



## Grape Variety Profile:

# Muscadines

Justin Scheiner\*

### *Muscadine cultivars*

Muscadines (*Vitis rotundifolia*) are a species of grape with a native range from the eastern one-third of Texas—where soils are acidic and rainfall is high—to Maryland (Fig. 1). Compared to the other wild grape species in Texas and European grapes (*Vitis vinifera*)—collectively referred to as bunch grapes—muscadines have slightly different characteristics.

Muscadines have smooth bark, un-forked tendrils, and fruit born in small clusters of large berries that ripen individually and fall away or shed when mature. Due to their additional pain of chromosomes, muscadines are generally incompatible with bunch grapes for grafting and hybridizing. Hybrids of muscadines and bunch grapes are rare and usually sterile.

Wild muscadine vines are dioecious, requiring a male and female plant to reproduce. They bear either male (staminate) or female (pistillate) flowers, but only female vines produce fruit. Both muscadines and bunch grapes are primarily wind-pollinated. There are over 100 improved muscadine cultivars. Most older cultivars are

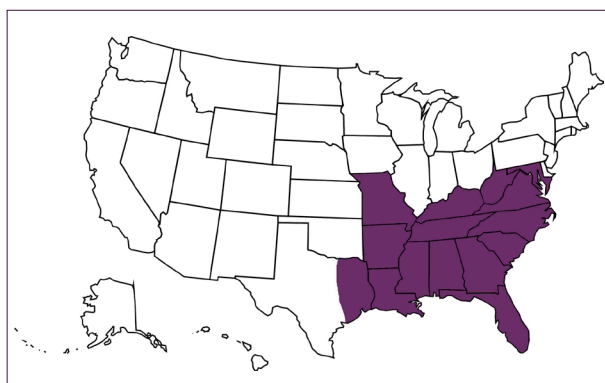


Figure 1. Native range of muscadine grapes.

female and require a pollinizer to produce fruit, but many new cultivars are self-fertile (perfect-flowered). These newer varieties are able to produce fruit when planted alone and can serve as a pollinizer for female flowers. A pollinizer should be planted within 30 to 40 feet of female vines for effective pollination. Many vineyards with pistillate cultivars plant a self-fertile cultivar every third row.

Muscadine berries are a slip-skin fruit meaning they have a thick skin and a gelatinous pulp that pops out when the berries are squeezed (Fig. 2). Muscadine berries generally contain up to five seeds, which are hard and often bitter.

\*Extension Viticulture Specialist, The Texas A&M University System



Figure 2. Slip-skin muscadine berry.



Figure 3. Small processing and large fresh market muscadines.

Berries of improved muscadines range in color from green to bronze and from red to black (Fig. 3). Berry weight can also range from a few grams for processing-type muscadines to 30 grams for the largest fresh-eating cultivars. Muscadine breeders target traits such as thin skin, crunchy texture, synchronous cluster-ripening, size, flavor, yield potential, and seedless-ness. The improved characteristics of modern muscadine cultivars make them far superior to their wild counterparts.

Noble and Carlos are the most widely planted red and white muscadine wine cultivars, respectively. Supreme is often considered to be the standard black-fruited, fresh-market cultivar and Fry is a commonly planted bronze, fresh-market cultivar. Other cultivars are grown on a commercial scale (Table 1).

Many of the newer muscadine cultivars (Lane, Hall, Southern Jewel, Delicious, Onyx, and Paulk) have not been extensively trialed in Texas but may be considered for test plantings. Commercial production of muscadines in Texas for fresh eating, juice, and wine is limited to approx-

Table 1. Recommended muscadine cultivars

Cultivar	Size	Color	Pollination	Use		
				Fresh eating	Juice and jelly	Wine
Black Beauty	Black Beauty	Black	Female	●	●	●
Black Fry	Black Fry	Black	Female	●	●	
Carlos	Carlos	Bronze	Self			●
Cowart	Cowart	Black	Self	●	●	
Darlene	Darlene	Bronze	Female	●	●	
Fry	Fry	Bronze	Female	●	●	
Hunt	Hunt	Black	Female	●	●	●
Nesbitt	Nesbitt	Black	Self	●	●	
Noble	Noble	Black	Self		●	●
Pam	Pam	Bronze	Female	●	●	
Regale	Regale	Purple	Self	●	●	
Southern Home	Southern Home	Black	Self	●	●	
Supreme	Supreme	Black	Female	●	●	
Sugargate	Sugargate	Black	Female	●	●	
Sweet Jenny	Sweet Jenny	Bronze	Female	●	●	
Tara	Tara	Bronze	Self	●	●	●
Triumph	Triumph	Bronze	Self	●	●	

imately 80 acres of production, but states such as North Carolina and Georgia have much larger, more developed markets.

The primary criteria for selecting fresh-market muscadine cultivars include fruit quality potential, yield potential, harvest timing, size, and stem scar. In colder locations, cold hardiness may be an important selection criterion. Muscadines are generally hardy through cold zone 7 with damage likely to occur when temperatures fall below 10°F. Cold sensitivity differs between cultivars, and the physiological status of the vine going into winter is important during dormancy. Avoiding large fertilizer applications helps improve winter hardiness. Fertilizers, particularly nitrogen, applied after harvest and other practices may stimulate late season growth which decreases cold hardiness.

## *Training systems*

Muscadines are vigorous growers with shoots that have a downward or procumbent growth habit (Fig. 4). They are usually trained to high-wire systems with cordons at 5 to 6 feet off the ground. Cordons are the woody arms of the grapevine and are at least 2 years old. The shoots are then allowed to cascade downward. Commercial vineyards use both high-wire bilateral cordon and quadrilateral training systems. Vines are spaced anywhere from 12 to 24 feet apart and rows are commonly spaced at 10 to 12 feet



Figure 4. Procumbent growth of muscadine shoots.

apart. This spacing allows equipment to pass down the row. Because muscadine vines are heavy, 12.5-gauge, high-tensile wire or 9-gauge soft wire are used for load-bearing wires. The most common materials for training systems are 5- or 6-inch round CCA-treated wood posts or 2 7/8-inch drill stem pipes for end posts and 3- or 4-inch round CCA-treated wood posts or metal posts (t-posts or vineyard stakes). Both options can be used as line posts situated within each row. Set the posts a maximum of 12 to 18 feet apart and plant the vines between the posts. Use a small stake, string, or wire to train a straight trunk up to the cordon wire.

End-post configurations must be strong enough to resist the tension put on them. Tie-back systems, H-brace end post assemblies, and dead man assemblies are most common (Fig. 5). H-brace and dead man assemblies generally offer superior support and do not result in any unused spaces in the trellis.



Figure 5. Dead man made from drill stem pipe (top) and H-brace made from wood posts (bottom).



## Soil

Muscadines grow best in acidic to slightly acidic soils with a pH of 5.5 to 6.8. They are not well adapted to soils with high concentrations of calcium carbonate (calcareous) and a high pH. Problems with iron uptake usually occur in soils with a pH above 7.0, leading to iron chlorosis (Fig. 6). Soils with a pH higher than 7.0 may be improved with large additions of compost, but this often does not completely solve chlorosis problems, particularly with high-alkaline irrigation water. Applying chelated iron as a foliar spray or through the drip irrigation system may mitigate this problem but may not be sufficient for highly calcareous soils.

Generally, it is not economically feasible to acidify an alkaline soil by adding sulfur. However, soil with a pH lower than 5.5 may be limed



Figure 6. Symptoms of iron deficiency are visible as interveinal chlorosis (top photo) beginning at the tip of shoots (bottom photo).

to raise the soil pH to a more favorable range for plant nutrients intake.

Like most other fruit crops, muscadines do not tolerate “wet feet” or grow well in soils with poor drainage. Conduct a percolation test on the soil’s absorption rate to determine whether drainage is suitable. If the drainage at your site is inadequate, set the plants on a raised row that will drain in all directions.

## Propagation

Muscadines are most commonly propagated using soft cuttings or by layering. Layering allows the stem to root while attached to the original vine. Cuttings taken in early to late summer are most successful. Avoid selecting the tips of shoots and basal regions with bark or periderm formation. Place cuttings in a soilless potting mix or other medium and use intermittent mist until rooting takes place in approximately 2 to 4 weeks. In a commercial setting, vines are usually grown in a field nursery for a year before they are dug and sold. Muscadine vines are typically sold as dormant, bare-root, 1-year-old vines or in pots.

## Planting

The time to plant muscadines is from the start of the dormant season through early spring (December through April). Do not plant dormant, bare-root plants later than May. This will help avoid hot, dry conditions that can lead to poor establishment. You can plant potted vines later in the growing season, but they perform best when planted early. Earlier in the season, they can become established under the most favorable weather conditions of the season.

To plant muscadines:

- Start with large, healthy plants with shoots about the size of a pencil.
- Dig a hole to accommodate the entire root system.
- Plant the vine and gently firm the soil around the roots.

- Do not backfill with potting soil or add fertilizer to the planting hole.
- Once the vine is planted, water immediately to ensure good contact between roots and soil, and to prevent the roots from drying out. The most common reason a new dormant, bare-root plant dies is that the roots become too dry.
- After planting, cut the top of the dormant vine down to two buds. This ensures stronger shoot growth than if the vine is left untrimmed.

## *Training - Trellises and Arbors*

Training is bending, tying, or pruning a plant or branch into a particular shape or position onto a trellis system. Trellising is training the vine to the support structure, which includes hardware such as end posts, line posts, bracing, and wire. Train muscadines onto a high-wire trellis with a top wire situated 5 or 6 feet above the ground (Figure 7 and Figure 8). Muscadines also make beautiful arbors.

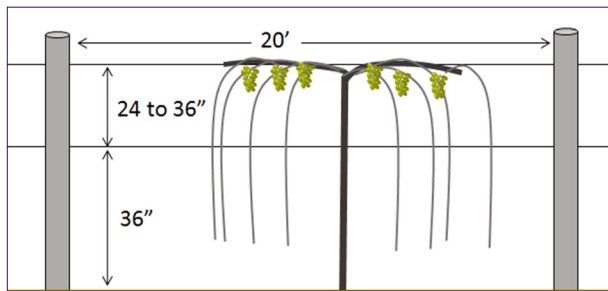


Figure 7. Two-wire trellis system.



Figure 8. Quadrilateral trained muscadine vineyard.

To train muscadine vines into a trellis:

- In the first year, select a vigorous shoot that will grow up the training stake and become the trunk of the vine.
- Remove any other shoots as they develop during this time to encourage one robust, upright shoot that will develop into a healthy, permanent trunk (Figure 9).



Figure 9. Establishing a muscadine trunk in the first season.

- Allow this main shoot to grow upward until it reaches the top wire, making sure to tie it to the training stake along the way.
- This may occur during the first season, but if it does not, prune the main shoot back down to two buds during the dormant season before growth commences in the second year, beginning the process again.
- Avoid the common mistake of retaining a small or weak cane in hopes of building a trunk more quickly.
- Once the main shoot reaches one foot beyond the top wire, cut it back to a few inches below the wire to encourage lateral shoot growth. Shoots will grow from buds just below where the shoot was cut.



- Select two lateral shoots—one to the right and one to the left—at or below the point where they touch the wire. Each lateral shoot will serve as an “arm” (cordon) of the grapevine and can then be trained along the cordon wire (Fig. 10). The cordon can sometimes develop to the full length of the wire during the second growing season.



Figure 10. Cordon establishment in the second season.

Depending on the health of the vine, soil conditions, and weather, newly planted muscadines may grow anywhere from a few feet to over 10 feet within a single year. You can also retain two trunks rather than a single one.

To train vines into an arbor:

- During the first 2 years, train the vine up the arbor post.
- In the third year, establish a cordon down the wire, with horizontal bars (cross-members) spaced 24 inches apart.
- In January or February, prune the cordon to two or three bud spurs every 4 to 6 inches.
- Prevent overgrowth by establishing cordons at least than 48 inches apart.
- If you use only one cultivar and want it to fruit, be sure it is a perfect plant, one that is self-fruitful and does not require a pollinizer.
- Choose a bronze-colored cultivar if a patio or concrete surface is below the arbor and staining from fruit drop is a concern.

## Cluster Thinning

To ensure healthy vine development in the first season:

- Pinch off all of the clusters as they appear.
- If vine growth is not satisfactory after the first season, pinch off all clusters as they appear during the second season.
- Otherwise, pinch off approximately half of the clusters as they appear in the second season. Typically, a full crop can be harvested by the third season.
- If over-cropping occurs in a mature vineyard, you may need to implement cluster thinning before the fruit ripens (Fig. 11).



Figure 11. Muscadine vine showing signs of over-cropping.

## Pruning

Once the trunk and cordon are established, prune the 1-year-old shoots (canes) that arise from the cordon down to two to three buds. These short sections of cane are spurs. Space spurs 3 to 5 inches apart along each cordon (Fig. 12).

Once vines are established, prune them by cutting back the canes that grew in the previous season to manage growth and production. Remove any unwanted shoot growth that arises from the trunk or other regions of the vine soon after it appears, or during the dormant season. If left unpruned, a muscadine's canopy



Figure 12. Before dormant pruning (left) and after (right).



Figure 13. Cordon spur pruned vine with visible spur positions along the cordon.

becomes unmanageable making harvest difficult. Muscadines produce fruit on shoots that arise from 1-year-old wood, so it is necessary to remove around 90 percent of the previous season's growth to control the canopy and prevent over-cropping (Fig. 13).

An unpruned or otherwise unhealthy vine can often be retrained by cutting back to near the trunk or cordon to re-establish a cordon or spur positions. Pruning invigorates the plant and is necessary for to produce high-quality fruit.

## Fertilizer

Conduct a soil test before planting a muscadine vineyard to determine if pre-plant amendments are necessary. Some amendments, such as lime, should be tilled into the soil before planting and constructing a trellis to be effective.

Your soil test should guide your first-year nutrition program. For instance, sandy soil has a relatively low nutrient-holding capacity. As a result, muscadines grown on sandy soil will require more frequent applications of fertilizer.

Table 2. Target values for vineyard soil nutrients.

Nutrient	Target soil values (ppm)	Target soil values (lbs/acre)
Potassium (K)	75–100	150–200
Phosphorus (P)	20–50	40–100
Calcium (Ca)	500–2,000	1,000–4,000
Magnesium (Mg)	100–250	200–500
Boron (B)	0.3–2	0.6–4
Iron (Fe)	20	40
Manganese (Mn)	20	40
Copper (Cu)	0.5	1.0
Zinc (Zn)	2	4
Organic Matter	3–5%	—

Muscadines respond well to fertilizers such as 15-5-10. Unless specific deficiency symptoms develop, muscadine grapes need no other fertilizer additions in Texas.

To fertilize muscadine vines:

- For every year of vine age, apply about 1 pound (2 cups) of fertilizer, not exceeding 4 pounds per vine.
- In the first and second years, apply  $\frac{1}{4}$  pound once a month from March through June.
- Do not place fertilizer closer than 18 inches from the vine trunks or in the sod between the rows.
- If you maintain a weed-free or bare strip under the vines, broadcast the fertilizer along this strip.

If growth is poor or a nutrient deficiency is suspected, collect tissue samples for diagnostic testing. In the first year of production, conduct tissue testing via petiole both at bloom (50 percent cap fall) and between ripening (veraison) and harvest. Doing so will guide fertilizer applications moving forward. During each

growing season that follows, take tissue samples during the same time of the season, using the same methods to build a database that accurately reflects the vineyard nutrient status. Some laboratories in Texas offer nutrient testing services with plant tissue.

## Weed control

Muscadine roots are very shallow. To prevent root damage, avoid mechanical tillage or use the tiller on a very shallow setting. Most commercial vineyards maintain a 3- to 5-foot wide weed-free strip beneath the trellis. Weeds compete with vines for water and nutrients; have the potential to harbor pests and diseases; and interfere with vineyard activities. Control weeds in first-year vines by either hoeing a 3-foot circle around each vine or by very carefully applying an herbicide. Glyphosate herbicide is effective, but avoid spraying it onto the foliage or trunk, especially on young vines with green bark. Use a vine shelter (grow tube) to protect vines from particle drift and to safeguard it from rabbit and deer browsing. Contact and preemergence herbicides are also available for vineyards. Do not underestimate the importance of weed control. It is one of the most significant challenges for new vineyards.

## Irrigation

Many commercial muscadine vineyards irrigate with drip irrigation. At a minimum, irrigation is necessary for vineyard establishment. It is also crucial for fruit sizing and to maintain vine health and fruit quality during dry periods. Irrigation requirements depend on soil, vine size, and weather conditions. Adjust the watering rates to compensate for extremes in soil drainage or weather events.

The minimum delivery capacity of a vineyard irrigation system is 5 gallons per minute per acre. Most vineyards use well water, but surface water of sufficient quality and quantity can also be used. All irrigation sources require adequate

filtration but surface water generally requires a higher level of filtration.

Test irrigation water before planting. Some aquifers in Texas are not suitable as an irrigation source for muscadines due the salt content. If irrigation water quality parameters fall outside of the recommended range, it may be necessary to find another water source (Table 3).

Table 3. Guidelines for irrigation water quality for muscadine vineyards.

Analysis	No problem	Increasing problem	Severe problem
Electrical Conductivity (mmhos/cm or dS/m)	<1.0	1.0–2.7	>2.7
Total Dissolved Solids (ppm)	<640	640–1728	>1728
Sodium Absorption Ratio (SAR)	<6	6–9	>9
Sodium (ppm)	<460	—	—
Boron (ppm)	<1	1–3	>3
Chloride(ppm)	<140	140–525	>525

## Pests and Diseases

Compared to improved bunch grapes, muscadines have excellent disease resistance. However, a disease-control program remains necessary to maximize production and fruit quality. Bunch rots such as bitter rot, ripe rot, and macrophoma rot are the most common threats, and often warrant control, particularly in wet years (Fig. 14). Well-timed fungicide sprays can reduce the incidence of these diseases. Bronze-fruited cultivars are more susceptible to rots and

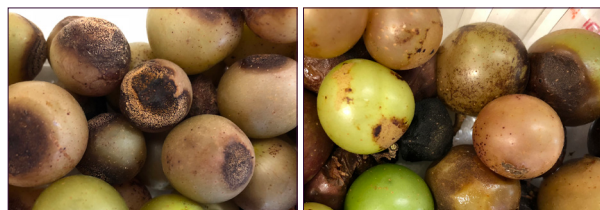


Figure 14. Macrophoma rot and ripe rot.



their fruit is more prone to visible imperfections, both of which reduce quality.

The grape berry moth is the most common insect pest of muscadines and bunch grapes in Texas. It lays its eggs on developing flower and fruit clusters, where the larvae infest. A single larva can infest and destroy several flowers or berries, reducing yield and quality (Fig. 15). In Texas, it is common to observe multiple generations of grape berry moth during a single season.



Figure 15. Infested muscadine cluster just after fruit set (left) and a mature berry with a visible larval exit hole (right).

## Harvest

In East Texas, most muscadine cultivars ripen from late July through September. Muscadines are not considered to be ripe as soon as they change color. Instead, they continue to increase in sweetness, decrease in tartness (accumulate sugar and lose acid) for several weeks following color change. When berries become fully ripe, they often take on a slightly dull appearance and are easily dislodged from the cluster. Many processing-type muscadines ripen at the same time and allow for just one or two harvests (Fig. 16).

To harvest ripe grapes efficiently, place a canvas or catching frame (Fig. 17) under the vine and gently shake the vine or wire. Larger vineyards use mechanical harvesters, such as blueberry harvesters, to pick their fruit.



Figure 16. Synchronous ripening allows for efficient harvesting.



Figure 17. Catch frame made from PVC pipe.

Process cultivars or individual berries that have a wet stem-end scar directly after harvest as they do not store well (Fig. 18). Those with a dry stem scar will keep for up to 2 weeks if refrigerated at a temperature between 34°F and 45°F.



Figure 18. A dry (top) and wet (bottom) stem scar.

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