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MARKETING GUIDE FOR FRESH MARKET MUSCADINE GRAPES

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Introduction

Muscadines (*Vitus rotundifolia*) are native to the southeastern U.S., found from Virginia to Florida and as far west as east Texas. Unlike bunch table grapes, many muscadine varieties can be picked without a stem, the berries have large seeds, and have a thick slip skin. Several private and public breeding programs have released muscadine varieties designed for fresh market use. The purpose of this guide is to inform growers of the muscadine varieties found to be most suitable for fresh market use and provide guidelines for harvest, handling, storage, and grade standards for commercial markets.

Muscadines are easily adapted to harvest into vented, lidded plastic containers (clamshells) if stem scar is dry after removing from rachis or stem, eliminating issues with the shatter and rachis browning that plague bunch grapes. Picking as clusters, with stems attached, is also an option. Muscadines also have a full fruity aroma and flavor. For best repeat customers, the total soluble solids content (sugars) in muscadines needs to be above 13%, and preferably above 16%, but less than 21%.

Here is an overall summary of considerations:

Fresh market muscadines differ from those for processing in these ways:

1. Berry size is large (over 6 grams each)
2. Slower softening during storage
3. Sweetness should be 13-20% brix
4. Peel or skin is thinner, easier to chew
5. Color and ripeness should be uniform (all green, all bronze)
6. 'Dry' stem scar to reduce juice and leakage

Marketing Needs:

1. Follow the USDA grade standards and eliminate damaged, overripe or underripe berries
2. Consider using a water wash (spray rinse, not submersion) with potable and chlorine treated water (100 ppm) to remove dust and sticky residue
3. Packing system must have labels for traceability, including farm and source.
4. Clamshells of pint to strawberry quart are preferred, but depends on retail outlet
5. Cold chain is critical, from precooling through delivery

Markets:

1. Retail stores generally want known and consistent volumes of delivery
2. Organization and prompt response of the producer greatly helps keep the retailer
3. Locally grown is very important to include on label
4. Utilize the 'elite' nature of these grapes-the only native grape, Southeastern US origin
5. Consider adding health information to labels or as point of sale material
6. Consider adding recipes, how to eat information to labels, POS
7. Do in store demonstrations, with personal touch, samples

Selection of muscadine variety or cultivar

The most important decision for fresh market is choosing the right cultivar to plant. Muscadine varieties designed for juice or processing, like Carlos or Cowart, are too soft and too small for good fresh market shelf life. As more consumers become familiar with muscadines, larger fruit size appears to be more in demand (Table 1). Also, a pack with many small berries generally tends to have more trouble with bruising than one with large berries. While seedless muscadines are generally not available, some varieties have a thinner skin or a more crisp texture, similar to a seeded bunch grape. And, similar to cantaloupes, some varieties have a very strong aroma or foxy flavor while others have very little. Consumers not familiar with muscadines generally want something more neutral, with low aroma but high sweetness, while in areas where muscadines are traditional, consumers want a non crisp, highly aromatic muscadine. Understanding the demographics of the market you will be selling to helps determine what varieties you may want to plant in terms of size, color, aroma and shelf life. A list of the muscadine cultivars most often recommended for fresh markets from state extension bulletins is given in Table 2, and a more complete list of recommended fresh market cultivars is provided in Table 3.

Table 1. Muscadine berry size.

Berry size	Weight (g/berry)	No. berries per quart
Medium	6-8	50
Large	8-10	40
Very large	>10	30

Table 2. Top recommended muscadine cultivars for fresh market, based on berry size, dry stem scar, sugars, storage life.

Bronze	Purple/black
Fry	Supreme
Triumph	Nesbitt
Summitt	Lane

Table 3. Recommended varieties for fresh market use based on pack characteristics and shelf life (medium may be too small for some retailers):

Cultivar	Color	Size	Ripening season	No. weeks storage at 41 F	Comments
Fry	Bronze	Large	midseason	2	Industry standard, wet stem scar
Darlene	Pink/Bronze	Very large	Early-mid	2	Cluster clip for shipping
Early Fry	Bronze	Very Large	Early	2	Wet stem scar, goes from green to bronze
Pam	Bronze	Very large	Early-mid	2	Can cluster clip, early sweet
Sterling	Bronze	Large	Mid	2	Can have high fruit rot susceptibility
Summit	Bronze	Large	Mid	3	Yield better than Fry, very dry stem scar
Granny Val	Green/Bronze	Very large	Very late	3	Wet stem scar when underripe; stays green
Tara	Bronze	Large	Early	2	Low flavor, very dry stem scar
Triumph	Bronze	Medium	Early	2	Shatters if cluster clipped
Southern Home	Purple	Medium	Mid-late	2	Elongated shape, thin skin, less aroma
Farrar	Purple	Med-large	Mid-late	3	Dry scar, tough skin
Nesbitt	Purple	Large	Early-Mid	2	May exhibit Pierces, dry scar
Supreme	Purple	Large	Mid	3	Good flavor, crisp skin
Black Fry	Purple	Large	Early-mid	2	May crack in wet weather
Black Beauty	Purple	Large	Early-mid	2	May crack in wet weather, crisp skin
Ison	Purple	Medium	Early	2	Can shatter from clusters, may shrivel, have dry scar
Lane	Purple	Very large	Early-mid	3	Dry stem scar, uniform color, crisp skin
Scarlett	Red	Large	Mid	2	Dry stem scar, less aroma, crisp skin

Figure 1. Photos of fresh market muscadine cultivars.

Purple or black types:


Southern Home


Supreme

Farrar

Lane

Nesbitt

Ison

Bronze or white types:


Summit


Darlene


Fry


Triumph


Late Fry


Granny Val


Tara


Scarlett (red)

USDA Grading Standards

Grading standards are set up to ensure a fair quality of pack for both growers and consumers. Muscadine standards were updated in 2006 and a complete list of standards can be found at:

United States Standards for Grapes of Muscadine (Vitis rotundifolia) Grapes. 2006. USDA AMS Fruit Vegetable Programs Fresh Products Branch. pp. 1-4. (http://www.ams.usda.gov/AMSv1.0/standards)

There are 2 grades for muscadine: US No. 1 and US. Extra No. 1. Unlike many other fruits, muscadines are acceptable either with or without stems. The pack should be of uniformly sized berries, of similar varietal color (for instance, not mixed bronze and purple), not overly soft or underripe, and free of dirt, decay, mold, insects, injury, damage. Stem scar tears (large or leaky) have a 5% tolerance for grades and 10% for ungraded. Damage can also include discoloration, leaves, loose stems, or russeting exceeding 10% of the berry surface.

Colors used in grading standards are white (light green, straw, amber, bronze, with some blush or pink); black (reddish purple, purple, or black); red (light pink, red, dark red, purple). Black or red must have 75% color. Russetting is allowed if smooth and less than 10% of the berry surface. Soluble solids content must be at least 13%.

Figure 2. Types of stem scars

Intact stem scar

Stem scar tear (dry)

Figure 3. Defects during storage

Shrivel

Splitting

Berries with shrivel, splits, fermented

Excessive russeting

Stem attachment

Black Beauty grapes showing fully mature (left) and immature (right) berries

Chill injury in Granny Val.
Note brownish look and area of water soaking.

Mold

Leaky berries

Harvesting and handling:

Muscadines accumulate a lot of sugars. A minimum of 12% sugars/Brix is needed, to a maximum of 20%. Berries low in sugar may not harvest easily, with splits at the stem end. Berries high in sugar (over20%) are often soft or overripe. Berry color will also change with ripeness and sugars. For instance, purple berries will lack full color or be reddish, while bronze types may look green when lower in sugars, then become increasingly bronze to brown as sugars reach 20% (Fig. 4).

Fruit color will vary within a pack. For instance, bronze muscadines may range from bright green to a light pink color, depending on ripeness (Fig. 4). In traditional slip skin types, there should be a slight give to the berry when squeezed gently with thumb and finger, indicating the fruit are ripe but not bruised or overripe. Crisp (non slip skin) types will be firm but not hard, and evenly and intensely colored.

Figure 4. Bronze muscadines at full ripe (Brix of 18%) and green ripe (Brix of 15%).

Despite the tough peel, muscadine grapes are a tender fruit. If picked early in the morning, the turgidity of the berry can cause cracking if berries are dropped onto a hard surface. Warmer berries can get internal bruising and soft spots if dropped too far or with too much force. Fresh market muscadines **must** be picked by hand for longest shelf life. Machine harvesting can be done, but will shorten shelf life by 4-5 days. Avoid a catch frame system as there is too much damage to fruit from the long drop. Muscadines can be picked directly into clamshells or into larger containers such as one gallon buckets or shallow vented lugs, then sorted in the field or in a packhouse on conveyor belts. A rinse of the berries using potable water followed by an air blast to dry them and automatic fill into clamshells can be done using a sorting line and conveyor.

Since muscadines in the southern US ripen in the hottest part of the summer, it is important to reduce and eliminate field heat. Harvesting early in the day and placing fruit in the shade or under a tent helps reduce build up of heat. Do not cover tightly with a tarp as this will trap hot air around the berries. Bring fruit to an in-field sorting station or to a nearby pack house so pallets can be made quickly and put into cold rooms or reefer trucks. Thorough cooling should be done before fruit are shipped to markets. Precooling using a forced air is more efficient than room cooling; muscadines should not be hydrocooled as water can enter into the stem ends.

Container and size

There are some variables locally in how muscadines are harvested and packaged. It is important to meet with the retailers or visit stores to see how muscadines are presented. For instance, some grocery chains want muscadines only in pint clamshells while others want a larger pack, such as a strawberry quart clamshell. A few prefer a more open style, where customers can hand pick fruit into produce bags. Also, some retailers prefer the fruit to be presented as clusters, with stems attached, rather than single berries. These variables will impact harvesting, handling, and packaging costs. For instance, it's usually least expensive to pick single fruit into larger clamshells, or run single fruit on a sorter line into clamshells, than to pick clusters or pack in pint clamshells. For long distance shipping, vented clamshells offer the best packaging protection and best maintenance of cooling. Fruit are picked into clamshells that are then placed in masters (cartons that hold 6 to 12 clamshells, have reinforced corners, and vents in the sides for cooling).

Recommended storage and storage life:

As with most small fruits, muscadines have a longer life when field heat is promptly removed and fruit are held at low temperatures. Also, muscadines tend to lose weight and shrivel when held in dry, low humidity packaging. It has been difficult to use sulfer dioxide effectively to stop mold growth because muscadine peel is very sensitive and will bleach.

Muscadines have not been commonly stored under high carbon dioxide/low oxygen (10-15%/10%) to extend shelf life, although studies indicate that they will tolerate these conditions. Little to no ethylene is found in uninjured, not decayed muscadines. It is likely, although not tested, that muscadines exposed to ethylene when stored with other fruits producing ethylene (raspberry, cantaloupe, tomato) will soften more quickly. **Do not** store muscadines with fruits and vegetables as the characteristic muscadine aroma can be tainted by earthy odors (potatoes) and also may taint vegetables of low odor (carrots).

Table 4. Storage conditions and expected shelf life of muscadines.

	Days shelf life	
Temperature	Air	5-15% CO2
32-34 F	21-28	42-48
41 F	7-14	42
50 F	5-7	-
68 F	3-5	-

Recommended storage conditions: Keep between 35 and 41 F. Major causes of postharvest loss are softening and decay (botrytis, anthracnose) all of which are suppressed at lower storage temperatures. Chilling injury (discoloration) can become noticeable on bronze grapes after 10 days at 34 F.

At this time, the amount of shelf life extension that can be gained with carbon dioxide is not clear for fresh market varieties, although promising.
Use of SmartFresh (1-MCP; ethylene blocker) does not improve firmness enough to be cost effective, and effects are dependent on variety and ripeness stage (Steve Mcartney, personal communication).

Health and Nutrition information

Nutrient information for muscadines can be obtained from the US Food Composition Database at:

http://www.nal.usda.gov/fnic/foodcomp/search/

This provides the nutrients in a specific portion unit, of 100 g. There is no specific serving size for muscadines, although 10 large berries (10 g each) would be 100 g. Nutrients are usually expressed on labels as a percent of daily values, as set by the National Academy of Sciences, Institute of Medicine, Food and Nutrition Board.

In addition to nutrients (vitamins, minerals, sugars), another class of compounds referred to as phytonutrients, phytochemicals, or neutraceuticals is becoming important in marketing fruits and vegetables. These compounds are not necessarily needed for human growth and function (a nutrient) but do appear to be protective against chronic diseases and inflammation. A list of these compounds in grapes can be found in the USDA database: http://www.ars.usda.gov/Services/docs.htm?docid=6231. For muscadine grapes, total content of phenolics and anthocyanin among cultivars can be found in Striegler et al. 2005.

Below is a summary of the nutrients and phytochemicals currently identified in muscadines (Tables 5,6). Under guidelines from the FDA, a product can be labeled as being a good source of a nutrient if the serving meets or exceeds 10% of the daily value. It can be labeled as an excellent source if exceeding 20% of the daily value. If one assumes that a serving size of muscadine is 100 g, then muscadine is a good source of vitamin C and dietary fiber, and an excellent source of manganese.

Table 5. Phytonutrients found in muscadine grapes (on whole berry base, pulp and peel) (Ector, 2001; Striegler et al., 2005).

Compound	**Amount (mg/kg)**
Resveratrol	0.09-0.12
Ellagic Acid	1.3-3.9
Total anthocyanin	5-700
Total phenolics	3000-9500

Table 6. Nutrient values for raw (uncooked) muscadine grapes, based on 100 g weight and excluding seeds (based on Higgins, Jumbo, Roanoke varieties).

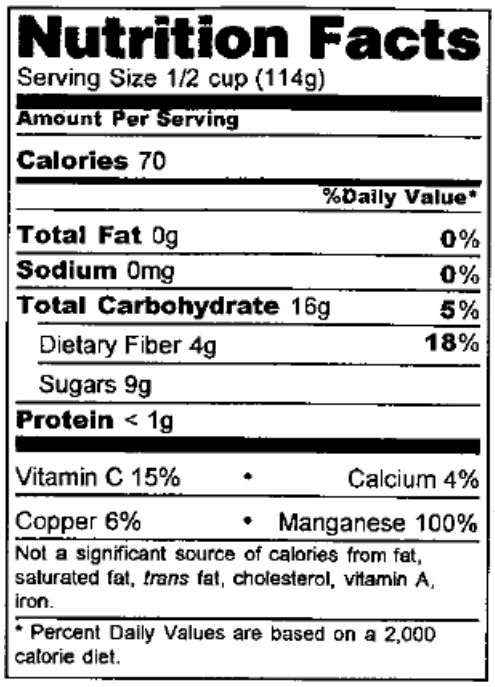
Nutrient and unit of measure	**Amount per 100 g**	**% Daily value**	**Amount per ½ cup serving (114 g)**	**% Daily value**
Water (g)	84.3		96.1	
Energy (kcal)	57	3	65.0	
Protein (g)	0.8	2	0.9	
Total lipid (fat) (g)	0.5	<1	0.6	<1
Ash (g)	0.5		0.6	
Carbohydrate (g)	13.9	5	15.8	6
Fiber, total dietary (g)	3.9	16	4.4	18
Sugars: Total	8.2		9.3	
sucrose (g)	0.6		0.7	
Fructose (g)	3.7		4.2	
Glucose (g)	3.9		4.4	
Minerals				
Calcium (mg)	37	4	42	5
Iron (mg)	0.3	2	0.3	2
Magnesium (mg)	14	4	16	5
Phosphorous (mg)	24	2	27	2
Potassium (mg)	203	6	231	7
Sodium (mg)	1	0	1	0
Zinc (mg)	0.1	1	0.1	1
Copper (mg)	0.1	13	0.1	13
Manganese (mg)	2.0	99	2.3	100
Vitamins				
Folate, food (mcg)	2	<1	2.3	<1
Vitamin A, IU	67	1	76	2
Vitamin C (mg)	8	12	9	14

%Daily value is based on a 2000 calorie intake.
Adapted from USDA Nutrient Database and Ector, 2001

Labels

Nutrition labeling is required to follow specific guidelines, as shown at

http://www.fda.gov/Food/ResourcesForYou/Consumers/NFLPM/ucm274593.htm



Nutrition Facts

Serving Size 1/2 cup (114g)

Amount Per Serving

Calories 70

	%Daily Value*
Total Fat 0g	**0%**
Sodium 0mg	**0%**
Total Carbohydrate 16g	**5%**
Dietary Fiber 4g	**18%**
Sugars 9g	
Protein < 1g	

Vitamin C 15% • Calcium 4%

Copper 6% • Manganese 100%

Not a significant source of calories from fat, saturated fat, *trans* fat, cholesterol, vitamin A, iron.

* Percent Daily Values are based on a 2,000 calorie diet.

Figure 6. A sample label, based on information from Table 6.

Labels can be generated using on line programs such as this one:
http://www.shopncook.com/nutritionFactsLabel.html

Marketing

These tips were given by two large retail grocery stores: one a no frills type and the other a consumer-experience type.

1. Must be GAPs certified
2. Must be on top of the market and able to provide consistent volumes.
3. Must be organized, punctual in deliveries, and provide a clean, top quality product
4. Make sure a good label is present on the product that gives the farm name, the state, and information on use/nutrition.
5. If the store is willing to allow in store product demonstrations, a person from the growers operation should be there and good at interaction with the public.
6. Locally grown is a term that consumers like to see.

7. Talk to the local produce manager about creative marketing ideas, such as campaigns centered around holidays (a native American grape for Labor Day or Columbus day, for instance).

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