

Grape Tomatoes as a Potential Crop for Growers and Consumers in the Southeastern United States

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Abstract

Grape tomatoes have become popular additions to the produce offerings at supermarkets across the country. These tomatoes are smaller in size than cherry tomatoes making them desirable for salads and snacking. Several varieties are now available from many seed sources. Sixteen varieties were evaluated at the Beaumont Horticultural Unit in Beaumont, MS in the summers of 2002 and 2003. Samples of 11 varieties were sent to the Garrison Sensory Evaluation Laboratory evaluation for by panelists in 2003. An expert panel was conducted evaluating the reactions of respondents. All panelists were instructed to taste and evaluate the attributes of appearance, shape, size, color, gloss-shininess, translucency, stem, stem appearance, aroma, descriptor terms of aroma, general tomato aroma, hand/texture/firmness, mouth/bite/skin penetration, skin chewability, firmness of flesh, mealiness, juiciness, mushiness, internal pressure in mouth, seed/seed size, flavor, sweetness, sourness, saltiness, umami, overripe flavor, and general tomato flavor. Based on the information gathered through the sensory evaluation panel, >Mini Charm= was the most preferred grape tomato variety in this study. >Mini Charm= ranked first in 11 of the 20 attributes evaluated. The least preferred variety was >St. Nick=.

Keywords: *Solanum lycopersicon*; Cultivar comparison; Sensory evaluation; Consumer preference

Introduction

Tomatoes are among the most popular fresh produce items in grocery stores [1]. Grape tomatoes (*Solanum lycopersicon* L. var. *cerasiform*) have gained popularity and market share among consumers due to their flavor, sweetness, potential health benefits, and ease of consumption [2]. In a survey of 389 respondents from throughout the United States, 42% preferred grape tomatoes over plum (36%), cluster (27%), cherry (25%), and yellow slicing tomatoes (4.4%). Only red slicing tomatoes were preferred over grape tomatoes (76%) [3]. Grape tomatoes make easy, low calorie snacks and are rich in vitamins A, B, and C. The red pigment, lycopene, has been linked to lower levels of cancer in people who consume large amounts of cooked or processed tomatoes in their diets [4].

In the late 1990s, grape tomatoes were considered a novelty crop and seed were scarce. A single cultivar, >Santa=, dominated the limited market. As demand grew, seed companies began to develop their own hybrids. Originally imported from Asia, there are now more than 20 grape tomato cultivars commercially-available in the United States [4]. While grape tomatoes= enhanced sweetness and convenient size make it ideal for consumers, its high yields and hearty skin are beneficial for producers. However, grape tomatoes present a number of production challenges that differ from those of large-fruited or even cherry tomatoes. Because of their small size, grape tomatoes are a labor-intensive crop to harvest as it takes more time to pick. Similar to grapes in a vineyard, they form clusters on the vine, but need to be picked individually. They should be harvested when the fruit is light pink to red. Harvest any sooner yields off-flavor fruit and they will not sweeten after harvest. Harvest any later results in poor shelf life.

Consumers have indicated that they are willing to pay a premium price for tomatoes that are full-flavored and meet sensory expectations [5-7]. In response to this growing trend, cultivar evaluations were conducted and followed up with sensory evaluations. **Descriptive analysis** provides the description of the sensory qualities of food. It pertains to the sensing and describing of both qualitative and

quantitative sensory attributes. Qualitative attributes are aroma, flavor, texture and sound. Quantitative attributes reflect the degree of the characteristic and is expressed by a scale value. Highly trained panelists are required for descriptive work. Reference scales are used to ensure consistency between panelists during repeated evaluations [8,9].

The objectives of this research were two-fold: 1) to evaluate yield of several grape tomato cultivars and 2) to ascertain consumer preferences through sensory evaluation.

Materials and Methods

Plant material and growing conditions

Grape tomato research began at the Mississippi State University, Beaumont Horticultural Unit in Perry County, MS in 2002. Ten cultivars were initially evaluated (data not shown). In the spring of 2003, the evaluation was expanded to include 14 cultivars: >Mini Charm= and Gabrielle= (Twilley Seed Co., Hodges, SC); >St. Nick=, >Jolly Elf= and >Morning Light= (Siegers Seed Co., Holland, MI); >Red Grape, >Sweet Olive and >Chiquita= (Johnny=s Selected Seeds, Winslow, ME); >Grapette=, >Fond Red Mini=, and >Sweet Baby Girl= (Totally Tomatoes, Randolph, MI); >Tami G= (Stokes Seeds, Inc., Buffalo, NY); >Santa= (Holmes Seed Co., Canton, OH); and >Navidad (Clifton Seeds Co., Faison, NC) (Table 1). Five-week-old transplants of each grape tomato cultivar were planted on 17 June 2003

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| Variety | Description | Supplier |
|-----------------|---|--------------------------------------|
| Chiquita | Determinate; sweet rose pink fruits; good acid/sugar balance. | Johnny's Selected Seeds, Winslow, ME |
| Fond Red Mini | Oblong; bright red skin. | Totally Tomatoes, Randolph, MI |
| Grapette | Semi-determinate; grow in clusters of 16 to 40; very easy to pick. | Totally Tomatoes, Randolph, MI |
| Gabrielle | Early plant; produces ¼ oz. fruit; big clusters. | Twilley Seed Co., Hodges, SC |
| Jolly Elf | Determinate; sweet, firm, bright red fruit on five foot plants; resistant to cracking. | Siegers Seed Co., Holland, MI |
| Mini Charm | Indeterminate; grape-sized baby plum variety; fruit is ideal for harvesting in clusters or separately. | Twilley Seed Co., Hodges, SC |
| Morning Light | Indeterminate; true yellow grape tomatoes. | Siegers Seed Co., Holland, MI |
| Navidad | Determinate; red, pear-shaped variety growing to 24-36 in. | Clifton Seed Co., Faison, NC |
| Red Grape | A miniature grape variety; fruit is bright, glossy, and about half the size of regular grape tomatoes; resistant to cracking, late blight, and leaf spot virus; plants are heat-tolerant. | Johnny's Selected Seeds, Winslow, ME |
| Santa | Indeterminate; oblong fruit producing up to 50 fruits per truss. | Holmes Seed Co., Canton, OH |
| St. Nick | Indeterminate bush; mid-early season; oblong, grape-shaped fruit with brilliant red color. | Siegers Seed Co., Holland, MI |
| Sweet Baby Girl | Small fruit that are about ½ to 1 ounce; produces big clusters on intermediate short internode vines; rarely cracks. | Totally Tomatoes, Randolph, MI |
| Sweet Olive | Semi-determinate; baby plum type; small bite sized oval fruits; requires staking. | Johnny's Selected Seeds, Winslow, ME |
| Tami G | Indeterminate; picks for an extended period; very sweet, firm, fruit. | Stokes Seeds, Inc., Buffalo, NY |

Table 1: Catalog descriptions of 14 grape tomato varieties grown at the Beaumont Horticultural Unit in Perry County, MS.

at the Beaumont Horticultural Unit in Perry County, MS on McLaurin sandy loam soil. Tomatoes were grown using plasticulture on 24 in beds spaced 6 ft apart at a 2 ft staggered within row spacing. A total of 4 20 ft replications of each cultivar were evaluated with 8 plants per replication (N=480). Pre-plant N was applied at 450 lb/acre 5N-6.5P-24.9K according to soil test recommendations. Rows were side-dressed with 20 lb N per acre at 60 days after transplanting.

Tomatoes were staked with 8' stakes and tied using the Florida weave system. Other cultural practices followed current recommendations for commercial tomato production in Mississippi [10]. Entire plots were harvested. There were a total of 6 harvests beginning on 18 Aug. 2003 and ending on 6 Oct. 2003.

Total yield was determined by total fruit weight of the entire plot. Marketable fruit were fully colored with few or no blemishes. Culls included cracked, damaged, and diseased fruits. Data were analyzed using analysis of variance and means were separated with Duncan=s multiple range test at the 5% level.

Sensory evaluation

Eleven of the 14 varieties of grape tomatoes were sent to Mississippi State University for organoleptic evaluation. 'Chiquita', 'Morning Light', and 'Jolly Elf' were excluded from sensory evaluation due to low marketable yields at the time. An expert panel was conducted evaluating the reactions of 5-6 participants to the grape tomatoes at the Garrison Sensory Evaluation Laboratory. Panelists were at least 18 years of age and were from Mississippi State University, Starkville, Mississippi and surrounding areas. All panelists were instructed to taste and evaluate the attributes of appearance, shape, size, color, gloss-shininess, translucency, stem, stem appearance, aroma, descriptor terms of aroma, general tomato aroma, hand/texture/firmness, mouth/bite/skin penetration, skin chewability, firmness of flesh, mealiness, juiciness, mushiness, internal pressure in mouth, seed/seed size, flavor, sweetness, sourness, saltiness, umami, overripe flavor, and general tomato flavor. Panelists were also instructed to indicate the order of the tomatoes in which they preferred. Data were analyzed using analysis of variance according to Stone et al. [11]. The grape tomatoes were washed in clear, cold water and then rinsed in the same. They were sanitized in a solution of clear, cold water with 100-ppm chlorine

bleach. Samples were finally rinsed in clear, cold water and drained on paper towels. The different varieties of grape tomatoes were handled individually and placed on numbered trays to maintain number codes. The grape tomatoes were administered to the panelists along with water to rinse between samples.

Results and Discussion

Cultivar comparison

Varieties can be subdivided into 3 groups based on marketable yields (Table 2). The highest yielding varieties were St. Nick (2148.4 kg/ha), Mini Charm (2142.8 kg/ha), Sweet Baby Girl (2135.0 kg/ha), Fond Red Mini (2094.1 kg/ha), and Gabrielle (1895.4 kg/ha). The second best performing varieties included Red Grape, Tami G, and Santa yielding 1543.4, 1501.4, and 1490.2 kg/ha, respectively. The third tier of varieties included Sweet Olive, Navidad, Morning Light, Grapette, and Jolly Elf yielding, 981.0, 948.0, 861.3, 850.6, and 719.8 kg/ha, respectively. However, they did not yield significantly higher than other varieties with the exception of Chiquita, which yielded the least at 382.4 kg/ha.

| Cultivar | Marketable weight | Cull weight |
|-----------------|----------------------|-------------|
| St. Nick | 2148.4a ^z | 117.6c |
| Mini Charm | 2142.8a | 108.5c |
| Sweet Baby Girl | 2135.0a | 180.2bc |
| Fond Red Mini | 2094.1a | 161.5bc |
| Gabrielle | 1895.4a | 366.2ab |
| Red Grape | 1543.4ab | 151.2bc |
| Tami G | 1501.4ab | 157.7bc |
| Santa | 1490.2ab | 96.2c |
| Sweet Olive | 981.0bc | 285.3abc |
| Navidad | 948.0bc | 283.5abc |
| Morning Light | 861.3bc | 135.6c |
| Grapette | 850.6bc | 150.3bc |
| Jolly Elf | 719.8bc | 223.8abc |
| Chiquita | 382.4c | 435.9a |

^z Means within columns followed by different letters are significantly different according to Duncan=s Multiple Range Test at the 5% level.

Table 2: Marketable and cull yields (kg/ha) of 14 grape tomato cultivars grown at the Beaumont Horticultural Unit, Perry County, MS.

| Attribute | Mini Charm | Grapette | Fond Red Mini | Santa | Gabrielle | Navidad | Sweet Olive | Red Grape | Tami G | Sweet Baby Girl | St. Nick |
|-----------------------------|------------|----------|---------------|-------|-----------|---------|-------------|-----------|--------|-----------------|----------|
| Appearance | 1 | 8 | 9 | 4 | 3 | 11 | 6 | 2 | 13 | 15 | 12 |
| Color | 11 | 9 | 8 | 1 | 3 | 13 | 12 | 6 | 4 | 2 | 15 |
| Gloss-Shininess | 1 | 8 | 4 | 3 | 6 | 9 | 13 | 2 | 15 | 12 | 11 |
| Aroma | 9 | 6 | 11 | 3 | 8 | 13 | 4 | 1 | 2 | 15 | 12 |
| Tomato Aroma | 6 | 1 | 9 | 4 | 11 | 8 | 13 | 3 | 15 | 2 | 12 |
| Aroma Descriptor | 9 | 6 | 11 | 3 | 8 | 13 | 4 | 1 | 2 | 15 | 12 |
| Mouth feel/Skin Penetration | 4 | 9 | 6 | 15 | 8 | 11 | 3 | 13 | 2 | 1 | 12 |
| Skin Chewability | 1 | 13 | 12 | 8 | 11 | 9 | 15 | 3 | 4 | 6 | 2 |
| Firmness of Flesh | 4 | 9 | 15 | 11 | 3 | 6 | 2 | 8 | 13 | 1 | 12 |
| Translucency | 9 | 15 | 4 | 3 | 11 | 12 | 2 | 1 | 13 | 8 | 6 |
| Internal Pressure | 1 | 15 | 4 | 3 | 2 | 13 | 11 | 9 | 8 | 6 | 12 |
| Mealiness | 8 | 1 | 12 | 3 | 11 | 6 | 2 | 4 | 13 | 15 | 9 |
| Juiciness | 12 | 11 | 13 | 1 | 15 | 8 | 2 | 6 | 3 | 9 | 4 |
| Mushiness | 8 | 4 | 3 | 9 | 6 | 11 | 15 | 2 | 13 | 1 | 12 |
| Flavor | 1 | 11 | 8 | 3 | 9 | 2 | 6 | 15 | 4 | 12 | 11 |
| Tomato Flavor | 11 | 12 | 8 | 15 | 9 | 13 | 3 | 1 | 4 | 2 | 6 |
| Sweetness | 1 | 3 | 9 | 11 | 8 | 12 | 2 | 6 | 13 | 15 | 4 |
| Sourness | 1 | 9 | 12 | 3 | 15 | 13 | 4 | 6 | 11 | 2 | 8 |
| Saltiness | 1 | 15 | 8 | 6 | 3 | 11 | 4 | 9 | 12 | 13 | 2 |
| Umami | 12 | 11 | 15 | 9 | 2 | 6 | 3 | 4 | 8 | 13 | 1 |
| OVERALL PREFERENCE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |

Table 3: Attribute rankings of 11 grape tomato varieties on a 15-point hedonic scale.

'Mini Charm' and 'St. Nick' both exhibited high marketable weights and low cull weights. While 'Morning Light' also had a low cull weight of 135.6 kg/ha, that number represents 15% of the total yield for that variety. 'Santa' had the lowest cull yield at 96.2 kg/ha.

Sensory evaluation

Twenty attributes were scored by panelists participating in the sensory evaluation of 11 grape tomato varieties (Mini Charm, Grapette, Fond Red Mini, Santa, Gabrielle, Navidad, Sweet Olive, Red Grape, Tami G, Sweet Baby Girl, and St. Nick) (Table 3). 'Mini Charm' was rated highest for 8 attributes including, appearance, gloss/shininess, skin chewability, internal pressure, flavor, sweetness, sourness, and saltiness. 'Red Grape' was rated highest for tomato aroma, aroma descriptor, translucency, and tomato flavor. 'Sweet Baby Girl' was rated highest for mouth feel/skin penetration, firmness of flesh, and mushiness. 'Grapette' and 'Santa' each rated highest for 2 attributes: tomato aroma and mealiness for 'Grapette' and color and juiciness for 'Santa'. 'St. Nick' was only rated highest for umami. 'Fond Red Mini', 'Gabrielle', 'Navidad', 'Sweet Olive', and 'Tami G' did not rate highest for any of the attributes evaluated.

Conclusion

'St. Nick', 'Mini Charm', 'Sweet Baby Girl', 'Fond Red Mini', and 'Gabrielle' each performed well in variety trials performed under summer conditions in South Mississippi. The most preferred varieties overall in sensory evaluation were Mini Charm, Grapette, Fond Red Mini, 'Santa', and 'Gabrielle'. Overall sensory evaluation preference was given to 'Mini Charm', which was later recommended as a Mississippi Medallion winner. These initial observations indicate that the degree of difference of the eleven varieties of grape tomatoes included in the sensory evaluation is consistent. Nevertheless, the degree of difference

within each attribute varies. Further study should be given to the relationship of certain attributes for each variety of grape tomato.

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