try (Morris, 1985). Another juice that is widely accepted commercially is Niagara, also a *Vitis labrusca*, a white juice grape.

Flora (1979) showed that muscadine juice could be successfully blended with commercial fruit juices without sacrificing quality and, in some cases, improving acceptability. Blends of Concord and Niagara juices with muscadine juice can have good color and a refreshing taste. In addition, blending muscadine juice with juices from different varieties of grapes can improve the acceptability of the strong-flavored muscadine and therefore increase the market potential for muscadines.

Sistrunk and Morris (1985) looked at the acceptability and storage stability of muscadine juice blends. Two varieties of muscadine grapes, Noble (black skinned) and Carlos (bronze skinned) were each blended at three levels with apple juice, cranberry juice, Concord and Niagara grape juice, and with each other. The Noble/Concord blends were found to be the most acceptable of the dark blends (data not shown). They also retained the most flavor during a 12-month storage period. Carlos juice blended with light-colored apple juice or with the light-colored Niagara grape juice was rated higher than blends with darker juices. The light amber color of the Carlos-light juice blends was stable during a 12-month storage period, and the flavor and overall acceptability ratings were the highest of all of the blends.

Another approach which needs to be investigated for increasing the acceptability of muscadine juice would be to blend it with Thompson Seedless grape concentrate. This white juice is used extensively commercially for blending with other juices since it provides the light color preferred by consumers, but is inexpensive compared to other juices used in blending. Concentrate from Thompson Seedless has been successfully used commercially for many years to stretch the flavor of the Niagara (white) cultivar.

Muscadine Wine

Most of the commercial muscadine grape crop is used to produce wine. Wine made from suitable cultivars of muscadine grapes has a fruity flavor that appeals to an increasing number of people. Procedures for making muscadine wine are described in Appendix A.

Muscadine grape wines are very susceptible to browning and overall loss of color quality during processing and storage (Sims and Morris, 1985). This color instability severely limits shelf-life and hinders marketing of muscadine wines. In a comparison of the color stability of Noble muscadine wine and Cabernet, Noble browned to a much greater extent during twelve months of storage. This browning was revealed by greater increases in CDM ‘b’ and absorbance (Abs.) at 420 nm in Noble than in Cabernet (Table 17). Apparently, chemical changes in the pigments of the Cabernet wine, measured as chemical aging, served to protect this wine from darkening. The pigments of Noble changed much less than those of Cabernet during storage as shown by a much lower increase in chemical age.

Table 17. Effect of species[1] on color changes of red wine during 12 months of storage (Sims and Morris, 1985).

Cultivar	Increase in CDM 'b'	Increase in Abs. @420nm	Increase in Chemical Age
Noble	2.9a[2]	0.94a	0.098b
Cabernet	1.3b	0.68b	0.398a

[1] *Vitis rotundifolia* , c.v. Noble, and *Vitis vinifera* , Cabernet Sauvignon

[2] Means within columns followed by different letters were significantly different at $p \leq 0.05$

Initial chemical content and conditions of processing and storage have been shown to influence the color quality and stability of muscadine wine (Sims and Morris, 1984). Raising the pH of muscadine wine causes the wine to have a lighter color as indicated by higher 'L" values and lower scores for visual intensity (Table 18). Lowered 'a' values and absorbance at 520 nm show that higher pH also decreases redness of the wine. These effects of altering the pH were seen initially and after three and nine months of storage. Higher pH initially resulted in increased blueness, as indicated by lower 'b' values. However, at three and nine months, increased blueness was not observed, probably because of increased browning which caused 'b' values to go up.

Table 18. Effects of pH on the color of red wine from Noble muscadines initially and after 3 and 9 months storage (Sims and Morris, 1984).

pH	Visual intensity[1]	Absorbance @ 520 nm	CDM L	CDM a	CDM b
		Initial			
2.90	9.0a[2]	0.185a	12.4c	25.5a	4.2a
3.20	7.0b	0.118b	15.2b	24.8b	1.5b
3.80	5.0c	0.077c	18.8a	12.5c	-0.4c
		3 Months			
2.90	7.5a	0.118a	18.5c	18.8a	5.1c
3.20	6.5b	0.095b	19.8b	16.8b	5.7b
3.80	4.3c	0.079c	21.4a	11.2c	6.0a
		9 Months			
2.90	6.1a	0.103a	20.2c	13.1a	7.0c
3.20	5.4b	0.086b	21.2b	11.6b	7.3b
3.80	4.7c	0.067c	24.0a	8.7c	8.2a

[1] Rated on a scale of 1 to 10 with 10 = dark red color and 1 = light red color

[2] Means within pH and storage time separated by a different letter are significantly different $p \leq 0.05$

Storage temperature had a tremendous influence on the browning of muscadine wine (Table 19). During nine months of storage, as storage temperatures increased, there were increases in visual browning, absorbance at 430 nm, and CDM 'b' values, all of which indicate increased browning (Sims and Morris, 1984). This was probably due to greater destruction and/or chemical changes to the anthocyanin color pigments at higher temperatures. Wine stored at 104°F had browned to an unacceptable level after only three months, and wine stored at 86°F had become unacceptable after nine months of storage (data not shown). Wine stored at 68°F browned slowly during nine months, but was still judged acceptable.

Table 19. Effect of storage temperature on color changes of Noble muscadine wine during 9 months of storage (Sims and Morris, 1984).

Storage Temperature	Increase in CDM 'b'	Increase in Abs. @420nm	Increase in Visual Browning
68°F (20°C)	2.1c^2	0.031c	2.5c
86°F (30°C)	5.7b	0.069b	4.3b
104°F (40°C)	9.3a	0.096a	7.0a

In a comparison of the color stability of Noble muscadine wine and Cabernet, the Noble had better color initially (after four months), but had browned to a much greater extent and lost more redness after ten and sixteen months of storage (Sims and Morris, 1985). The color and stability of the muscadine red wine were damaged by higher pH to a greater extent than those of the *Vitis vinifera* red wine.

Vinegar

The word vinegar means sour ("aigre") wine ("vin") in French. Vinegars can be made from a variety of raw materials; however, with muscadines, vinegar is usually produced by bacterial fermentation of wine. Wine connoisseurs may consider it a waste to convert good wine into vinegar, however, there are economic reasons why this could be a profitable plan. First, high quality vinegars often sell for more than the wines from which they were made (Diggs, 1999). In addition, an abundant crop of muscadines can result in a large quantity of wine. Placing an oversupply of even a very good wine on the market will lower the price, but, storing it to control the market supply can be costly. Adding value by further processing the wine to vinegar will eliminate these problems while producing an additional or alternative product to place on the market.

The production of vinegar is described in Appendix A. Those considering producing vinegar are cautioned to use separate facilities for their wine and vinegar production. Lactic acid bacteria used in the production of vinegar can contaminate the fermenting wine, causing the development of poor appearance, undesirable aroma, and off-flavors.

Sweet Spreads

The process of making muscadine grape jelly, jam, preserves, butter, or marmalade consists mainly of cooking the grapes and/or their juice in combination with sweeteners and pectins to the proper solids level (See Appendix A). There are federal standards that dictate the ingredients, their proportions, and the final concentration of soluble solids in each type of sweet spread. The minimum total soluble solids to fruit as required by the Federal Food and Drug Administration for grape jelly, jam, preserves, and fruit butter is:

Finished Product	Soluble Solids	Parts by Weight Fruit to Sweetener	
Grape butter	43% minimum	5	2
Grape jelly	65% minimum	45	55
Grape preserves/jam	68% minimum	45	55

Jam, preserves, and grape butter are made from whole or crushed fruits (Brady, 1995a). Preserves differ from jam, only in that the fruit pieces are usually larger. Muscadine butter is made by cooking the screened fruit (seeds and skins removed) to a smooth, thick consistency. It differs from jam in its ratio of fruit to sweetener and in the final solids concentration. Jelly is made from the fruit juice so that the product is clear and firm enough to hold its shape when removed from the container.

Making sweet spreads from muscadines is a challenge because these grapes have a characteristic thick, leathery skin that does not soften during normal cooking and because muscadines tend to have a poor juice yield. A study by Rizley et al. (1977) looked at various treatments to soften the skins of two cultivars of muscadines so that preserves could be made without removing the skins. Treatments investigated included water blanching, blanching in 2% citric acid, treatment with 0.4% pectinase prior to water or citric acid blanching, and pressure cooking.

Following pre-treatment with pectinase to soften the skins, muscadine preserves could be made from the whole berries (Table 20). With the Noble cultivar, the enzyme treatments resulted in greater skin softening than pressure cooking. Neither blanching in citric acid or in water alone resulted in sufficient skin softening.

Table 20. Effect of cultivar and pretreatment to soften skins on quality of muscadine preserves (Rizley et al., 1977).

Cultivar and pretreatment	Shear	Color Lightness - 'L' value[1]	Sensory Ratings[2]			
			Color	Flavor	Texture	Overall
Carlos						
Water blanch	329	19.4	6.5	6.9	3.9	5.8
Citric acid blanch	442	21.9	6.8	6.6	2.8	5.4
Water blanch + pectinase	226	20.8	7.8	6.9	7.0	7.2
Citric blanch + pectinase	204	21.5	8.0	7.1	7.5	7.5
Pressure cooking	187	22.5	8.0	7.5	6.1	7.2
Noble						
Water blanch	428	8.2	8.5	9.5	3.8	7.3
Citric acid blanch	334	7.5	8.5	9.0	3.8	7.1
Water blanch + pectinase	29	8.2	9.5	8.3	9.5	9.1
Citric blanch + pectinase	21	8.3	9.5	8.5	9.5	9.2
Pressure cooking	144	8.3	9.7	9.3	6.8	8.6

[1] Percent white standard plate L = 92.1

[2] Scale: 1 = poor to 10 = best

There was little variation in the color of the preserves due to skin softening treatments. Sensory ratings of the preserved products indicated an overall preference for products made from grapes that had been blanched in citric acid and pretreated with pectinase. The panelists in this study preferred darker preserves as indicated by higher sensory scores for preserves made from Noble grapes than for those from Carlos.

Dried Products

Drying involves the removal of moisture from foods to inhibit microbial growth and prevent spoilage. At the same time, it is important to preserve as much of the product's nutritive value, natural flavor, nutraceuticals, and quality as possible.

Product development experiments are being conducted at the University of Arkansas looking at the feasibility and technological requirements for commercially producing and marketing products containing dried muscadines such as trail mix and fruit leathers.

Fruit leathers get their name from the fact that, when dry, the product is shiny and has the texture of leather (Brady, 1995b). Fruit leather is essentially the same as commercial fruit roll products. They are made by drying puree of fruit on a flat surface. A single fruit can be used or purees of more than one fruit can be mixed to give a mixed fruit flavor. Sugar may be added to the leather to reduce the tartness of the fruit, or sugar may be omitted to produce a product appropriate for use by those on a reduced sugar diet. The procedure for making fruit leather is described in Appendix A.

By-Products and Nutraceuticals

In addition to research looking at processing muscadines into traditional products like juice, wine, and sweet spreads, a great deal of interest has recently been focused on using muscadine by-products, most notably the skins and seeds. Information regarding potential health benefits of muscadine consumption has led to interest in the development of foods and nutraceutical products containing muscadine components.

By-Products

After muscadines are pressed to remove the juice, the remaining press fraction, or pomace, consisting of skins and seeds (Figure 8), is a large percentage of the fruit (Woodroof et al., 1956; Flora, 1977). Rizley et al. (1977) reported that the muscadines used in their study were approximately 40% skin, 50% pulp and 10% seed. Thus for processing operations like juice, wine, and jelly production, approximately half of the fruit may be lost as press fraction. The use of muscadine pomace could have an important economic impact on the muscadine industry both by increasing the market value per ton of fruit and decreasing or eliminating waste disposal problems (Ector, 2001).

Figure 8. The seeds and skins represent a large percentage of the muscadine fruit. Pictured are the pomace portions from (l to r) Ison, Carlos, and Nesbitt muscadines.

Research at Mississippi State University has led to the development of a process to produce a seedless muscadine pomace puree (Ector, 2001). This puree has been used in a variety of products including fillings and toppings for baked goods, fruit extenders and blends, fruit roll-ups, sauces, toppings, and as ingredients in fruit drinks, frozen fruit bars, cakes, muffins, candies, and breads.

A variety of grape seed extract products are coming into the ingredient market. Individual manufacturers have developed their own systems for removing components that contain nutraceutical properties from the grape seeds. These extract products have recently been the subject of a great deal of research since their antioxidant effects may both inhibit oxidative deterioration of product components, such as fats and vitamins, and may provide antioxidant benefits to human diets (Leigh, 2003). Grape seed extracts are currently being used as nutritional supplements in fruit-flavored beverages and beverage mixes and will soon appear in hot and cold ready-to-eat cereals, meal replacers, snack bars, yogurts, and frozen dairy desserts (Anon., 2004).

Grape seed oil is a by-product of the grape industry. The oil can be extracted from the seeds in a variety of ways including pressing, soluble extraction, and through centrifugation (Axtell, 1992; Peterson, 2001). Grape seed oil is low in saturated fat and high in unsaturated fat (the heart-healthy kind). A tablespoon of grape seed oil has about 10 milligrams (14 IU) of vitamin E, slightly more than sunflower or safflower oil, which are also high in this vitamin. The RDA for vitamin E is 15 milligrams a day.

Grape seed oil has been used in soaps and paints and for food use. It can be used as a cooking oil since it has a high smoke point, meaning that it can be used to cook at high temperatures. It is virtually tasteless, and so it is a good carrier for infused flavors like those from herbs and spices. The president of a company making a mayonnaise-like product containing grape seed oil has reported that, although this product costs about one third more than the company's canola-based variety, it is outselling the more traditional product (O'Donnell, 2004). The grape seed oil product is marketed as a heart-healthy alternative to mayonnaise, and its packaging includes a hang tag that refers to studies showing the oil's ability to raise HDL cholesterol and lower LDL.

Pigments extracted from grape skins are other by-products of the juice and wine industry that are receiving considerable attention as food ingredients. Depending on the level of usage, these pigments have the potential to both color products and increase the nutraceutical content of the foods containing them (Katz, 2004). Canandaigua Wine Co. has recently released two color agents derived from grapes. The company has suggested that, since the color pigments of these products are stable at pH 3 to 4.5, these pigments have potential for use in acidic products where many other coloring agents fail.

All of the current commercial applications of grape seed extract, grape seed oil, and grape pigment have been developed using seeds and skins of *V.*

vinifera or *V. labrusca* grapes. The large scale production of juice and wine from these grapes assures an abundant supply of these by-products. The much lower level of production of muscadine products means their volume of seeds and skins is less; however, the excellent nutrient profile of muscadine materials would suggest that niche market products from these grapes could be developed and marketed successfully.

Nutraceuticals

Muscadines are significant sources of several phytochemicals (chemicals found in plant foods) that have been associated with disease prevention in humans. High concentrations of gallic acid, catechin, epicaechin, ellagic acid, and resveratrol found in the seeds and skins give muscadines a high antioxidant capacity (Ector et al., 1996; Striegler et al., 2004).

Antioxidants are substances that prevent or slow destructive oxidation reactions. They protect key cell components by neutralizing the damaging effects of "free radicals," natural byproducts of cell metabolism. Free radicals form when oxygen is metabolized or burned by the body. They travel through cells, disrupting the structure of other molecules, causing cellular damage. Such cell damage is believed to contribute to aging and various health problems. Antioxidants scavenge free radicals, convert them to harmless substances, absorb them or attach to them before the free radicals can attack normal tissues, destroy cellular proteins or enzymes, or even cause DNA mutations leading to cancer.

A number of components contribute to the antioxidant capacity of muscadine grapes. Antioxidant compounds include vitamins, phenols, carotenoids, and flavonols. As interest in the antioxidant capacity of muscadines has increased, there has been expanded interest in quantifying the amounts of these materials in these grapes. Pastrana-Bonilla et al. (2003) looked at the phenolic content of various portions of the fruits of ten cultivars of muscadines (five bronze and five purple). They found that most phenolics in the grapes were located in the skins and seeds. Muscadine pulps were found to have very low phenolic content. The main phenolics found in muscadines were ellagic acid, kaempferol, myricetin, and quercetin. The seeds were found to have the highest antioxidant capacity compared to the other fruit parts.

Laboratory tests frequently used to measure antioxidant capacity include tests for total phenolics, anthocyanins, and oxygen radical absorbance capacity (ORAC). In general, the higher the values per equivalent weight of fruit for each of these components, the more antioxidant potential the fruit contains.

Threlfall et al. (2004) compared the nutraceutical levels of Black Beauty muscadines with those of Sunbelt (*Vitis labrusca* L.) grapes. Juice was pressed from the grapes using either a hot-press or cold-press method. Nutraceutical analysis (total phenolics, anthocyanins, and ORAC) was completed on the juices obtained from each cultivar by each pressing method as well as on the whole frozen grapes and dried seeds and skins. The juice had lower levels of all three nutraceutical components than the whole grapes except that the total anthocyanin level of the juice from heated Black Beauty samples showed no difference (Table 21). The juice from heated Black Beauty and Sunbelt samples had higher total phenolics and anthocyanins than juice from the cold-pressed samples.

Table 21. Nutraceutical analysis of juice and frozen, thawed grapes from Black Beauty and Sunbelt grapes processed with and without heating (Threlfall et al., 2004).

Cultivar	Processing Treatment	Product	Total Phenolics[1]	Total Anthocyanins[2]	ORAC[3]
Black Beauty	Hot	Juice	1354 b[4] BC[5]	414 a C	25 b C
		Grapes	3461 a A	464 a C	28 a B
	Cold	Juice	424 c D	89 b E	5 c D
		Grapes	3823 a A	451 a C	38 a B
Sunbelt	Hot	Juice	1937 b B	513 b C	23 b C
		Grapes	4028 a A	1312 a B	63 a A
	Cold	Juice	880 c CD	247 c D	23 c C
		Grapes	3684 a A	1424 a A	55 a A

[1] Total phenolics expressed as mg/kg fresh weight for whole grapes or mg/ml fresh weight for juice

[2] Total anthocyanins expressed as mg/kg fresh weight for whole grapes or mg/ml fresh weight for juice

[3] ORAC = oxygen radical absorbance capacity expressed as _mol of Trolox exuivalents (TE) per gram fresh weight for whole grapes and per milliliter for juice.

[4] Within a column and variety, numbers followed by the same lowercase letter are not significantly different $P \leq 0.05$

[5] Within a column, numbers followed by the same uppercase letter(s) are not significantly different $P \leq 0.05$

The dried seeds had more phenolics and less anthocyanins than the skins (Table 22). The highest total phenolic level was in the Black Beauty seeds from cold-pressed samples (Threlfall et al., 2004). The skins of the cold-pressed Sunbelt grapes had the highest amount of anthocyanins. Although the data for the seeds and skins are on a dry weight basis, the press fraction had higher levels of phenolics and ORAC than the whole grapes and juice.

Striegler et al. (2004) looked at the ORAC values and nutraceutical components of the berries and juice from several cultivars of muscadines recommended for production in Arkansas (Table 23). They found that all cultivars have similar levels of total phenolics and ORAC values. As expected, there were no measurable anthocyanins (the pigments that provide the red-purple color) in the bronze cultivars (Carlos, Granny Val, and Summit), and the levels in the dark cultivars (Black Beauty, Ison, Nesbitt, Southern Home, and Supreme), varied with the color intensity of the grapes. In the dark cultivars, the whole fruit had higher total anthocyanin levels than the juice.

Table 22. Nutraceutical analysis of dried seeds and dried skins from Black Beauty and Sunbelt grapes processed with and without heating (Threlfall et al., 2004).

Cultivar	Processing Treatment	Product	Total Phenolics[1] (mg/kg)	Total Anthocyanins[2] (mg/kg)	ORAC[3] (μM TE/g)
Black Beauty	Hot	Seeds	77615 b[4] B[5]	273 c D	893 a B
		Skins	22944 d E	2489 b C	332 b E
	Cold	Seeds	95338 a A	65 c D	1100 a A
		Skins	34543 c D	4942 a B	422 b DE
Sunbelt	Hot	Seeds	42665 ab D	187 c D	571 b CD
		Skins	25732 c E	3743 b BC	383 c E
	Cold	Seeds	51389 a C	232 c D	667 ab C
		Skins	40530 b D	11889 a A	700 a C

[1] Total phenolics expressed as mg/kg dry weight

[2] Total anthocyanins expressed as mg/kg dry weight

[3] ORAC = oxygen radical absorbance capacity expressed as _mol of Trolox exuivalents (TE) per gram dry weight

[4] Within a column and variety, numbers followed by the same lowercase letter are not significantly different P≤0.05

[5] Within a column, numbers followed by the same uppercase letter(s) are not significantly different P≤0.05

Table 23. Juice nutraceutical analysis from muscadine grape cultivars grown at the Southwest Research and Extension Center, Hope, Ark. in 2002 (Striegler et al., 2004).

Cultivar	Product	Total Phenolics[1]	Total Anthocyanins [2]	ORAC [3] (μM TE•g^{-1})
	Grapes			
Black Beauty		3012 a[4] E[5]	303 a D	23 a C
Carlos		9498 a A	5 a E	66 a A
Granny Val		5740 a BCD	7 a E	43 a B
Ison		4560 a CDE	612 a B	53 a AB
Nesbitt		5099 a BCD	422 a C	51 a AB
Southern Home		4417 a ED	298 a D	42 a B
Summit		6586 a B	5 a E	50 a AB
Supreme		6072 a BC	737 a A	45 a AB
	Juice			
Black Beauty		297 b ABD	35 b C	2.9 b BC
Carlos		179 b D	2 a D	3.9 b A
Granny Val		356 b A	3 a D	2.6 b BC
Ison		251 a BCD	104 b A	2.5 b BC
Nesbitt		206 b CD	97 b A	2.1 b C
Southern Home		251 b BCD	83 b B	4.1 b A
Summit		373 b A	4 a D	2.6 b BC
Supreme		339 b AB	35 b C	3.4 b AB

[1] Total phenolics expressed as mg/kg fresh weight for whole grapes or mg/ml fresh weight for juice

[2] Total anthocyanins expressed as mg/kg fresh weight for whole grapes or mg/ml fresh weight for juice

[3] ORAC = oxygen radical absorbance capacity expressed as _mol of Trolox exuivalents (TE) per gram fresh weight for whole grapes and per milliliter for juice.

[4] Within a column and product, numbers followed by the same lowercase letter are not significantly different P≤0.05

[5] Within a column, numbers followed by the same uppercase letter(s) are not significantly different P≤0.05

Nutraceutical analyses of the seeds and skins (dried press material), were compared (Striegler et al., 2004). The seeds had higher total phenolic levels in all cultivars than the skins (data not shown). The seeds also had higher ORAC values in all cultivars than the skins. Although the data for the seeds and skins is on a dry weight basis, the press fraction had higher levels of phenolics and higher ORAC values than the whole grapes and juice.

There has been a great deal of interest recently in resveratrol, a phenolic substance produced by plants, such as grapevines, in response to stress. Consumption of resveratrol has been shown to lower blood levels of low density lipoproteins (LDL), bad cholesterol, and it also has cancer chemopreventative activity (Ector et al., 1996). Resveratrol is the active ingredient in red wine that has been associated with its beneficial effects in reducing the risk of coronary heart disease. Ector et al. (1996) showed that resveratrol is a natural constituent of both bronze- and dark-skinned muscadine grapes with dark-skinned muscadine products having only slightly higher concentrations of resveratrol than most bronze-skinned varieties. Although the seeds of *V. vinifera* or *V. labrusca* grapes have very little resveratrol, muscadine grape seeds were found to have a high resveratrol concentration.

Also present in muscadines is ellagic acid, a phytochemical which has been shown to have a number of human health benefits, including a possible role in preventing some forms of cancer. Strawberries, raspberries, and blackberries are often cited as the best dietary sources of this material, however, the ellagic acid content of muscadine grapes far exceeds that of the other berries (Ector, 2001; Akoh and Pastrana-Bonilla, 2002). Since ellagic acid is found predominantly in the skins of the muscadines, development of consumer products made from this portion of the grape would not only aid in increasing consumption of this nutritional component, but would also make use of a major part of the waste from muscadine processing.

Muscadines are also an excellent source of fiber. The beneficial effects of fiber consumption have been recognized for many years. Fiber-rich foods help prevent constipation, hemorrhoids, and diverticular disease. Some types of fiber may have a cholesterol-lowering effect which could lead to reduced risk of heart disease. In addition, fiber may reduce the incidence of certain types of cancer, particularly those associated with the digestive tract; it may also be helpful in controlling diabetes. Ector (2001) reports that the fiber content of both light- and dark-skinned muscadines is greater than that of most other fruits and is almost three times higher than that of other types of grapes.

Based on the many ways muscadines can contribute to health, researchers and those in the muscadine industry have sought creative new ways to offer these grapes and/or their products to the public. For example, one grower in Georgia has reported that he not only markets his muscadines on the fresh market, but also deseeds and extracts the juice from the pulp and skins, freezes it, and sells it to a commercial winery. The winery uses it to make bottled juice and wine (Omahen, 2001). In addition, the grower grinds the seeds to a powder that is sold in capsules and is currently working on a way to also powder the skins for use as an ingredient in a variety of products.

Although muscadines have been shown to contain significant amounts of several compounds that are known to contribute to health, very little research currently exists demonstrating the bioavailability of these components. Until this research is conducted, care must be taken in making marketing claims about the health benefits of muscadines and products made from them.

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