Late-Season Watermelon Production: Evaluating Mini Cultivars in Mississippi

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Late-Season Watermelon Production: Evaluating Mini Cultivars in Mississippi

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ABSTRACT

Mississippi's favorable climate for fruit production provides an opportunity to explore innovative practices to optimize watermelon farming, particularly during late-season cultivation when risks from adverse weather increase. This study evaluates twelve mini watermelon cultivars, focusing on yield, quality, and market feasibility for small-scale households. A trial was conducted in locations in Fall of 2024, using a randomized complete block design. We assessed growth metrics such as fruit weight, circumference, and sensory characteristics. Results revealed that the cultivar 'Moon & Stars' yielded the highest total weight; however, 'Smile' emerged as the top performer based on fruit count and overall appeal. The mini cultivars demonstrated shorter maturation times, with 'Yellow Petite' maturing in as few as 62 days, offering significant advantages for producers in mitigating late-season, weather-related losses. Sensory panels indicated 'Lemon Ice' received the highest ratings for sweetness and textural appeal, highlighting a potential market preference despite lower overall yield performance. The findings suggest that incorporating mini watermelon varieties could enhance late-season production viability, allowing Mississippi farmers to capitalize on reduced competition and consumer demand for smaller fruit.

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INTRODUCTION

Mississippi's ample rainfall and long growing season make it an ideal place for fruit and vegetable production. There are over 300 watermelon farmers who grow over 1,400 acres of melons (USDA, 2022). Most of the production occurs from July to September. Because of tropical storms and hurricanes in the latter part of the season, the USDA recommends avoiding late-season production (da Silva et al., 2021). These conditions promote various fungal plant pathogens that are difficult to control even with fungicides. However, severe storms are destructive to all crops and pose a risk to all crops grown in the late summer months.

Watermelons can grow to be very large, even too large for smaller households to consume before the fruit spoils. Through breeding efforts, smaller cantaloupe-sized watermelons have been developed and have gained popularity in the marketplace (Walters, 2009). In addition to being better suited to smaller households, they also typically have fewer days to harvest than larger watermelons. For example, cultivar 'Jubilee' requires 90 days to harvest while cultivar 'Mini Love' requires 70 days. Being able to harvest 2 to 3 weeks earlier means that the crops have fewer days to be impacted by inclement weather.

We conducted a multi-site cultivar mini watermelon trial on 12 cultivars in late season to determine the feasibility of producing these crops late in the growing season when traditional watermelon may suffer from severe weather. We also identified the top-yielding cultivars and their fruit quality.

MATERIALS AND METHODS

This study was conducted in Fall 2024 at two locations: the MAFES Truck Crops Branch in Crystal Springs, MS, and the MAFES Beaumont Horticultural Unit in Beaumont, MS.

A randomized complete block design was used with 12 watermelon cultivars: 'Baby Doll', 'Bush Sugar Baby', 'Early Crimson Treat', 'Jade Star', 'Lemon Ice', 'Mini Love', 'Moon & Stars', 'Sirius', 'Smile', 'Sugar Baby', 'Yellow Doll', and 'Yellow Petite'. Each cultivar was replicated four times, resulting in 48 total plots per location.

Field Setup and Planting

At the Crystal Springs location, the field consisted of seven 210-ft rows on 6-ft centers, with 20-ft-long plots and 10-ft spacing between plots. White-on-black plastic mulch was used for weed suppression. Seeds were started on July 29, 2024, in 50-cell trays filled with ProMix BX + Biofungicide Mycorrhizae (Premier Tech, Rivière-du-Loup, QC, Canada). Trays were placed in a germination chamber and then moved outdoors post-emergence. Due to poor germination, additional seeds were directly sown in the field on August 6. Transplants were used to replace missing plants after thinning on August 26, resulting in 8 plants per plot (2 plants per hole across 4 holes).

In Beaumont, twelve cultivars were direct-seeded on July 21, 2024, into nine rows of white-on-black plastic mulch. Plots were 24 feet long with plants spaced 6 feet apart both within and between rows. Three seeds were sown per hole, then thinned to 2 as needed.

Fertilization and Pest Management

At Crystal Springs, seedlings were fertilized with alternating injections of 20-10-20 and 15-5-15 at (Jack's Professional, JR Peters Inc., Allentown, PA) 150 ppm. On August 28, plots received 0.95 lb of 33-0-0, 0.71 lb of 0-45-0, and 0.83 lb of 0-0-60 per 100-ft row. A second application of 0.95 lb of 33-0-0 and 0.83 lb of 0-0-60 was made at vine run. Additional treatments included a fungicide application of Kocide (Certis Biologicals [Certis USA], Columbia, MD) at 12.6 g/gal applied on September 24, a beneficial microbial blend application of TerraGrow (BioSafe Systems, East Hartford, CT) at 1.5 lb/acre via drip irrigation) on September 25, and a fungicide application of Mancozeb (United Phosphorus Limited, King of Prussia, PA) at 4 tsp/gal sprayed on September 26.

In Beaumont, no preapplications of fertilizer were needed. Instead, two foliar applications of Fertileader Elite (Timac Agro USA, Reading, PA) were applied at bloom and fruit set. Cease (BioWorks Inc., Victor, NY), an organic fungicide, was sprayed twice during the production cycle to prevent and reduce fungal pathogens. Cucumber beetles were also observed and treated with imidacloprid (Bayer CropScience LP, Research Triangle Park, NC).

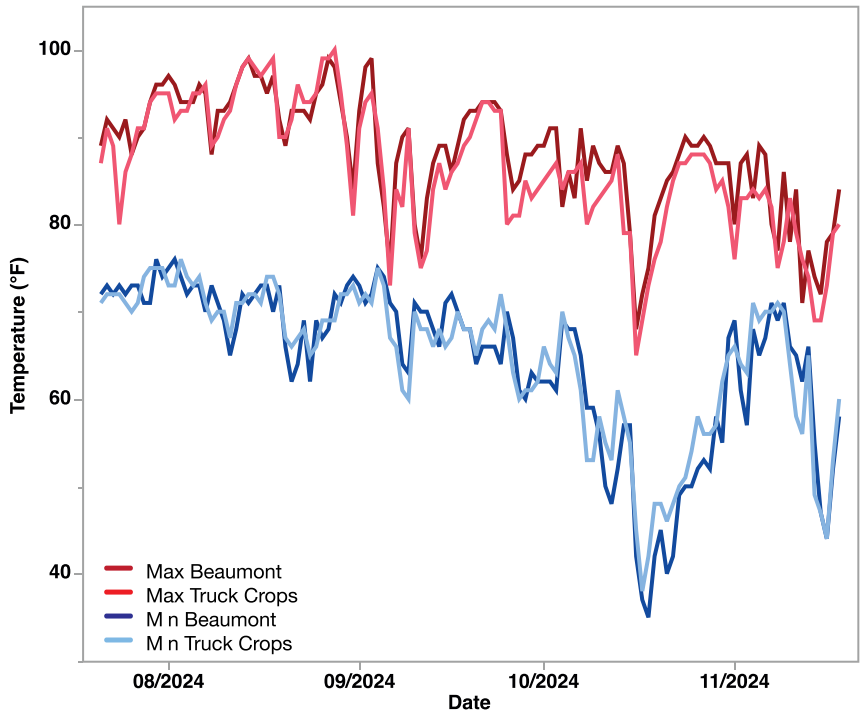
Harvest and Data Collection

Watermelons were harvested when tendrils adjacent to the fruit were brown and dry. Fruit weight and circumference were recorded at both locations. At Crystal Springs, a sensory panel rated sweetness, texture, and overall taste. At Beaumont, the percentage of dissolved soluble solids (Brix) was assessed using a refractometer. For each plot, a representative melon was cut in half, and a cylindrical core was taken from the heart of the fruit using a coring tool. Juice from the core was then measured to obtain the Brix.

Data Analysis

Yield by cultivar was normalized using fruit counts to account for variability in the number of plants per plot. All yield and size data were analyzed using JMP Pro 17 (SAS Institute Inc., Cary, NC) with the fit least squares method. For scoring, averages per cultivar and location were scaled from 1.0 to 10.0 and summed to generate an overall index score.

A.



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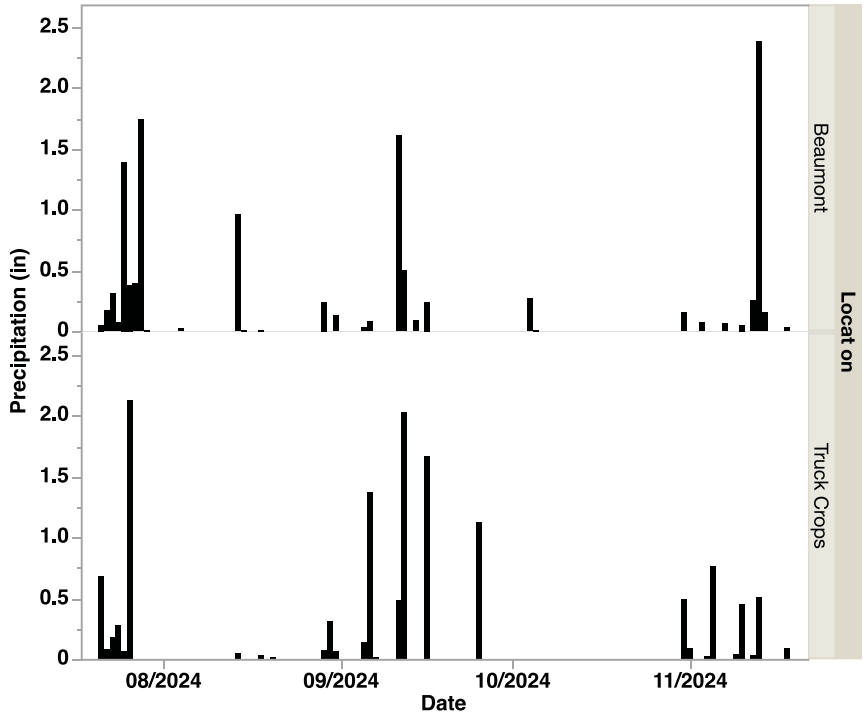

Figure 1.

Local climate data at trial sites. (A) Daily high temperatures (red) and low temperatures (blue) at the MAFES Beaumont Horticulture Unit and the MAFES Truck Crops Branch. (B) Daily rainfall at the MAFES Beaumont Horticulture Unit and the MAFES Truck Crops Branch.

Temperature trends were similar across the two locations. Both locations saw a temperature dip in mid-October, with lows dropping to the upper 30s. The MAFES Beaumont Horticulture Unit received the most rain across the trial in November, over two inches. The MAFES Truck Crops Branch had a period of no rain from the latter part of September to the end of October. Beaumont received little rain during this period, less than half an inch.

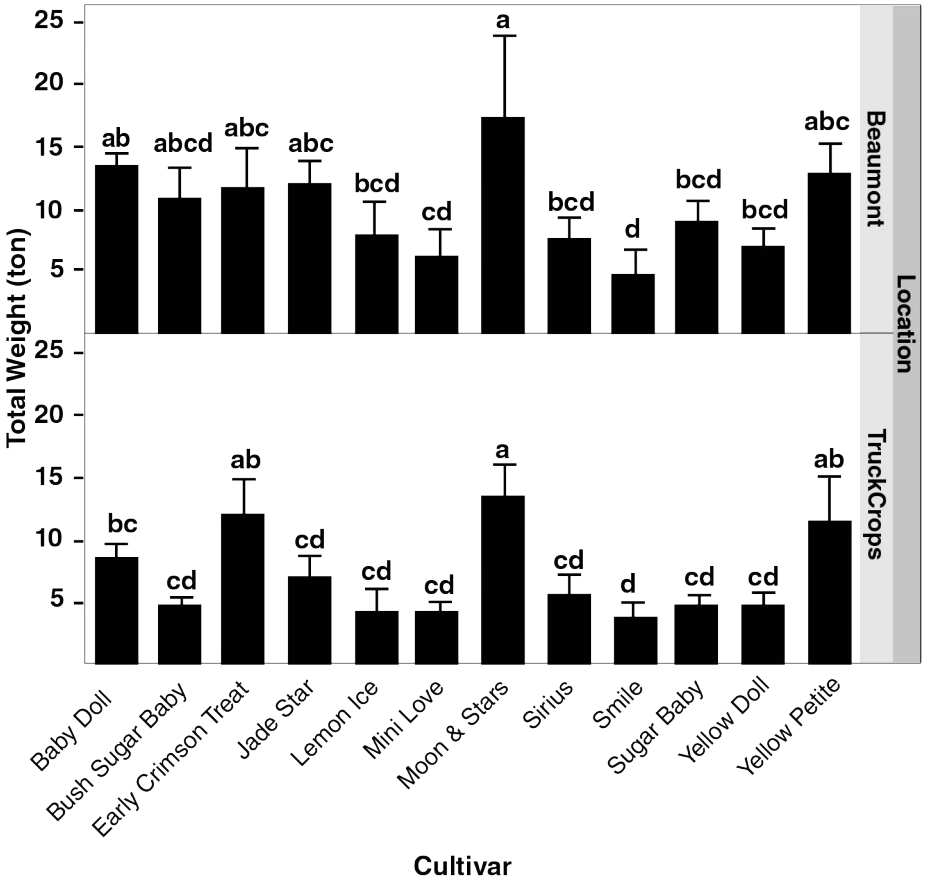

Figure 2.

Total yield per acre by location and cultivar. Standard errors are included. Watermelon cultivars in each location sharing the same letter are not statistically different and were separated using least-square means.

Cultivar 'Moon and Stars' had the highest total yield at both locations. 'Early Crimson Treat' and 'Yellow Petite' were also high-yielding cultivars at both locations. Cultivar 'Smile' had the least yield across the sites. At the MAFES Beaumont Horticulture Unit, 'Baby Doll' was another cultivar that produced high yields, whereas at the MAFES Truck Crops Branch, it did not perform as well. There is a similar trend in yield across both locations, however, the MAFES Beaumont Horticulture Unit saw an overall higher-yielding crop. Planting density at Beaumont was 2,420 plants per acre, while Truck Crops was 2,904 plants per acre.

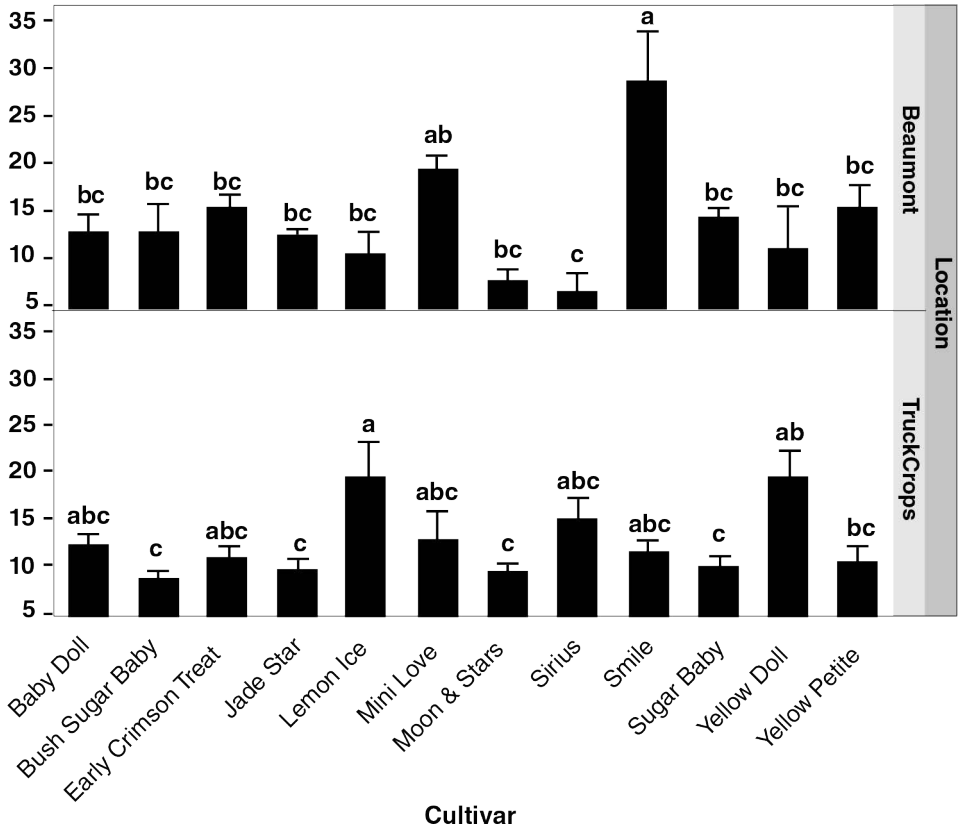

Figure 3.

Total fruit count by location and cultivar. Standard errors are included. Watermelon cultivars in each location sharing the same letter are not statistically different and were separated using least-square means.

There was considerable variation in total fruit count between sites. The Beaumont location produced the highest number of fruits from the cultivar 'Smile', while 'Smile' produced much lower fruit counts at the Truck Crops location. The highest count at Truck Crops came from the cultivar 'Lemon Ice', which again had one of the lower counts from Beaumont. 'Sirius' was the lowest-producing cultivar at Beaumont, and 'Bush Sugar Baby' was the lowest at Truck Crops. However, 'Bush Sugar Baby' was not statistically different from other low-producing cultivars, such as 'Jade Star', 'Moon & Stars', and 'Sugar Baby', along with other cultivars.

Table 1. Fruit Circumference: Truck Crops

Cultivar	LS Mean (in)			
Moon & Stars	21.5	A		
Yellow Petite	21	A		
Early Crimson Treat	20.2	A	B	
Baby Doll	18.5	A	B	C
Lemon Ice	18.4	A	B	C
Jade Star	18.4	A	B	C
Sugar Baby	17.2	A	B	C
Sirius	16.3		B	C
Yellow Doll	15.8		B	C
Bush Sugar Baby	15.7		B	C
Smile	14.7			C
Mini Love	14.5			C

Mean fruit circumference ranged from 14.5 to 21.5 inches. Cultivars 'Moon and Stars' and 'Yellow Petite' produced the largest fruits, while 'Smile' and 'Mini Love' produced the smallest.

Table 2. Average days to harvest: Beaumont

Cultivar	LS Mean (day)	Lower 95%	Upper 95%			
Lemon Ice	72	69.2	74.8	A		
Yellow Doll	71	67.8	74.2	A	B	
Sirius	71	67.8	73.3	A	B	
Early Crimson Treat	68	65.3	70.8	A	B	C
Moon & Stars	68	64.8	70.3	A	B	C
Baby Doll	67	63.7	69.3	A	B	C
Bush Sugar Baby	65	62.2	67.8		B	C
Mini Love	64	61.2	66.8		B	C
Smile	64	61.2	66.8		B	C
Sugar Baby	64	61.2	66.8		B	C
Jade Star	63	60.2	65.8			C
Yellow Petite	62	59.2	64.8			C

The average days to harvest at the Beaumont location was 67 days. 'Lemon Ice' had the most days to harvest, and 'Yellow Petite' had the least days to harvest. There was only a 10-day difference between the earliest harvest date and the latest.

Table 3. Average days to harvest: Truck Crops

Cultivar	LS Mean (day)	Lower 95%	Upper 95%	
Mini Love	84	77.2	90.8	A
Sirius	84	77.2	90.8	A
Smile	84	77.2	90.8	A
Sugar Baby	83	76.2	89.8	A
Bush Sugar Baby	83	76	89.6	A
Lemon Ice	81	73.7	87.3	A
Yellow Doll	81	73.7	87.3	A
Yellow Petite	80	72.7	86.3	A
Early Crimson Treat	80	72.7	86.3	A
Moon & Stars	77	70.2	83.8	A
Jade Star	75	68.2	81.8	A
Baby Doll	72	64.7	78.3	A

The average days to harvest at the Truck Crops location was 80 days. The cultivars 'Mini Love', 'Sirius', and 'Smile' had the most days to harvest, and 'Baby Doll' had the least number of days to harvest. Although there is a 12-day difference between the earliest date and the latest date, the days to harvest across cultivars were not significantly different.

Figure 4.

Mosaic virus on cultivar Jade Star.

Cultivars 'Jade Star', 'Yellow Petite', 'Baby Doll', and 'Sugar Baby' all had some fruit that displayed mosaic virus symptoms. 'Yellow Petite', 'Baby Doll', and 'Sugar Baby' had only one fruit that showed virus symptoms. While cultivar 'Jade Star' had two fruits infected and more significant mottling, as shown in Figure 4

Table 4. Soluble solids by cultivar using Brix analysis: Beaumont

Cultivar	°Brix	LS Mean
Yellow Doll	10.0	A
Lemon Ice	9.8	A
Jade Star	9.4	A
Mini Love	9.2	A
Moon & Stars	9.1	A
Early Crimson Treat	8.9	A
Sirius	8.9	A
Smile	8.9	A
Sugar Baby	8.7	A
Yellow Petite	8.6	A
Baby Doll	8.6	A
Bush Sugar Baby	8.1	A

The USDA marketable minimum standard is 8 °Brix. The average Brix measurement across all cultivars was 9. The highest Brix was 'Yellow Doll' (10.0), and the lowest was 'Bush Sugar Baby' (8.1). Cultivar had no significant impact on the percentage of soluble solids (Table 4).

Table 5. Perceived sweetness among cultivars.

Cultivar					Sweetness LS Mean	Lower 95%	Upper 95%
Lemon Ice	A				5.8	5.0	6.6
Sirius	A	B			4.8	4.0	5.6
Yellow Doll	A	B			4.8	4.0	5.6
Smile	A	B			4.7	3.9	5.5
Bush Sugar Baby	A	B	C		4.2	3.4	5.0
Mini Love	A	B	C		4.2	3.4	5.0
Early Crimson Treat		B	C	D	3.5	2.7	4.2
Yellow Petite		B	C	D	3.4	2.6	4.2
Sugar Baby		B	C	D	3.0	2.2	3.8
Jade Star			C	D	2.7	1.9	3.5
Moon & Stars				D	2.3	1.5	3.1
Baby Doll				D	2.2	1.4	3.0

Perceived sweetness ranges from 2.2 to 5.8 on a scale of one to seven and was significantly impacted by cultivar. 'Lemon Ice' scored higher (5.8 out of 7.0) than 'Early Crimson Treat', 'Yellow Petite', 'Sugar Baby', 'Jade Star', 'Moon & Stars', and 'Baby Doll' (Table 5).

Table 6. Textural preferences among cultivars.

Cultivar		Texture LS Mean	Lower 95%	Upper 95%
Lemon Ice	A	4.8	3.8	5.8
Yellow Petite	A	4.4	3.4	5.4
Early Crimson Treat	A	4.2	3.2	5.2
Smile	A	4.0	3.1	5.0
Baby Doll	A	4.0	3.0	5.0
Jade Star	A	4.0	3.0	4.9
Moon & Stars	A	3.8	2.8	4.7
Bush Sugar Baby	A	3.7	2.7	4.7
Sirius	A	3.7	2.7	4.7
Sugar Baby	A	3.7	2.7	4.7
Yellow Doll	A	3.7	2.7	4.6
Mini Love	A	3.5	2.5	4.4

Cultivar had no impact on textural differences, which ranged from 3.5 to 4.8 out of 7.0 (Table 6).

Table 7. Overall appeal among cultivars.

Cultivar				Overall Appeal LS Mean	Lower 95%	Upper 95%
Lemon Ice	A			5.6	4.8	6.5
Sirius	A	B		4.5	3.6	5.3
Smile	A	B	C	4.1	3.2	5.0
Yellow Doll	A	B	C	4.1	3.2	5.0
Bush Sugar Baby	A	B	C	4.1	3.2	4.9
Mini Love	A	B	C	3.6	2.8	4.5
Early Crimson Treat		B	C	3.4	2.6	4.3
Yellow Petite		B	C	3.4	2.5	4.3
Moon & Stars		B	C	2.8	1.9	3.6
Jade Star		B	C	2.7	1.8	3.6
Sugar Baby		B	C	2.7	1.8	3.6
Baby Doll			C	2.4	1.5	3.2

Cultivar significantly impacted the overall appeal of the trial entries. 'Lemon Ice' was significantly higher than 'Early Crimson Treat', 'Yellow Petite', 'Moon & Stars', 'Jade Star', 'Sugar Baby', and 'Baby Doll', earning a score of 5.6 out of 7.0. The lowest overall appeal was with 'Baby Doll', with a score of 2.4 (Table 7).

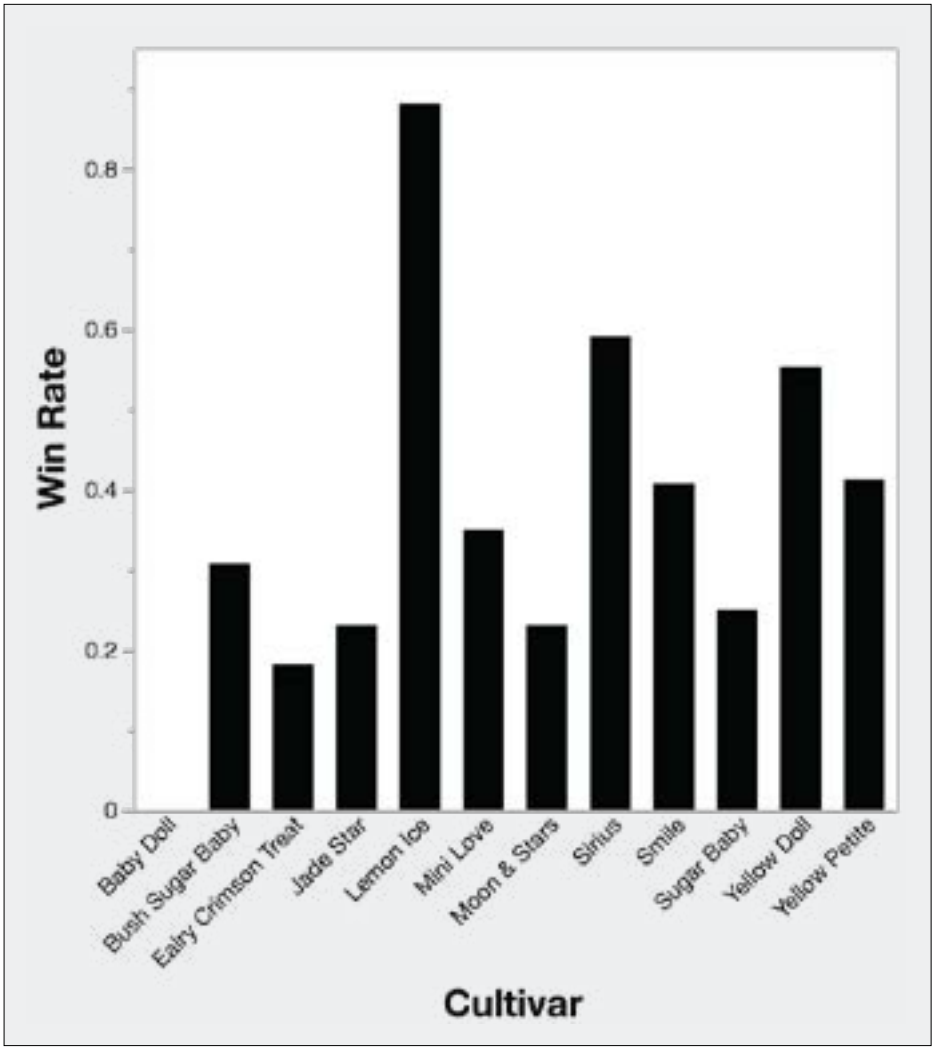

Figure 5.

Cultivar win rate in head-to-head comparisons

A secondary sensory panel compared the performance of watermelon cultivars head-to-head. 'Lemon Ice' has the top win rate of 0.88, while 'Baby Doll' never won in any head-to-head comparisons (0.0). 'Sirius' and 'Yellow Doll' had win rates of 0.59 and 0.55, respectively. The remaining cultivars have a win rate of less than 0.50.

Table 8. Correlation among perceived sweetness, Brix, texture, overall appeal, and the win rate.

	Sweetness	Brix	Texture	Overall appeal	Win rate
Sweetness	1	0.3309	0.2239	0.9641	0.8863
Brix	0.3309	1	0.0557	0.2766	0.4647
Texture	0.2239	0.0557	1	0.3817	0.3874
Overall appeal	0.9641	0.2766	0.3817	1	0.9153
Win rate	0.8863	0.4647	0.3874	0.9153	1

We compared the first and second sensory panel results and found a high degree of significance. There was a very strong correlation between the sweetness and the overall appeal (96.4%), the sweetness and the win rate (88.6%), and the overall appeal and the win rate (91.5%). Moderate correlations were found between the sweetness and the Brix (33.1%) as well as the Brix and the win rate (46.5%). Textural correlations were moderate between the overall appeal (38.2%) and win rates (38.7%) but were weakly correlated with sweetness (22.4%). No meaningful correlation was found between Brix and texture (5.6%).

Table 9. Watermelon cultivar performance scoring index

Cultivar	Fruit count	Total yield weight	Minimum days to harvest	Win rate	Circum-ference	Total score	Overall rank
Smile	10.0	1.0	8.5	5.2	9.8	34.5	1
Mini Love	6.9	1.8	8.5	4.6	10.0	31.8	2
Yellow Petite	4.5	7.4	10.0	5.2	1.7	28.8	3
Bush Sugar Baby	2.9	4.0	7.8	4.1	8.5	27.3	4
Lemon Ice	6.1	2.5	3.4	10.0	5.0	27.0	5
Jade Star	3.0	5.3	9.8	3.4	5.1	26.6	6
Sugar Baby	3.7	3.2	8.5	3.6	6.6	25.6	7
Baby Doll	4.2	6.5	8.3	1.0	4.9	24.9	8
Yellow Doll	6.3	2.2	1.0	6.6	8.4	24.5	9
Sirius	2.8	2.8	3.6	7.0	7.8	24.0	10
Early Crimson Treat	4.6	7.0	5.5	2.9	2.7	22.7	11
Moon & Stars	1.0	10.0	5.9	3.4	1.0	21.3	12

Scores from 1.0 to 10.0 were assigned to each attribute to determine the best-performing cultivars in the trial across locations. 'Smile' ranked first overall, producing abundant, small fruit in a short amount of time. It ranked 5.2 in flavor (win rate) and had the lowest total yield weight. 'Moon & Stars' received the lowest overall rank, producing the fewest and largest fruits. The total weight score was highest in this cultivar, but it had a low win rate score of 3.4.

DISCUSSION

Growing watermelons in the fall has many advantages, such as harvesting watermelon at a time when it is not in peak season. This allows farmers an opportunity to sell produce when there is less local competition. The mini watermelons can also be produced in a shorter production window, particularly in the Perry County region of the state. The watermelons at the MAFES Beaumont Horticultural Unit were harvested in as little as 62 days—for cultivar 'Yellow Petite'. While the watermelons at the MAFES Truck Crops Branch were harvested in 72 days, for cultivar 'Baby Doll'. Environmental factors like daily highs and lows, as well as soil differences, may account for this.

Producers can utilize the scoring index table to add the points most important to their program. For example, if days to harvest are not of concern, then it can be removed from the total score for each cultivar, and a new score can be calculated.

Generally, plants were healthy throughout the trial. Diseases were very minimal. Watermelon mosaic virus symptoms were observed on four cultivars but only impacted one or two fruits of any cultivar.

While two sensory panels were conducted using different methods, the results were very highly correlated, especially the overall appeal and sweetness and the overall appeal and the win rate, which were more than 90% correlated. This suggests that either method could be used to obtain a similar outcome. Panelists commented that while there were differences among cultivars in sweetness, they generally were not as sweet as watermelon harvested in summer months. This may be due to cultivar variation or environmental differences in peak temperature, day length, or light intensity. 'Lemon Ice' had a win rate 50% higher than the next closest cultivar, 'Sirius'. Panelists rated this the highest cultivar in both tastings and said it would be a good option if flavor is important. However, it was not one of the better-performing cultivars in yield.

The Brix analysis and perception of sweetness were not highly correlated in this study. The correlation between the Brix measurements and sensory panel sweetness results were conducted on fruits from different locations, which could impact the correlation of these data. However, the perception of sweetness and Brix in watermelon have been reported as not highly correlated (OSAWA et al., 2024). Sugar content is highly corelated in watermelon (Tian et al., 2007), but the perception of sweetness depends on many additional factors than sugar content—even to the extent that watermelons with the same amount of sugars will yield differing sweetness results in sensory panels (OSAWA et al., 2024). Textural differences were similar for all cultivars. For optimal flavor, we recommend summer production; however, fall production could still result in quality fruit.

Cultivar and location significantly impacted yields regarding total weight and fruit counts. Between locations there are differences in soil texture, daily light integral, temperatures, and planting densities. Each of these can impact plant growth and yield. 'Moon & Stars' was the highest-yielding cultivar in terms of weight at both Beaumont and Truck Crops, but it also had the largest fruit circumference and a low fruit count. It ripened at a comparable rate to smaller fruiting cultivars. If smaller, more abundant fruit is the criterion for choosing a watermelon cultivar, then producers may consider growing the cultivars 'Smile' or 'Mini Love', which produced good fruit counts, even though the total weight in yields was relatively low. 'Lemon Ice' was a clear winner in terms of flavor and would be the optimal cultivar if yield, fruit counts, and fruit size were less important.

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