listed below is recommended for collecting the leaf samples for tissue analysis (*Establishment and Maintenance of Muscadine Vineyards, 1983*) by Hegwood et al. The analytical lab where the tissue samples will be sent usually has a detailed procedure for the grower to follow in collecting and preparing the samples. Check with the lab and follow all instructions.

- Randomly collect 100 leaf petioles from healthy vines.
- Collect one or two petioles from fruiting shoots opposite fruit clusters from each vine.
- Collect a representative sample from the vineyard. Collect different samples from different areas that show differences in vine growth habits.
- Avoid collecting samples from end rows and vines from under the shade and diseased leaves.
- Sample each variety separately. Example, if the vineyard has 50% Noble and 50% Carlos, then half of the samples should be from Noble and 50% from Carlos vines.

Sometimes, the determination of a nutrient need can be done by visual examination of the leaves and the vigor of the vine. A common rule of thumb is that annual individual shoot growth should be 30-36 inches (Clark and Spiers, 2001). A lesser growth rate would indicate that the vines may need a closer examination. The nutrient status for muscadine grapevines should fall within the specified ranges. Any value below and above the ranges would suggest remedial action may be necessary. For more information, please see *Irrigation and Mineral Nutrition* by Clark and Spiers, 2001).

The following fertilization program is recommended for North Florida. The fertilizers are applied beginning at bud swell in March/ April in a circular band around the vines. The last application is in October.

Year 1

Type of fertilizer: Mixture 10:10:10
Amount/vine/year: 0.2 lb/vine/application - 4 applications - April, June, August, and October
Total: 0.8 lbs per year.
Apply in circular bands around the vine, about 1 foot from the vine.

Year 2

Type of fertilizer: Mixture 10:10:10
Amount/vine/year: 0.25 lb/vine/application-4 applications- April, June, August, and October
Total:1.0 lb/year.
Apply in circular band around the vine, about 1-3 feet from the vine.

Year 3

Type of fertilizer: Mixture 10:10:10
Amount/vine/year: 0.5 lb/vine/application —3 applications – April, June and October
Total: 1.5 lb/year
Apply on both sides of the trellis row about 2-3 feet wide.



Year 4

Type of fertilizer: Mixture 10:10:10
Amount/vine/year: 0.6 lb/vine/application —3 applications —April, June and October
Total: 1.8 lb/year
Apply on both sides of the trellis row about 3-4 feet wide.

Year 5 +

Type of fertilizer: Mixture 10:10:10
Amount/vine/year: 0.75 lb/vine/application —3 applications - April, June, and October
Total: 2.25 lb/year
Apply on both sides of the trellis row about 3-4 feet wide.

The fertilization program for Central and South Florida, where the soil is usually more sandy, is based on recommendation made by Dr. John Mortensen (*Florida Vineyard Fertilizer Recommendations, 1989*). Because of the sandy nature of the soil type in Central Florida, the fertilizer should have a higher nitrogen (N) and lower phosphorus (P) formulation. To minimize leaching, it is suggested that 50% of N in the fertilizer should be ammonium based. The fertilizers should also be applied more frequently to ensure that they are available to the vines.

Year 1

Type of fertilizer: Mixture 12:4:8
Amount/vine/year: 0.15 lb/vine/application – 7 monthly applications from March – September
Total: 1.05 lb/year
Apply in circular bands around the vine, about 1 foot from the vine.

Year 2

Type of fertilizer: Mixture 12:4:8
Amount/vine/year: 0.3 lb/vine/application – monthly applications from April - August
0.2 lb/vine/application in September
Total: 1.7 lb/year
Apply in circular band around the vine, about 1-3 feet from the vine.

Year 3

Type of fertilizer: Mixture 12:4:8
Amount/vine/year: 1.0 lb/vine/application – April, June and September
Total: 3.0 lb/year
Apply on both sides of the trellis row about 2-3 feet wide.

Year 4 +

Type of fertilizer: Mixture: 12:4:8
Amount/vine/year: (1-8 - 2.2) lb/vine/application —April
(0.9 – 1.1) lb/vine/application in–June and–September
Total: (3.6-4.4) lb/year
Apply on both sides of the trellis row about 3-4 feet wide.



Best Management Practices

- Do a soil analysis of the vineyard once every five to six years to determine the soil nutrient status and do the necessary correction. Send the samples to a reputable lab for analysis. The local county extension office may be able to provide assistance in sample collection as well as soil analysis.
- Do a tissue sampling of the vines once a year during berry development stage between June and July to determine the nutrient status of the vines. Send the samples to a reputable lab or county extension office for assistance.
- Apply the recommended amount of fertilizer as recommended by the lab.
- Provide irrigation water after the fertilizer has been applied.
- Do not let the fertilizers come in contact with the vines.
- Do not apply the fertilizers after a heavy shower or on very dry conditions.

Stop Fertilization

There should be one more round of fertilization after harvest to prepare the vines for winter but not later than October in North Florida. This is to slow the growth of the vines after the fertilizer application and to give them time to hardened and not damaged by any early freeze. In central and south Florida, the vines should not be fertilized later than November.

Fertigation

Fertigation is the application of plant nutrients through the irrigation system. This is done by injecting the liquid fertilizer into the system through a control valve that regulates the rate and quantity of fertilizer into the irrigation water. Several types of injectors are available in the market. At the Center we use a venture/ suction type injector that is attached to the main irrigation line and does not need electricity to operate. The rate of flow for this type of pump is dependent on the flow of the irrigation water. An irrigation specialist is the best person to recommend the type of injector to use for the vineyard, depending on the design of the existing or proposed irrigation system and other technical considerations.

Fertigation can be practiced with drip irrigation to complement the regular fertilization program or as a primary means of fertilization in the vineyard. At the Center, fertigation has been seen to have a positive effect on vine growth and productivity.

For smaller vineyards, it is recommended that liquid fertilizers with the desired nutrient composition be purchased from one of several suppliers in Florida and South Georgia.

Some factors to take into consideration when planning to install or using a fertigation system.

- The pH of the water, high acidity and high alkalinity does not mix well with certain types of fertilizers.
- Water high in iron and sulfur concern may cause a problem by clogging the irrigation lines.
- The fertilizers should be water soluble and do not form precipitates that could clog the irrigation system.
- Phosphorous should be used with care as many dry phosphate fertilizers have low solubility and form precipitates.



Weed Management

Weed management is an important part of good vineyard management. After the vineyard has been established, maintain a permanent sod area between the rows. The sod area should be frequently mowed to keep the grass under control. Obnoxious perennial weeds, such as Bermuda Grass, Johnson Grass and nut sedges should be eliminated from the vineyards through chemical herbicides or mechanical means.

The area under the canopy, about 4 feet wide, 2 feet on either side of the row should be cleared of weeds. For young vines without grow tubes, it may be necessary to use a half-gallon milk carton to protect the base of the vine before spraying the herbicides.

Best Management Practices

- Read the labels before using any herbicides. Use the recommended rate of application for the targeted weed species to be controlled. When the label recommends low volume such as 5-20 gallons per acre, follow the instructions on the label.
- Follow the recommended frequency of application and do not over apply.
- Spray the weeds when they are young and more susceptible to the herbicides.
- Rotate and use different herbicides in the vineyard to prevent herbicide tolerance.
- When using systemic herbicides such as Fusilade, Poast, Roundup UltraMax, Select and Touchdown, the recommended spray volume should not be greater than 30 gallons per acre (*Weed Management Considerations for Southeast Vineyards*).
- Check the label to see if the herbicide has an adjuvant and spreader. If not, add an adjuvant and nonionic surfactant to the spray solution as they will help to improve the efficiency of the herbicide effectiveness by helping the spray droplets better stick to the leaf surface of the weeds and prevent run-off. The surfactant also helps to provide a more uniform spreading and wetting of the leaf surface.
- Use proper attire and take recommended safety measures listed on the label when applying the herbicides.
- Maintain a herbicide register to include information such as: name of herbicide, date of application, rate of application, area sprayed,
- Maintain a 4 feet wide area free of weeds under the canopy. This will promote more efficient water and nutrient uptake by the vines as well as reduce the incidence of pests and diseases.
- Use a pre-emergent herbicide combined with a post-emergent herbicide as part of the



weed management strategy. The application should be made in early spring. Post-emergent herbicide application should be made as and when needed to maintain the weed free area under the canopy.

- When in doubt about the use of any herbicide, check the label or with the manufacturer or county extension agent before using it.
- Mow the sod area between the rows at least once a month, except during the winter months, to keep the vineyard clear of weeds.

The herbicide spray program used by the Center is listed below:

- First spray – Surflan + Glyphosate
- Second spray – Glyphosate
- Third spray – Glyphosate
- Fourth spray – Glyphosate (if necessary)

Application and Worker Protection Standard Information

- Herbicide: **Surflan A.S.** (Pre-emergent weed control)
- Rate: 2 – 4 quarts per acre.
- Frequency: Apply before weeds germinate or in combination with post-emergent herbicide (Check compatibility). Surflan does not control established weeds.
- Personal Protection Equipment (PPE): Long sleeved shirt and long pants, chemical resistant gloves, shoes plus socks, chemical resistant apron when cleaning and mixing or loading.
- Early Entry PPE: Coveralls, chemical resistant gloves, shoes plus socks.
- Re-entry Interval (REI): 24 hours
- Restrictions: Do not use on soils containing more than 5% organic matter.
Do not plant root crop within 12 months from last application.
Do not apply more than 12 quarts/ac per year.

- Herbicide: **Glyphosate** (Post-emergent weed control -several formulations are currently available). Spray when the weeds are relatively young (about 6 inches tall) and actively growing.
- If necessary add ammonium sulfate (1%) to the mixture to increase its effectiveness.
- Rate: 3 fl. oz (88.7 ml) per gallon.
- Frequency: Every 2-3 months depending on weed type and weather condition.
- Personal Protection Equipment (PPE): long sleeve shirt, long pants, shoes plus socks, protective eyewear
- Early Entry PPE: coverall, waterproof gloves, shoes plus socks, protective eyewear
- Re-entry Interval (REI): 12 hours
- Days before harvest: 14 days



Harvesting Muscadine Grapes

Depending on location, muscadine grapes will be ready for harvesting between April and September, with the areas in south Florida maturing first. It is important to check the brix or sugar level of the grapes to ensure that they have reached the optimum ripeness. It is also important not to leave the grapes too long on the vines as they will shrivel and dry up which will affect their marketability. Muscadine grapes for fresh fruit consumption should be hand harvested and those for processing should be mechanically harvested, if economically feasible. Some wineries are willing to harvest the grapes mechanically for a fee if the grapes are sold to them. The grapes should be harvested, preferably, in the morning or late evening when they reached the maximum brix/sugar level which can be checked with a refractometer. Depending on weather and management practices done in the vineyard, individual growers may experience a slightly higher or lower sugar level.

As a guide, the average brix/sugar content of selected muscadine grapes at maturity is listed below.

<u>Cultivar</u>	<u>Brix Content at Maturity (App.%)</u>
Carlos	14.8
Cowart	14.3
Fry	16.1
Higgins	14.9
Jumbo	13.9
Noble	14.1
Summit	17.1
Triumph	13.5
Welder	17.9

- Source: IFAS. P.C. Anderson, M. W. Bryan and L.H. Baker. 1985. Effect of two vertical and Geneva Double Curtain training systems on berry quality and yield of muscadine grapes. Proc. Fla. State Hort. Soc. 98:175-178.

Note: Sugar content of patented cultivars can be obtained from *Ison's Nursery and Vineyard* catalogue.

A more comprehensive listing of muscadine grape cultivars and their berry characteristics (yield, berry weight, soluble solids/brix and dry scars) can be obtained from P. Anderson and T. Crocker, *The Muscadine Grape*.



Best Management Practices

Fresh Market

- Check the grapes daily when they reached veraison stage (change in color). Harvest when the grapes reached the desired brix/sugar level and pH. Take a random sample of the berries to determine the sugar level with a refractometer.
- Do hand harvesting to minimize berry tear that is quite common in muscadines for selected varieties. Hand harvesting will also help to ensure only ripen berries are harvested since uneven ripening is also another muscadine characteristic.
- It may be necessary to do more than one harvesting since muscadine grapes ripen unevenly.
- Harvested grapes should be transported to the storage/ cooling shed as soon as possible, cleaned of extraneous materials, graded, packed and cooled as soon as possible between 33F – 40F.—Grapes stored at 33F can stay fresh up to 3 weeks. (Peter Anderson and T. Crocker, *The Muscadine Grapes*).
- For bulk shipment, packed the grapes in 20 lb boxes with the appropriate markings and contact information. If there are any complaints from the store, it will be easier to trace and determine the source of the problem.
- Shipped the grapes to the stores or consumers as soon as possible.

Processed Market

- Check the grapes daily when they reached the veraison stage (change in color) and harvest when they reached the desired brix, acidity (0.3-0.5) and pH (3.1-3.2). Take a random sample. The pH can be determined with a pH meter or lab procedure.
- Check with the processor/winery for the desired brix, acidity and pH before harvesting the grapes. Make sure that the processor is ready to receive the grapes.
- Harvest the grapes mechanically, if possible, since it will be more efficient and economical. If a mechanical harvester is not available, use a catch frame to harvest the grapes. A description of how to make the catch frame is available from *Catch Frames for Harvesting Muscadines* by J. R. Clark.
- Grapes for processing should also be shipped to the wineries as soon as possible, usually within 24 hours of harvesting. If possible, ship the grapes in a refrigerated contained.
- Time the harvesting such that the grapes could be shipped during the cooler hours of the evening or night.



MARKET CONSIDERATION

Muscadine grapes can be categorized into two broad classifications - fresh fruit and processed, based on their fruit characteristics and fruit qualities. Muscadines recommended for fresh fruit often have large berries, high sugar content, and relatively firm texture and those muscadines recommended for winegrapes have stable pigment, low acidity, and high sugar content. It should be pointed out that, although, all muscadine grapes can be processed into wine (or juice), jams and jellies, some are more suited than others because of their inherent organoleptic characteristics, and it is important to recognize these distinguishing characteristics when matching the cultivars with the appropriate markets.

There are several factors to be considered when planning to grow muscadine grapes, commercially. The most important consideration, of course, is marketing. Investigative work should be done to collect and analyze as much market information as possible to determine the target market(s) and potential profitability (feasibility), before establishing the vineyard. The market information should address the following questions:

- Who are my current and potential buyers (types of market)?
- What kind of grapes do they want (cultivar selection)?
- What prices can I expect from the buyers?
- Who are my competitors and where are they located?
- What is my expected return on investment?

Once, the market(s) is determined, the cultivar(s) and production system are easily decided. The following market alternatives are listed as a guide:

Market Alternatives

Muscadine grapes as fresh fruit can be sold through the following market alternatives:

- U-Pick Operation
- Roadside Market
- Farmers Market
- Supermarket
- Broker/Distributor

Muscadine grapes as wine grapes can be sold through the following market alternatives:

- Winery
- Food/Juice Processor

Each of these market alternatives or outlets has their own market characteristics and requirements. Personal preference, expected production, expected prices, location of vineyard and market environment should all be considered in the choice of market outlets since they all impact on the expected return on investment. Several outlets may be available in a particular area or region, but not all of them are feasible, reliable or profitable because of logistics or other economic considerations. Grape growers can choose to sell in one or more outlets to minimize market risk, after doing the necessary analysis. The advantages and general requirements of the



market outlets are listed below:

Fresh Fruit Market - U-Pick Operation, Roadside Market, and Farmers Market

Market Characteristics and Requirements

- Ideal for grape growers with small acreages.
- Prices for the grapes are often relatively higher than other market alternatives.
- In U-Pick, the buyers pick the grapes themselves and no grower labor is required.
- The business is easy to operate with little or no hired labor and be on a flexible schedule.
- Vineyard should be located at or near densely populated community, preferably along a heavily traveled road.
- Area should be clean and attractive.
- Fresh fruit cultivars with large berries are often preferred.
- Adequate parking area and restroom facilities should be provided near the vineyard.
- Some supervision is necessary to ensure safety.
- Liability insurance to protect business and customers may be high.
- Roadside promotion is often necessary to attract customers.

Fresh Fruit Market - Supermarket, Broker and Distributor

Market Characteristics and Requirements

- Essentially a buyers' market.
- Large quantities can be sold at a time, but buyer may want grapes in small packages (pint or quart size) with UPC codes.
- Ideal for large vineyards.
- Prices are negotiable, but are often lower than other markets.
- Payment is often made during delivery, but credit terms may be requested by buyers.
- Buyers may require reliable and regular supply of grapes during the season.
- May need grading, packaging, cooling and storage facilities on site.
- Fruit quality is important consideration for repeat orders.
- Market contract with specifications and terms may be used by buyers to define quantity, quality and price.

Processed Market - Winery, Food/Juice Processor

Market Characteristics and Requirements

- Limited number of buyers.
- Provide reliable market for large vineyards producing winegrapes.
- Sale is often through contractual arrangements that protect buyer and seller.
- Price is negotiable, but is often lower than other market alternatives.
- Market contract will often specify types and quality of grapes, terms of purchase and mode of payment.
- Fruit quality and supply reliability is essential for repeat orders.
- Large acreage and large volume production may be needed to secure market order from processors or wineries.
- Growers may have to deliver grapes to processing site.



Best Management Practices

- Practice good business and marketing principles.
 - Sell good quality grapes only.
 - Set fair prices for the grapes – do not overcharge.
 - Develop and maintain good relationship with buyers even during off-season.
 - Conduct honest advertising and promotion.
 - Reward loyal consumers and buyers for U-Pick and fresh fruit operations.
- Invest in post-harvest facilities.
 - Grading and packing shed.
 - Cooling facilities
 - Labeling equipment if necessary.

Expected Prices

Expected price is often used to determine projected profitability and feasibility of growing muscadine grapes. Selling muscadine grapes in the processed market, that is, winegrapes to wineries or processors often fetch a much lower price than selling muscadine grapes in the fresh fruit market.

It is important to recognize that marketing volume between the markets also differ significantly. Sale of grapes to wineries is often in tons while sale to supermarkets and wholesalers are either in 20 pound boxes or in quart or pint containers. This distinction is important to determine the resources required as well as projecting profitability and expected return on investment. The average market prices for muscadine grapes in the different markets vary greatly. As a guide, the average price per pound for fresh fruit vary from \$0.80 to \$1.25 and for wine from \$300 - \$500 per ton. Potential investors and grape growers must do their own research by contacting different buyers to determine their own expected prices for the different target markets before making their final decision. In many cases, potential buyers such as wineries would tie the expected or contractual prices to fruit quality standards. Many Florida wineries are self-dependant for their supplies of muscadine grapes but do purchase limited quantities from other growers on as per need basis. A list of Florida wineries is in Appendix 1.

Market Standards

The US Department of Agriculture recently developed marketing standards for two grapes of muscadine grapes – U.S. Extra No. 1 and U.S. No. 1 (Appendix 2). The extent to which these standards are being used in the marketing channel is unknown, but expected to increase with time as buyers and growers become aware and are more acquainted with the specifications. It is believe that all grape growers grade their grapes even though they do not follow all the USDA grape specifications. It is a good practice to grade the muscadine grapes before packing them into containers and shipping them to wholesalers or retailers. A quality product on the store shelf will help to promote sales and consumer demand for muscadines.



Labeling Muscadine Grapes for Retail Sales

Identification coding of fixed weight produce items.

- Stock Keeping Units (SKU) Grower assigned number + assigned UPC Number.
Example: 7 07284 25076
- The UPC codes assigned for muscadine grapes as fresh fruit. Generic code for produce + code assigned for specific product and container size.
Example: 0 33383 25075

Container Size	Muscadine Type	UPC Code (33383+)
Pint	bronze/white/pink	25072
Pint	black/purple	25075
Quart	bronze/white/pink	25073
Quart	black/purple	25076
1 pound or 20 oz	bronze/white/pink	25074
1 pound or 20 oz	black/purple	25077

For more information: Produce Electronic Identification Board
P.O. Box 6037
Newark, DE 19714-6037

Source: Ervin Lineberger. Fresh Market MuscadineExperience. Proc. Georgia-South Carolina Muscadine Conference, Savannah, Georgia, Jan. 2007.



Appendix 1.

Florida Farm Wineries

Chautauqua Vineyards & Winery
364 Hugh Adams Road, DeFuniak Springs, FL 32435
Tel: (850)892-5887
www.chautauquawinery.com

Dakotah Winery
& Vineyards
14365 NW Highway 19, Chiefland, FL 32626
Tel: (352)493-9309
www.dakotahwinery.com

Emerald Coast Wine Cellars
1708 Old Highway 98 East, Destin, FL 32550
Tel: (850)837-9500
www.emeraldcoastwinecellars.com
www.emeraldcoastgiftbaskets.com

Florida Orange Groves, Inc., & Winery
1500 Pasadena Avenue S., St. Petersburg, FL 33707
Tel: (727)347-4025
www.floridawine.com

Henscratch Farms Vineyard & Winery
980 Henscratch Road, Lake Placid, FL 33852
Tel: (863)699-2060
www.henscratchfarms.com

Lakeridge Winery & Vineyards
19239 U.S. 27 North, Clermont, FL 34711
Tel: (352)394-8627
www.lakeridgewinery.com

Monticello Vineyards & Winery
1211 Waukeenah Highway, Monticello, FL 32344
Tel: (850)294-WINE
www.monticellowinery.com

Rosa Fiorelli Winery
4020 CR 675, Bradenton, FL 34202
Tel: (941)322-0976
www.fiorelliwinery.com



San Sebastian Winery
157 King Street, St. Augustine, FL 32084
Tel: (904)826-1594
www.sansebastianwinery.com

Schnebly Redland Winery
30205 SW 217th Avenue, Redland, FL 33030
Tel: (305)242-1224
www.schneblywinery.com

SeaBreeze Winery
13201 Hutchison Blvd.,
Panama City Beach, FL 32407
Tel: (850)230-3330
www.seabreezewinery.com

Three Oaks Winery
3348 Highway 79, Vernon, FL 32462
Tel: (850)535-9463
Email: lbiddle@digitalexp.com

Strong Tower Vineyard and Winery
17810 Forge Drive, Spring Hill, FL 34610
Tel: (352)799-7612
www.strongtowervineyard.com

Tangled Oaks Vineyard
1317 State Road 100, PO Box 98
Grandin, FL 32138
Tel: (386)659-1707
www.tangledoaksvineyard.com

Log Cabin Farm & Vineyard and Winery
376 C.R. 309, Satsuma, FL 32189
Tel: (386)467-0000
www.logcabinfarmwine.com

Pine Knoll Winery
2423 South Rock Crusher Road, Homosassa, FL 34448
Tel: (352)382-4900
www.pineknollwinery.com



Appendix 2.

United States Standards for Grades of Muscadine Grapes (*Vitis rotundifolia*)
Effective February 13, 2006

Grades

- 51.790 U.S. Extra No. 1
51.791 U.S. No. 1.

Tolerances

- 51.792 Tolerances.

Application of Tolerances

- 51.793 Application of tolerances.

Standard Pack

- 51.794 Standard pack.

Color Requirements

- 51.795 Color requirements.

Definitions

- 51.796 Good soluble solids.
51.797 Similar varietal characteristics.
51.798 Mature.
51.799 Not excessively soft.
51.800 Clean.
51.801 Overripe.
51.802 Damage.
51.803 Serious damage.

Grades

- 51.790 U.S. Extra No. 1.

Any lot of grapes may be designated as “U.S. Extra No. 1” when the grapes meet the requirements of U.S. No. 1: Provided, that in addition to these requirements, 90 percent by count of the containers in the lot meet the requirements of Standard Pack.

- 51.791 U.S. No. 1

“U.S. No. 1” consists of individual grapes or multiple grapes attached by a capstem, which meet good soluble solids and the following requirements:

- (a) Basic requirements for berries:
- (1) Similar varietal characteristics (except when designated as assorted varieties);
 - (2) Mature;
 - (3) Well colored;
 - (4) Clean;
 - (5) Not excessively soft;
 - (6) Not dried;



- (7) Not excessively wet from juice;
- (8) Not crushed, split, or leaking; and
- (b) Free from:
 - (1) Decay;
 - (2) Mold;
 - (3) Insect larvae or holes caused by them;
 - (4) Overripe;
 - (5) Free from damage by any other cause (See 51.802);
- (c) Stems free from:
 - (1) Mold;
 - (2) Decay;
- (d) For tolerance see 51.792.

Tolerances

51.792 Tolerances

In order to allow for variations incident to proper grading and handling, the following tolerances, by count, or equivalent basis are provided as specified: 5 percent tolerance for berries which are seriously damaged by pulled stems. Additionally, 10 percent for berries which fail to meet the requirements for the grade: Provided, that included in this amount not more than 5 percent shall be allowed for defects causing serious damage, including in this amount not more than 2 percent for berries affected by mold or decay.

Application for Tolerances

51.793 Application for tolerances.

Individual samples shall have not more than double the tolerances specified, except that at least two defective berries may be permitted in any sample: Provided, that the average for the entire lot are within the tolerances specified for the grade.

Standard Pack

51.794 Standard pack.

Berries packed as U.S. Extra No. 1 grade shall be fairly uniform in size.

- (a) "Fairly uniform in size" means that not more than 10 percent, by count of the berries in the sample may vary more than 3/8 inch in diameter.
- (b) "Diameter" means the greatest dimension of the berry measured at right angles to a line from the stem to blossom end of fruit.

Color Requirements

51.795 Color requirements.

- (a) "Well colored" means in the case of:
 - (1) "Black and red varieties" that 75 percent of the surface of the berry shows characteristic color for the variety.
 - (3) "White varieties." No requirement, except that Carlos, Fry or similar varieties must show any amount of blush or bronze color on the berry.



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Fry



Cowart



Noble



Carlos



Jumbo