which were priced slightly higher than the muscadine varieties. The sample of muscadine purchasers had a significantly higher proportion of black consumers than did the sample of non-muscadine grape purchasers. Eighty-seven percent of the muscadine grape purchasers said they would buy them again. Consumers liked the taste of muscadines so much that sales of red seedless and black seeded grapes, both of which were priced slightly higher than the muscadine varieties, were chosen rather than bunch grapes because they are native to the southeastern United States and probably offer greater immediate production potential due to the greater availability of adapted varieties. Further, they are harvested as single berries and growers were interested in consumer acceptance of the product relative to the more familiar bunch grape.

The langsat is easily damaged by cold. During the 1977 January freeze the writer's two largest langsat trees were nearly girdled by the low temperature. Wrapping the trunk from the ground up to a height of three or four feet with an insulating material could have prevented this injury. In Puerto Rico Almeyda and Martin report grafted langsat trees bearing before their eighth year (4). In Florida the 'Uttaradit' variety took 18 years to fruit or over twice as long. The 'Conception' variety was even slower to bear. This is because of the adverse winter weather in Florida during which the plants make little growth, no growth or even experience die-back. Almeyda and Martin state "It (the langsat) will not tolerate extremely alkaline soils." They suggest one that is slightly acid to neutral (4). Unfortunately the warmest areas in South Florida, as one approaches the coastline, nearly always have highly alkaline soils. This means that a low to neutral pH growing medium would have to be provided for this tropical fruit to succeed in such climatically favorable areas.

The langsat is seldom found in Florida rare fruit collections. Its distribution has been severely limited by this Asiatic fruit's special soil requirements, its susceptibility to cold and the prolonged time taken for it to fruit. Rare Fruit Council International member Adolf Grimal has grown the langsat on Big Pine Key to a height of 25 feet by using low pH Florida mainland soils. They would not survive on the existing indigenous Florida Key's marl and limestone soils. Carl W. Campbell in referring to langsats set out in the fields of the Agricultural Research and Education Center (formerly Sub-Tropical Experiment Station) at Homestead stated "The plants did not grow well in the limestone soil here. They made poor growth and were chlorotic. Ultimately all of the plants died, some evidently as a result of poor adaptation to the soil and some as a result of cold injury during the winters of the 1950's and early 1960's." (2).

The duku, with the same botanical name as the langsat, is usually preferred to the langsat because of the superior quality of its fruit. The santol (Sandoricum koetjape, Merrill), a closely related fruit in the same family as the langsat, appears to have a better future in South Florida. This is because vegetatively propagated santols can fruit in only a few years, are slightly more tolerant to cold weather and will survive on higher pH. Florida soils. In spite of its limitations the writer has found considerable pleasure in meeting the challenge of growing and fruiting the langsat in Florida. What's more this exotic fruit is quite good to eat!

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CONSUMER ACCEPTANCE OF MUSCADINE GRAPES

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Abstract. The fresh market potential for muscadine grapes was evaluated with an in-store sales test and through consumer interviews in Tampa, Florida in late August and early September, 1979. Bronze muscadine grape sales averaged about 13 pounds per store per day and purple sales about 12 pounds. Sales compared favorably with sales of red seedless and black seeded grapes, both of which were priced slightly higher than the muscadine varieties. The sample of muscadine purchasers had a significantly higher proportion of black consumers than did the sample of non-muscadine grape purchasers. Eighty-seven percent of the muscadine grape purchasers said they would buy them again. Consumers liked the taste of muscadines but criticized the tough skin and presence of seeds.

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**Objectives**

The basic objective of this research was to determine the feasibility of marketing fresh Florida-grown muscadine grapes through retail supermarkets. Specific objectives were to 1) determine retail sales of bronze and purple muscadine grapes relative to bunch grapes commonly sold by food stores, and 2) determine consumer acceptance of muscadine grapes, with emphasis on repeat purchase intentions.

These objectives were met by conducting an in-store sales test and by interviewing muscadine grape purchasers and other grape purchasers (1). Details follow as to procedures used during the research period of late August and early September, 1979.

**Procedures**

**In-store Sales Test**

A major supermarket chain in Tampa was selected to cooperate in the in-store sales experiment. The chain appeals to a broad spectrum of customers as evidenced by stores in practically all socioeconomic areas. It was anticipated that sales data from such stores would provide an accurate reflection of all grape sales in a relatively short period for various socioeconomic segments.

Six stores were selected on the basis of clientele income to assess the effects of income and other socioeconomic characteristics on grape purchase behavior. Two stores were selected in "low" income areas, two in "medium," and two in "high" income areas. The income area classifications were made on the basis of the produce merchandiser's knowledge of the stores' clientele and confirmed by examining census tract data.

No direct control was exercised by researchers with respect to retail pricing or display space. However, most requests and suggestions were honored. The produce merchandiser of the cooperating firm was asked to price the muscadines about the same as seeded table grape varieties obtained from other areas.

Two two types of muscadine grapes used in the study were the 'Higgins', a bronze, and 'Southland', a purple variety. The produce merchandiser was asked to allocate equal display space to the two varieties, and that total display space for each be similar to the space allocated to other seeded varieties in the respective test stores. Point-of-sale material consisting of 5½ x 7" price cards was used only for the muscadine grapes. The price cards used the slogan "Try Florida Grapes."

Trained market research personnel visited each of the test stores daily to obtain grape sales data for all varieties, spoilage, use of point-of-sale material, prices, and the amount of display space allocated to each variety.

Daily transaction totals were also obtained for each store. These transaction totals were used as estimates of the number of customers that each store attracted. This allowed grape sales to be expressed relative to the number of customers shopping a given store.

On Monday, August 27, several Gainesville area growers delivered a total of 12 lugs of each variety to the University of Florida Food Science Department's cold storage facilities. Florida Agricultural Market Research Center personnel transported the 24 lugs of grapes to the cooperating retailer's warehouse on Tuesday, August 28. Two lugs of each variety were distributed to each of the six test stores the following morning, in conjunction with the stores' regularly scheduled produce shipments. The 24 lugs were the only muscadine grapes available for the in-store tests.

**Consumer Interviews**

A professional interviewer was stationed in each of the six test stores between the hours of 2:00 P.M. and 8:00 P.M. on Thursday and Friday and 12:00 noon until 6:00 P.M. on Saturday, August 30 through September 1. The hours were selected to obtain a consumer sample which would include adequate numbers of homemakers employed outside the home. Interviewers obtained the names and telephone numbers of all grape purchasers willing to be interviewed by telephone at a later date. Seventy-eight muscadine grape purchasers and 290 purchasers of other table grapes were subsequently interviewed by professional interviewers approximately one week after consumers were contacted in the stores. A minimum of one week was allowed in order to give consumers a chance to use the grapes which they had purchased.

**Findings**

**In-store Sales Results**

Each of the six test stores received two lugs of 'Higgins' and two lugs of 'Southland' muscadine grapes on Wednesday, August 29. Because of the limited supplies of muscadine grapes, the six test stores only stocked them for part of a four day period, Wednesday through Saturday. Some stores received late deliveries on Thursday and some experienced out-of-stocks on Saturday. When inexact sales observations obtained Wednesday and Saturday are deleted, only 12 store-day observations could be used for analysis.

Both varieties of muscadine grapes were packaged in green plastic foam trays with a film overwrap. In most stores, the net weight of muscadine grape packages was slightly under one pound (0.45 kg.), usually about 15 ounces (0.43 kg.). Both varieties of muscadine grapes were priced at 78¢ per pound ($1.72 per kg.) as compared with 83¢ per pound ($1.83 per kg.) for the 'Ribier', a black seeded variety available in some stores. Red seeded grapes were available at all stores at 88¢ per pound ($1.94 per kg.) but 'Thompson' seedless were heavily advertised at 58¢ per pound. Red seeded grapes were not available, due to the abundance and consequently low prices of the seedless varieties during the test.

Display space was allocated approximately equally between the bronze and purple muscadine varieties. Approximately 3 square feet (0.28 m²) were devoted to the bronze and slightly less for the purple variety. The range was from about 1.5 to 4.25 square feet (0.14 to 0.40 m²). The space allocated to the bronze and purple muscadines constituted about 10 percent of the total shelf space allocated to all grapes. The black seeded variety was available in some of the stores during the test. In these stores display space allocated to this grape was only about one square foot (0.09 m²) or 2.8 percent of the total grape display space. Because the 'Thompson' seedless was featured during the test period, it received a large amount of display space. On the average, over 20 square feet (1.86 m²) of space was allocated to them. The display space devoted to the green seedless grapes ranged from about 7 to slightly over 30 square feet per store (0.65 to 2.79 m²). Overall, 70 percent of the display space for grapes was used for green seedless.

Sales of both types of muscadine grapes compared favorably with those of the red seedless and the black seeded varieties. Sales of the bronze muscadines averaged slightly over 13 pounds (5.9 kg.) per store per day. Sales ranged from 5.3 to 19.1 pounds (2.4 to 8.7 kg.) per day and constituted 3.8 percent of total grape sales over all six stores (Table 1).
Table 1. Average daily sales of various types of fresh table grapes, test supermarkets.

<table>
<thead>
<tr>
<th>Type of grape</th>
<th>Daily sales</th>
<th>Average proportion</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Averages</td>
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</tr>
<tr>
<td>Muscadines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bronze</td>
<td>13.1</td>
<td>5.5</td>
</tr>
<tr>
<td>Purple</td>
<td>11.5</td>
<td>2.9</td>
</tr>
<tr>
<td>Green seedless</td>
<td>300.2</td>
<td>81.0</td>
</tr>
<tr>
<td>Red seedless</td>
<td>9.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Black seeded</td>
<td>17.4</td>
<td>7.5</td>
</tr>
<tr>
<td>Totals, all types</td>
<td>342.6</td>
<td>143.4</td>
</tr>
</tbody>
</table>

* Averages are based on 12 observations from 6 supermarkets except for black seeded which are based on 5 observations. Most observations were made on Thursday and Friday. It should be noted that these observations preceded the Labor Day weekend and thus reflect heavier than normal sales.

Sales of the purple variety were quite similar. Average sales were 11.5 pounds (5.2 kg.) per store per day, with a range of 2.9 to 19.8 pounds (1.3 to 9.0 kg.). On the average, the purple muscadine grape sales amounted to 3.4 percent of all grape sales. Red seedless sales averaged 9.4 pounds (4.3 kg.) per store per day while sales of the black seeded variety averaged 17.4 pounds (7.9 kg.). These sales comprised 2.8 and 2.1 percent, respectively, of total grape sales. Caution should be used in interpreting these figures, particularly for the black seeded variety, because this variety was not available to all stores in quantity. Green seedless sales averaged slightly over 500 pounds (136.1 kg.) per store per day and constituted nearly 88 percent of the total grape sales. Daily sales per store ranged from 81 to 584 pounds (36.7 to 264.9 kg.).

Grape sales were also analyzed by income level of the respective stores’ clientele. Conclusions drawn from such limited data may be rather tenuous, but it appears that there were no significant differences in muscadine sales by income area.

Even though muscadine grapes were available in the stores for a very brief period of time, it is apparent that consumers will buy them if they are available. Most of the stores exhausted their supplies of muscadines within the four-day test period, and sales relative to other varieties (except for ‘Thompson’ seedless) were favorable.

**Consumer Survey**

A total of 78 muscadine grape purchasers and 290 purchasers of other table grapes (termed “other grape purchasers”) were interviewed by telephone approximately one week after they had been contacted in the stores.

A number of demographic and socioeconomic variables were compared for the two groups of grape purchasers. Chi-square analysis was used to determine whether or not statistically significant differences existed between the two groups with respect to age, education, employment status of the household head, family composition, race, income, and sex of the purchaser. The only statistically significant difference was with respect to race, which is consistent with other findings (9). Thirty-nine percent of the grape purchasers were black compared with only 22 percent of the other grape purchaser sample. It was found that blacks were more familiar with muscadines than were whites. This greater familiarity with muscadines is probably due to predominately rural southern backgrounds and the fact that muscadine grapes grow wild in many southern areas.

**Purchasers’ Evaluations of Muscadine Grapes**

Over 97 percent of the respondents sampled the muscadines within one day of purchase and all respondents had tried them within four days. On the day of interview over 90 percent had consumed or had discarded all muscadines purchased. About 8 percent reported having some on hand. Four of the 78 respondents, slightly over 5 percent, said they discarded the muscadine grapes without eating them. All discards occurred within 24 hours of purchase. Three of the four said they simply did not like the taste, while one said that they were spoiled.

Adults were the major consumers of muscadine grapes purchased. Approximately three-fourths of the respondents said adults in the households consumed most of the muscadine grapes. Children were the primary consumers in about 9 percent of the households. The remaining 16 percent of the respondents said that adults and children consumed the muscadine grapes in equal proportions.

Virtually all of the grapes were eaten fresh, as out-of-hand snacks. Only one person reported eating muscadine grapes as part of a meal, i.e., as a salad ingredient. None of the respondents used the grapes in jelly, for juice, or wine.

**Evaluation of muscadine grape characteristics**

Muscadine grape purchasers were probed to determine the muscadine qualities they liked and disliked most. Most respondents were able to verbalize only one or two qualities.

*Qualities liked most.* Taste was the first quality cited by 57 percent of the muscadine purchasers. When probed for additional responses two-thirds of all respondents stated taste as a quality liked. Sweetness, texture, juiciness and appearance were mentioned first by 15, 7, 7, and 3 percent, respectively. When all responses are analyzed, these same qualities were mentioned by 35, 17, 12 and 8 percent of the respondents. A few mentioned size, smell, color, freshness, general eating quality, and price as qualities liked most. Several others mentioned nostalgia and medicinal qualities.

*Qualities disliked.* Forty-one percent of the respondents had no complaints at all about the muscadine grapes. However, 32 percent of the muscadine purchasers mentioned tough skin as the quality disliked most. Seeds, tartness, and taste were mentioned by 9, 8, and 3 percent, respectively. Four percent mentioned the relatively high price as the thing they disliked the most. Analysis of subsequent responses revealed that tough skins were disliked by 42 percent of respondents, seeds by 16 percent, and tartness by 11 percent.

Fourteen shoppers purchased both bronze and purple muscadine grapes. They were asked to rate selected characteristics of both varieties on a scale of 10 (excellent) to 0 (poor). The purple variety received higher ratings on all characteristics. The rating difference for color was statistically significant at the 0.05 probability level and rating differences for flavor and overall quality were statistically significant at the 0.10 probability level. Differences for freshness and shelf life were not statistically significant.

**Repeat purchase intentions**

A very high proportion of the muscadine grape purchasers intended to buy them again. Overall, 87 percent said that they intended to buy them again, 8 percent did not, and 5 percent were undecided. Of the six persons that did not plan to buy muscadine grapes again, five cited taste and one expressed displeasure with the grapes because they were not ripe enough. Slightly over two-thirds of the muscadine grape purchasers were familiar with muscadine grapes as part of a meal, i.e., as a salad ingredient. None of the respondents used the grapes in jelly, for juice, or wine.

grapes to some degree. Eighty-nine percent of those familiar with them intended to buy them again, 4 percent did not and 8 percent were undecided.

Of the 25 people that were unfamiliar with muscadine grapes prior to buying them during the in-store sales test, 21 or 84 percent intended to buy them again. Four purchasers or 16 percent did not plan to buy them again; none were undecided. Repeat purchase intentions were similar regardless of the muscadine variety purchased.

Other Grape Purchasers' Awareness of and Aversions to Muscadine Grapes

The sample of 290 shoppers that purchased grapes other than muscadine grapes were interviewed to determine whether or not they had seen the muscadine grapes and if so, why they had not purchased them. The interviews also provided insight as to whether these shoppers had any identifiable socioeconomic or demographic characteristics which would set them apart from the shoppers that had purchased muscadine grapes. Since many shoppers shop and buy out of habit, unawareness of the muscadine grapes was a major reason why muscadine grapes were not purchased by more customers without recall assistance. Only 42 respondents, 14 percent of the other grape purchasers, recalled seeing at least one variety of muscadine grapes.

Aversions to muscadine grapes

All shoppers that recalled seeing muscadine grapes in the stores were asked why they had not purchased them. The most common reason given, mentioned by almost 43 percent of the respondents, was that muscadines contain seeds. A sizeable proportion, almost 27 percent, mentioned price as being the primary reason for not buying them. Appearance and uncertainty as to the nature of the grape were reasons given by almost equal numbers of shoppers, roughly 12 and 11 percent, respectively. Tough skin was the major reason given by two of the respondents, or 3.6 percent.

Conclusions

Muscadine grapes can be marketed satisfactorily through retail supermarkets in Florida. Sale of muscadinones compared favorably with sales of black seeded and red seedless grapes. Muscadine grapes particularly appeared to black consumers, but consumer acceptance of muscadinone grapes was generally favorable for all socioeconomic groups. Consumers' repeat buying intentions were particularly encouraging. These optimistic findings should be tempered by the recognition that the in-store portion of this research was very limited. It was conducted during the Labor Day weekend, a time when all grape sales were very high. Because the muscadine grapes were all sold over a four day period, shelf life problems were non-existent. A retail experiment over a longer period of time, with these or other varieties, may reveal problems. Other varieties of muscadines may also affect consumer acceptance. Also, varying price levels for muscadine grapes and other types of grapes will affect sales. However, it appears that consumer demand through retail food stores can provide a viable market for Florida's expanding muscadine grape production.

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Effects of Ethephon on Ease of Harvest of Muscadine Grapes

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Additional index words. abscission, mechanical-harvesting, Vitis.

Abstract. 'Hunt', 'Noble', and 'Dulcet' muscadine grapes (Vitis rotundifolia Michx.) were sprayed with ethephon 24 hr before harvest in 1978, 1979, and 1980. The purpose was to induce abscission of berries and facilitate mechanical harvesting of these cultivars that are normally difficult to harvest. In 1978 an application of 600 ppm ethephon increased dry stem scars on 'Hunt' berries from 40% to 90%, and reduced picking time from 10.5 to 5.5 minutes using a vibrator harvester. In 1979, an increase from 37% to 82% dry scar was obtained with 'Noble' and an increase from 9% to 100% with 'Dulcet' using 600 ppm ethephon. In 1980, sprayed and unsprayed 'Noble' vines had 43% and 19% dry scar, respectively, at 600 ppm and 66% and 17% at 1200 ppm, whereas 'Dulcet' had 80% and 3% dry scar, respectively, using 1200 ppm. Pre-harvest berry drop began 30 hr after spraying and became serious by 48 hr after spraying; unsprayed vines held fruit for weeks if left unpicked. No leaf abscission occurred following ethephon application. Translocation of ethephon from sprayed to unsprayed arms on the same vine was slight or nonexistent.

Mechanical harvesting of muscadine grapes has been successful using cultivars with berries that separate readily from the pedicel, such as 'Carlos', 'Roanoke', and 'Southland' (1). However, many muscadine cultivars have berries that do not separate readily from the pedicel because no abscission layer is formed. Berry ripening in some cultivars is so uneven that once-over harvesting is impractical. The use of 2-chloroethylphosphonic acid (ethephon) to promote abscission of Vitis vinifera berries was first reported in 1969 (5). In V. labrusca cv. Concord berry abscission was increased by 250 ppm ethephon if applied within 6 days.