

Handling and Marketing Of Muscadine Grapes

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Postharvest Changes

Soluble solids and acid content are the basis, for determining harvest maturity of grapes. Although a considerable amount of research effort has gone towards investigating the rate of maturation and optimum harvest maturity of cultivars of *Vitis unifera* and *Vitis labrusca* (primarily, Concord), until recently little was known about the maturation and fruit quality of muscadines (*Vitis rotundifolia*).

Muscadine Maturity Considerations

Uneven ripening is a major problem with muscadines with regard to the point of optimum once-over harvest maturity since a range of ripenesses is present during the entire harvest period. Cultivar selection helps but does not completely solve the problem. Two approaches have been taken to eliminate the immature fruit. Ballinger and coworkers (1) at North Carolina State University developed a high-speed fibre-optic sorter that could sort the unripe fruit from the ripe fruit using either black or bronze grapes. The system was based on the difference in absorption of light by the pigments within the various fruit maturities. However, different ranges in wavelength have to be used for the

black and bronze fruit. An inexpensive approach to sorting was taken at the University of Arkansas in 1976 (5). The changes in muscadine fruit maturity were followed by brine separation. Carlos muscadine grapes, which develop a dry stem scar, were sorted into five density grades using four brine solutions of 8, 9, 10, and 11 percent NaCl (sodium chloride). Soluble solids and berry weight increased, color improved, and acidity decreased with grape maturity and brine concentration. Panelist's sensory preference increased with increasing density (maturity). Berries that floated and sank in 11 percent NaCl (density grades 4 and 5) had acceptable ratings for flavor, aroma, and color. In this study, density separation also was used to monitor the rates of maturation of the cultivars Carlos and Noble. The technique was useful in characterizing the changes in berry population during the last month of ripening. Commercial application is currently using this density sorting approach to eliminate the undesirable immature fruit Flora (3) in Georgia and Hatton (4) with the USDA in Florida indicate positive results with density sorting muscadine grapes.

Once an optimum quality grape has been harvested and sorted, it is important to maintain this level of quality during storage and marketing. After harvest the translocation of sugars into the fruit ceases and unless respiration is limited or stopped the sugars and organic acids will be converted to carbon dioxide, heat and intermediate organic compounds. In addition to the loss of sugars and organic acids, other oxidative changes may occur during postharvest storage and marketing. Anthocyanins, the major pigments of red or blue colored grapes, are subject to nonenzymatic as well as enzymatic oxidation which results in a dull or brownish colored product. Other changes that occur are fruit softening due to mechanical changes or damages to the cells and chemical alteration of the pectic components of the cell walls and membranes. Due to the degradation of cell walls and membranes, enzymes and substrates that are normally kept separate due to 'compartmentation' within the cells come into direct contact with each other resulting in accelerated decomposition of the product. All of these processes influence the postharvest life of grapes.

Lutz and Hardenburg (6) report that the fresh-market storage life for *Vitis* species as follows: *Vitis vinifera*, 3 to 6 months; *Vitis labrusca*, 2 to 8 weeks; and *Vitis rotundifolia* (muscadines), 2 to 3 weeks.

Utilization of SO₂

Although the *Vitis vinifera* species have the potential for long storage, long-term storage requires immediate precooling followed by storage at low temperatures (31°F) at high relative humidity and the use of an antifungal material such as SO₂ (sodium bisulfite). SO₂ controls *Rhizopus* *Penicillium Botrytis* and other fungi causing decay of grapes. California table grapes are usually treated with SO₂ in the refrigerated van for immediate shipment or if the grapes are to be stored the treatment is applied in special gassing rooms before precooling at the rate of 1.0% for approximately 20 minutes. This treatment will vary to fit a given cultivar or situation. The grapes in storage are refumigated at 7 to 10 day intervals with a lower concentration of SO₂ (about 0.25% for 20 min.) (12). Modified CO₂ (carbon dioxide) atmosphere storage has shown little promise for extending the storage life of *Vitis vinifera* grapes due to their low respiration rate. This periodic treatment with SO₂ was successfully eliminated by Nelson and Ahmedullah (9) using in-package slow-release SO₂ generators.

Very little work has been conducted with SO₂ on fresh market muscadine grapes. Smit *et al.* (11) in Georgia reported that packing muscadine with Sodium bisulfite, in coated cellophane, gave an acceptable product after about 2 months at 32°F. Vinylidene chloride/vinyl chloride copolymer, as well as polyethylene bags, resulted in the development of off-flavors and slight bleaching of the grapes after approximately 2 weeks in storage. Additional research is needed on the respiration rate responses to modified atmospheres and SO₂ of the major muscadine cultivars. Extending the short storage life of the muscadine would eliminate a major fresh fruit

marketing problem associated with this species.

The utilization of SO₂ is also employed to maintain raw product quality of wine and juice grapes. Studies at the University of Arkansas (8) showed that temperature of fruit at harvest was the primary factor governing the rate of postharvest quality changes in machine harvested juice grapes. Fruit harvested at midday at 95°F remained at that temperature inside a bulk pallet box for 72 hours, regardless of diurnal temperature fluctuations. Without addition of SO₂, alcohol concentration steadily increased after 12 hours holding the

Harvesting at a cool temperature (75°) and SO₂ addition will allow for extended holding of the raw product with minimal alcohol production and raw product quality loss.

Economic Considerations

Little research has been conducted on the economics of marketing muscadine grapes, but Proctor (10) in North Carolina recently published an extensive study on fresh marketing muscadines and the University of Florida has initiated an active program in this area (7). Today the majority of the muscadine grapes



mechanically harvested grapes in a bulk pallet box and reached 3% after 72 hours. Loss of soluble solids began immediately after harvest and after 72 hours, 44% of the soluble solids present at the time of harvest had been lost. Addition of SO₂ at harvest or no later than 6 hours after harvest aided in slowing postharvest deterioration. The addition of 80 or 160 ppm SO₂ to a bulk pallet box of grapes mechanically harvested at a temperature of 95°F was as effective in retarding postharvest deterioration of the quality attributes determined in this study as was

are sold to the wine industry; however, many muscadine growers are trying to diversify their outlets through fresh market and pick-your-own operations. The muscadine grape has not realized its full potential in the South; however, there is an increased interest in producing this crop. Cost for planting and establishing (3 year period) a commercial vineyard on a Geneva Double Curtain training system is approximately \$3,000 per acre. In the future it is important that the market potential of all approaches (wine, fresh market and pick-your-own) be determined before establishing additional acres.

Future of Muscadines

A number of new muscadine wineries have either started or are in the process of being started throughout the South. Many of the dry and semi-dry muscadine wines that are coming from these cellars have successfully eliminated the characteristic harsh finish while maintaining the unique muscadine aroma and taste. This market should continue to expand. The pick-your-own operations and roadside stands that have

located near populated areas may not be severely affected by the energy shortage and should continue to enjoy success. A grower in Clinton, North Carolina has the largest successful fresh market operation for muscadine grapes. He has found a ready market for his grapes, but shelf-life remains his major problem. An increase in fresh marketing of muscadines should be successful if a high quality product is attractively packaged and if technology

can provide an adequate shelf-life. The processing of jam, jelly and juice should be expanded. At the present time these markets are limited to small specialty outlets. If a large volume of muscadines are to be used by processors, additional research is needed to develop new products and to determine the cause of instability of processed muscadine products (2). The challenge at the present time is to solve the problems and expand our muscadine industry in an orderly fashion.

Literature Cited

1. Ballinger, W. E., W. F. McClure, W. B. Nesbitt, and E. P. Maness. 1978. Light sorting muscadine grapes (*Vitis rotundifolia* Michx.) for ripeness. *J. Amer. Soc. Hort. Sci.* 103:629-634.
2. Flora, L. F. 1977. Considerations in marketing muscadine grapes. *Fruit South.* 1:130-132.
3. Flora, L. F. (personal communication). Food Science Dept., University of Georgia, Experiment, Ga.
4. Hatton, T. T. (personal communication). Dept. of Agric., Orlando, Fla.
5. Lanier, M. R. and J. R. Morris. 1979. Evaluation of density separation for defining fruit maturities and maturation rates of once-over harvested muscadine grapes. *J. Amer. Soc. Hort. Sci.* 104:249-252.
6. Lutz, J. M. and R. E. Hardenburg. 1968. The commercial storage of fruits, vegetables, and florist and nursery stocks. U. S. Dept, Agr. Handbook 66 (rev).
7. Mathis, K. (personal communication). Food and Resource Economics Dept., Florida Agricultural Market Research Center. Gainesville Fla.
8. Morris, J. R., D. L. Cawthon, and J. W. Fleming. 1979. Effects of temperature and SO₂ addition on quality and postharvest behavior of mechanically harvested juice grapes in Arkansas. *J. Amer. Soc. Hort. Sci.* 104:166-169.
9. Nelson, K. E. and M. Ahmedullah. 1976. Packaging and decay-control systems for storage and transit of table grapes for export. *Amer. J. Enol. Vitic.* 27:74-79.
10. Proctor, E. A. 1979. Muscadine grape fresh market study. N. C. Agr. Ext. Serv., Agr. Econ Rpt. 153.
11. Smit, C. J. B., H. L. Cancel and O. M. Nakayama. 1971. Refrigerated storage of muscadine grapes. *Amer. J. Enol. Vitic.* 22:227-230.
12. Winkler, A. J. and H. E. Jacob. 1925. The utilization of sulfur dioxide in the marketing of grapes. *Hilgardia* 1:107-131.