

Evaluating Harvest and Postharvest Potential of Fresh-market Muscadine Grapes Grown in Arkansas

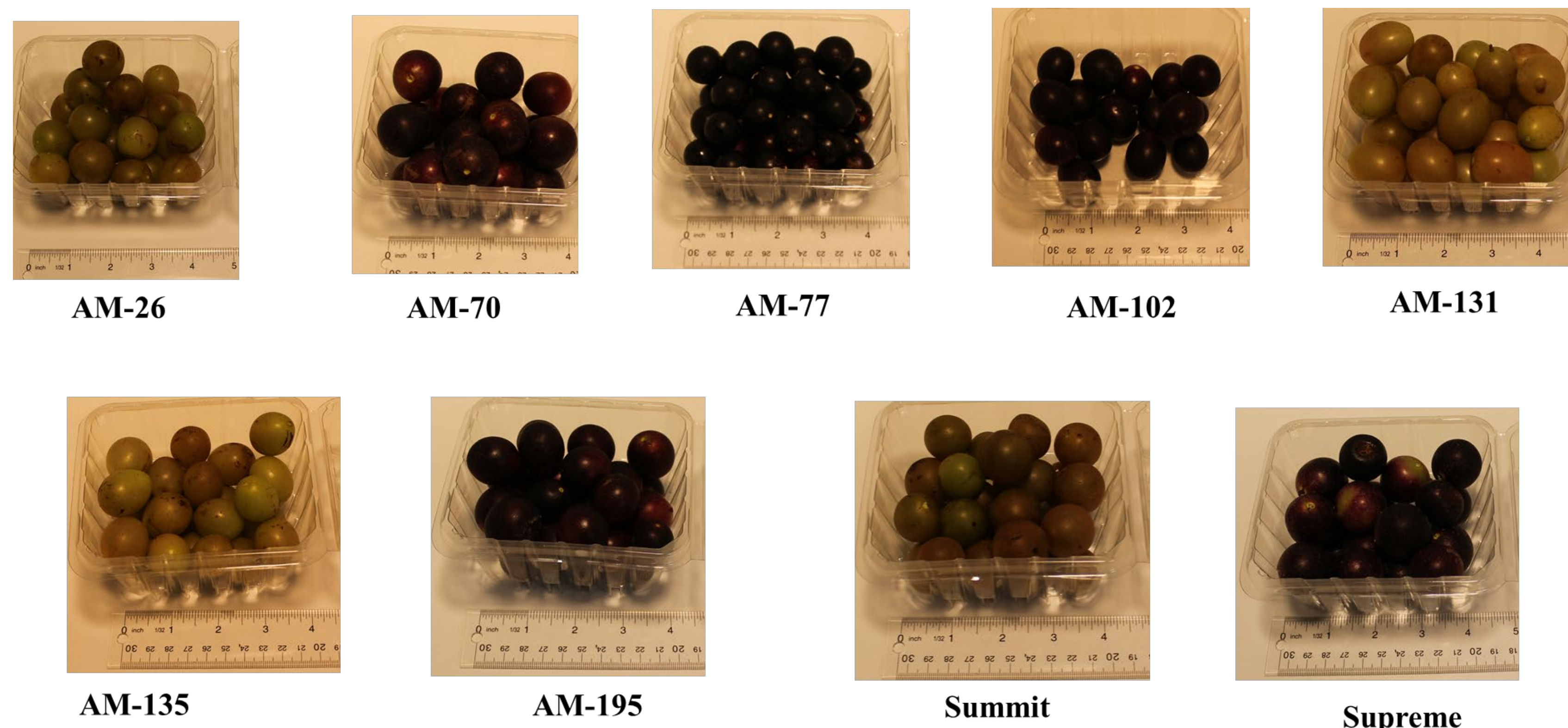


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Introduction

Muscadine grapes (*Vitis rotundifolia* Michx.) are a disease-resistant specialty crop native to the southeastern United States with potential for increased fresh-market expansion. The unique genetic makeup of muscadines is responsible for its distinguishing characteristics such as thick skins, small clusters, unbranched tendrils, and berries that abscise from the cluster. There have been major advances in U.S. muscadine private and public breeding efforts resulting in traits emerging with commercial, fresh-market potential. The muscadine breeding efforts aim to bring *Vitis vinifera* characteristics (seedlessness and thinner skins) to muscadines while retaining the unique flavors and aromas and disease resistance of muscadine grapes. With the release of new muscadine cultivars, particularly seedless cultivars, there is an opportunity to strengthen the market presence for the muscadine industry. The University of Arkansas (UA) System Division of Agriculture fruit breeding program began breeding muscadines in 2005 with a focus on large fruit size, crisp texture, edible skin, self-fruitful flowers, seedlessness, and improved postharvest storability. The United States Department of Agriculture (USDA) has grades and standards for commercial sales of fresh-market muscadines based on traditional cultivars of muscadines with limited visual aids and guides. The objective of this study was to determine the physical, composition, and postharvest attributes of fresh-market muscadine grapes grown in Arkansas. Understanding these attributes of Arkansas-grown muscadine genotypes (cultivars and advanced selections) is important to demonstrate fresh-market potential and provide data for revising the USDA standards and grades.



Acknowledgements

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Materials and Methods

Muscadine Grape Harvest

Grapes were harvested in September 2020 at the UA System Fruit Research Station in Clarksville, AR.

- Nine muscadine genotypes (AM-26, AM-70, AM-77, AM-102, AM-131, AM-135, AM-195, Summit, and Supreme) harvested
- 1.8 kg of each genotype harvested into clamshells, placed in ice chests, and transported to the UA System Food Science Department, Fayetteville
- Physical and composition attributes evaluated at harvest and postharvest attributes evaluated at 0, 14, and 28 d at 2°C in triplicate per genotype

Physical Attribute Analysis

Five berries per sample evaluated for berry weight, seed number, and firmness, and the berries in a clamshell evaluated for stem scar tear.

- Berry weight (g) of each berry measured on a digital scale
- Seed number determined by removing and counting seeds from each berry
- Stem scar tear (> 2x diameter of stem scar) calculated as (number of torn berries/total berries) × 100 and expressed as percent
- Berry firmness measured as force (N) to penetrate the flesh using a Stable Micro Systems TA.XT.plus texture analyzer with a 2-mm diameter probe

Composition Attribute Analysis

The juice from five berries per sample evaluated for composition attributes.

- Soluble solids (%) measured using a refractometer
- pH measured with the pH probe of an automated titrimer
- Titratable acidity (% tartaric acid) measured with an automated titrimer and determined using 6 mL of juice diluted with 50 mL of deionized, degassed water by titration with 0.1 N sodium hydroxide to an endpoint of pH 8.2

Postharvest Attribute Analysis

The postharvest attributes evaluated at 0, 14, and 28 d at 2-3 °C for each sample.

- Unmarketable (visible mold or rot) berries calculated as (number of decayed or torn berries/total berries) × 100 and expressed as percent
- Weight loss of the clamshell calculated as weight decrease of the total grapes in the clamshell and expressed as percent

Statistical Analysis

Data analyzed as a completely randomized design with three replicates per genotype using JMP® (version 15.2.0; SAS Institute Inc., Cary, NC). Tukey's Honestly Significant Difference (HSD) was used for mean separation at a p-value ≤ 0.05.

Results

Physical and Composition Attributes at Harvest

Genotype impacted all physical and composition attributes except seed number.

- Berry weights ranged from 4.76 g (AM 77) to 12.50 g (AM 70)
- Stem scar tear ranged from 0% (AM 26) to 30.61% (Supreme)
- Berry firmness ranged from 6.53 N (AM 135) to 10.75 N (Summit)
- Soluble solids ranged from 11.37% (AM 77) to 17.43% (Supreme)
- Titratable acidity ranges from 0.43% (AM-70) to 1.06% (AM 77)
- Soluble solids/titratable acidity ratio ranged from 10.75 (AM 77) to 35.17 (AM-70)

Table 1. Physical and composition attributes of muscadine grape genotypes at harvest, Clarksville, AR (2020)

Genotype ^z	Berry weight (g)	Seed number	Stem scar tear (%)	Berry firmness (N)	Soluble Solids (%)	pH	Titratable acidity (%) ^y	Soluble solids/titratable acidity ratio
AM 26	9.47 b	3.00 a	0.00 d	9.66 ab	11.77 ef	3.45 bc	0.57 de	20.79 bcd
AM 70	12.50 a	3.33 a	13.99 b	8.90 abc	14.50 bcd	3.49 b	0.43 e	35.17 a
AM 77	4.76 c	4.00 a	0.78 d	7.54 cd	11.37 f	2.81 f	1.06 a	10.75 d
AM 102	6.15 c	2.33 a	1.85 d	8.43 bcd	16.80 ab	3.18 e	0.67d	24.90 abc
AM 131	8.79 b	3.67 a	15.34 b	9.52 ab	16.13 abc	3.27 cde	0.96 ab	16.83 cd
AM 135	8.76 b	3.33 a	3.18 cd	6.53 d	13.33 def	3.37 b-e	0.70 cd	18.91 bcd
AM 195	10.17 b	3.00 a	9.53 bc	8.74 bc	14.67 bcd	3.80 a	0.72 cd	20.44 bcd
Summit	8.48 b	2.67 a	3.77 cd	10.75 a	14.07 cde	3.21 de	0.85 bc	16.53 cd
Supreme	10.17 b	2.67 a	30.61 a	9.53 ab	17.43 a	3.41 bcd	0.60 d	29.60 ab
P-value	<0.0001	0.1277	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

^z Genotypes were evaluated in triplicate. Means with different letters for each attribute are significantly different (p<0.05) using Tukey's Honestly Significant Difference test.

^y Titratable acidity expressed as % tartaric acid.

Postharvest Attributes during Storage

There was a significant genotype x storage interaction for both postharvest attributes.

- Weight loss and unmarketable berries increased during storage
- AM 102 had highest weight loss at 14 days (4.53%) and 28 days (7.83%)
- Supreme had highest unmarketable berries at 14 days (7.02%) and 28 days (24.56%)

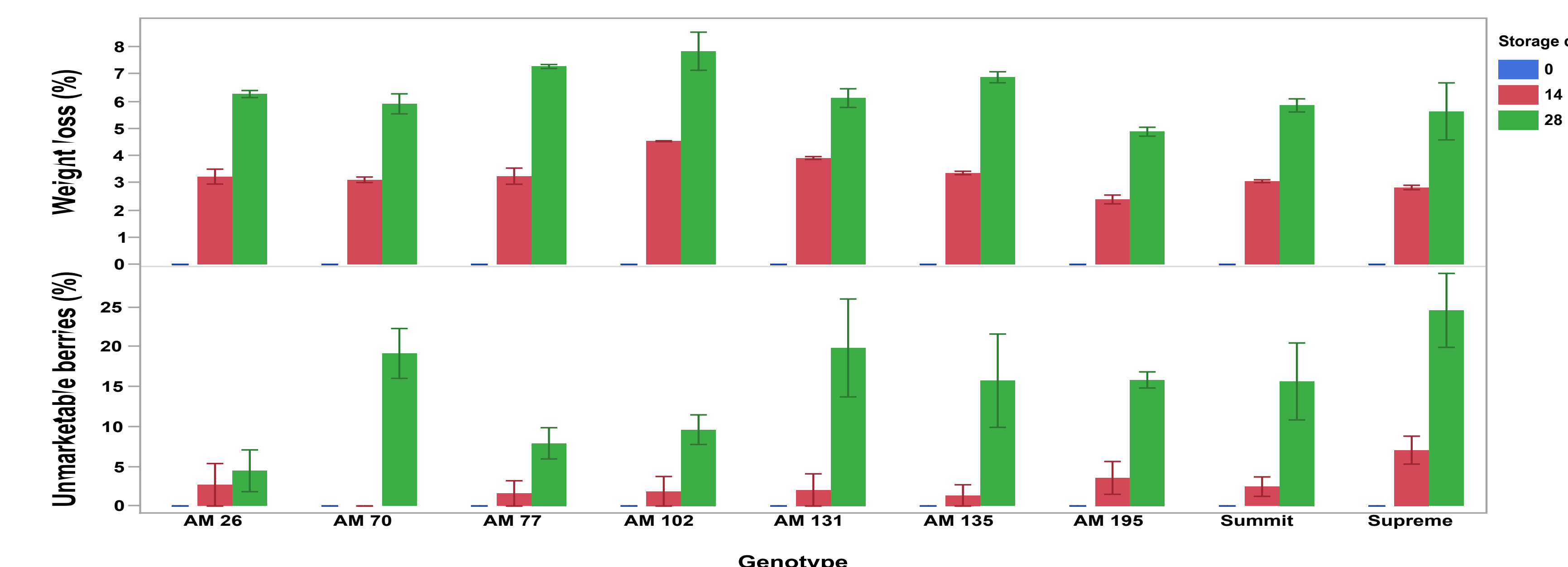


Figure 1. Postharvest attributes of muscadine grape genotypes during storage at 0, 14, and 28 d at 2°, Clarksville, AR (2020) Each error bar is constructed using one standard error from the mean.

Conclusions

This research demonstrates the potential for muscadines as a fresh-market crop and provides data for revising the USDA standards and grades.