

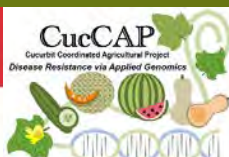
2023 North Carolina Standard Size Triploid Watermelon Cultigen Evaluation Study



**Jonathan R. Schultheis, Stuart W. Michel,
Baker E. Stickley, Brandon K. Parker, and
Andrew P. Pfefferkorn**

**Department of Horticultural Science
North Carolina State University**

NC STATE
EXTENSION



National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE

2023 North Carolina
Evaluation of Standard Size
Triploid Watermelon Cultigens
Hort. Series #243

Principal Investigators

Jonathan R. Schultheis¹, Stuart W. Michel², Brandon K. Parker³, Baker E. Stickley⁴, and Andrew P. Pfefferkorn⁵

¹Professor and Extension Specialist, Vegetables, Department of Horticultural Science, N.C. State University, Raleigh, NC 27695-7609

²Research Technician, Department of Horticultural Science, N.C. State University, Raleigh, NC 27695-7609

³Research Associate, Department of Horticultural Science, N.C. State University, Raleigh, NC 27695-7609

⁴Research Assistant, Department of Horticultural Science, N.C. State University, Raleigh, NC 27695-7609

⁵Field/Lab Technician, Department of Horticultural Science, N.C. State University, Raleigh, NC 27695-7609

Acknowledgements

We gratefully acknowledge the assistance of Hunter Barrier (Superintendent) and Wesley Hairre (Horticulture Supervisor), Horticultural Crops Research Station, Clinton, NC, as well as the personnel at the research station for their help in establishing, maintaining, and harvesting the 2023 cultigen evaluation study. We want to acknowledge summer employees Lia Hunt and Daphne Meyer for their assistance with this study. The cooperation and support of BASF/Nunhems, Bayer/Seminis, Enza Zaden, Hazera, HM Clause, Origene Seeds, Known You Seed, Sakata Seed Company, Seedway, Syngenta, and U.S. Seedless were also appreciated. We also want to thank Joy Smith for performing the statistical analysis and aiding in the interpretation of the data collected from this study.

Disclaimer

This publication presents data from the standard size triploid watermelon cultigen evaluation study conducted during 2023. Information in this report is believed to be reliable but should not be relied upon as a sole source of information. Limited accompanying detail is included but excludes some pertinent information, which may aid interpretation.

Table of Contents

<u>Introduction</u>	1
<u>Materials and Methods</u>	1-3
Table 1. Herbicides Standard Size Seedless Watermelon Study 2023	
Table 2. Insecticides Standard Size Seedless Watermelon Study 2023	
Table 3. Fungicides Standard Size Seedless Watermelon Study 2023	
Figure 1. Temperature and Precipitation at the Horticultural Crops Research Station in Clinton, NC	
<u>Financial Support</u>	4
<u>Results</u>	4
<u>Cumulative Harvests (1-5)</u>	5-14
Table 4. Total Yield (lb/acre) of Standard Size Seedless Watermelon Cultigens 2023	
Table 5. Total Yield (no/acre) and Number of Fruit Per Plant of Standard Size Seedless Watermelon Cultigens 2023	
Table 6. Total Bins Per Acre of Standard Size Seedless Watermelon Cultigens 2023	
Table 7. Average Fruit Size and Bin Size Distribution of Standard Size Seedless Watermelon Cultigens 2023	
Table 8. Quality of Standard Size Watermelon Cultigens 2023	
Table 9. Hollowheart of Standard Size Watermelon Cultigens 2023	
<u>Early Harvests (1-2): 21 and 24 July (harvest 1); 28 July and 1 August (harvest 2)</u>	15-19
Table 10. Early Yield (lb/acre) of Standard Size Seedless Watermelon Cultigens 2023	
Table 11. Early Yield (no/acre) and Number of Fruit Per Plant of Standard Size Seedless Watermelon Cultigens 2023	
Table 12. Early Bins Per Acre of Standard Size Seedless Watermelon Cultigens 2023	
Table 13. Early Average Fruit Size and Bin Size Distribution of Standard Size Seedless Watermelon Cultigens 2023	
<u>Mid-Season Harvests (3-4): 8 and 10 August (harvest 3) and 15 August (harvest 4)</u>	20-24
Table 14. Mid-Season Yield (lb/acre) of Standard Size Seedless Watermelon Cultigens 2023	
Table 15. Mid-Season Yield (no/acre) and Number of Fruit Per Plant of Standard Size Seedless Watermelon Cultigens 2023	
Table 16. Mid-Season Bins Per Acre of Standard Size Seedless Watermelon Cultigens 2023	
Table 17. Mid-Season Average Fruit Size and Bin Size Distribution of Standard Size Seedless Watermelon Cultigens 2023	
<u>Late Harvest (5): 24 August</u>	25-28
Table 18. Late Yield (lb/acre) of Standard Size Seedless Watermelon Cultigens 2023	
Table 19. Late Yield (no/acre) and Number of Fruit Per Plant of Standard Size Seedless Watermelon Cultigens 2023	
Table 20. Late Bins Per Acre of Standard Size Seedless Watermelon Cultigens 2023	
Table 21. Late Average Fruit Size and Bin Size Distribution of Standard Size Seedless Watermelon Cultigens 2023	
<u>Representative photos</u> (Figures 2–34).....	29-42

Introduction

In 2022, an estimated 93,200 acres of watermelon was harvested in the U.S. ([aei.ag](#)). Total acreage is down since 2021 and has been on a decline since 2016; acreage is 17% less in 2022 than it was in 2016. The southern regions of the U.S. are the primary watermelon producers with Florida leading production at 36% of U.S. acreage followed by Georgia (29%) and Texas (25%) as of 2022. Last year, watermelons accounted for 14.1 pounds of the 22.1 pounds of melons made available to U.S. consumers, making up the majority of that share; cantaloupe made up 5.3 pounds and honeydew made up 1.6 pounds per U.S. consumer ([ers.usda.gov](#)). Most of the watermelons consumed in the U.S. are grown domestically, but imports have increased to almost 40% over the past 5 years with most imports coming from Mexico.

North Carolina is ranked 5th in total watermelon acres harvested in the U.S. at 7,600 acres as of 2022. This harvested acreage equated to a value of 56 million USD ([nass.usda.gov](#)). Watermelon production in North Carolina is down by 1,700 acres from the 9,300 acres that were harvested in 2021 ([NCAgStatBook2022](#)). Typical planting dates in North Carolina range from 25 March to 10 May and typical harvest dates range from 1 July to 10 September.

In 2023, Dr. Schultheis and the Cultural Management Program in the Horticulture Department at NC State University conducted an evaluation of 32 standard size triploid (seedless) cultigens and 1 diploid (seeded) watermelon cultigen from 11 seed companies at the Horticultural Crops Research Station in Clinton, NC. The watermelon entries were evaluated for yield and quality characteristics such as soluble solids (sweetness or Brix), color, firmness, and hollow heart. The methods, results, and representative photos from the study are presented below (Figures 2-34).

Materials and Methods

Sowing and Field Preparations

Once all seeds were received from participating companies, they were planted into 72-cell poly trays to grow transplants (Hummert Int.; Earth City, MO). The watermelons were sown on 23 March 2023. The trays of sown seeds were placed in a germination room for 24-48 hours. Temperature in the germination room was kept between 90-95°F and humidity was kept between 85-90%. The planting medium used was a 'fine germinating mix', a commercial soilless mix (SunGro, Agawam, MA). After germination, transplants were moved to a greenhouse set to 85°F and hand watered twice daily. Due to a heater malfunction, transplants were moved to a larger greenhouse after approximately 1 week and remained there for 4 weeks until transplanting. The seedlings were fertilized at least once a week with 20-10-20 water soluble fertilizer at a rate of 200-250 ppm.

The field planting site was located at the Horticultural Crops Research Station in Clinton, NC. The watermelons were transplanted in the field blocks S1 and S2; a Lynchburg sandy loam soil type. Telone II (12 gal/ac) was applied broadcast to the entire study area on 1 March 2023 for weed and nematode control. K-Mag fertilizer (0-0-22-22-11Mg) at 150 lb/ac was applied pre-plant on 3 April 2023 and NPK fertilizer (10-10-10) at 500 lb/ac was applied on 12 April 2023. Black polyethylene plastic (1.25 mil thick, high density plastic film, 54 inches wide; TriEast Ag Group, Inc., Clinton, NC) was laid on 18 April 2023.

Transplanting and Vine Training

The triploid (seedless) watermelon transplants and the diploid (seedless) transplant were established in the field on 10 May 2023. Plot size for the watermelons was 1 row, 10 plants per row, 25 feet long with alleys of 10 feet between plots. Row middles were 10 feet and in-row spacing was 2.5 feet. Plots with missing plants were replaced 1 week after transplanting to achieve 100% plant stand. ‘SP-7’ and ‘Wingman’ (4 plants/plot) were used as the pollenizer plants in this study. ‘SP-7’ pollenizers were planted after triploid plants 1 and 7 while ‘Wingman’ pollenizers were planted after triploid plants 4 and 10 in each plot. Once vines had grown over the plastic mulch, they were gently turned/trained back into the plot each week. This aided with harvest by avoiding mixing cultigens and reducing vine damage at harvest.

Fertilizer and Pest Management

A total of 50 units/ac N, 50 units/ac P, 83 units/ac K, 33 units/ac S, and 16.5 units/ac Mg were applied broadcast (pre-plant) to the entire study area. Drip tape (NETAFIM, 12 in spacing, 0.24 gph; NETAFIM, Tel Aviv, Israel) was installed beneath the black plastic mulch to fertigate the crop throughout the growing season. Liquid fertilizer with 4-0-8 analysis was applied through drip tape fertigation 11 times at rates of 25, 20, or 15 gal/ac. Cumulative totals, preplant and through the drip tape, of applied fertilizer nutrients were: 166 units/ac N, 50 units/ac P, 314 units/ac K, 33 units/ac S, and 16.5 units/ac Mg.

Herbicides (Table 1), insecticides (Table 2), and fungicides (Table 3) were applied as needed and as directed by the label for that crop ([2023 North Carolina Agricultural Chemicals Manual](#)). Different products were rotated to avoid potential development of resistance.

Table 1. Herbicides¹ Standard Size Seedless Watermelon Study 2023

Product	Rate per acre	Application Date(s)
ROUNDUP ORIGINAL MAX	1 qt	8-Feb, 16-Feb
SANDEA	0.75 oz	5-May
Strategy	4 pt	5-May
Liberty	29 fl oz	25-May
Dual Magnum	1.5 pt	6-Jun
Gramaxone	1 qt	28-Jun
Crop Oil	1 qt	28-Jun
Select	16 fl oz	6-Jul

1. Herbicides were applied to the row middles

Table 2. Insecticides Standard Size Seedless Watermelon Study 2023

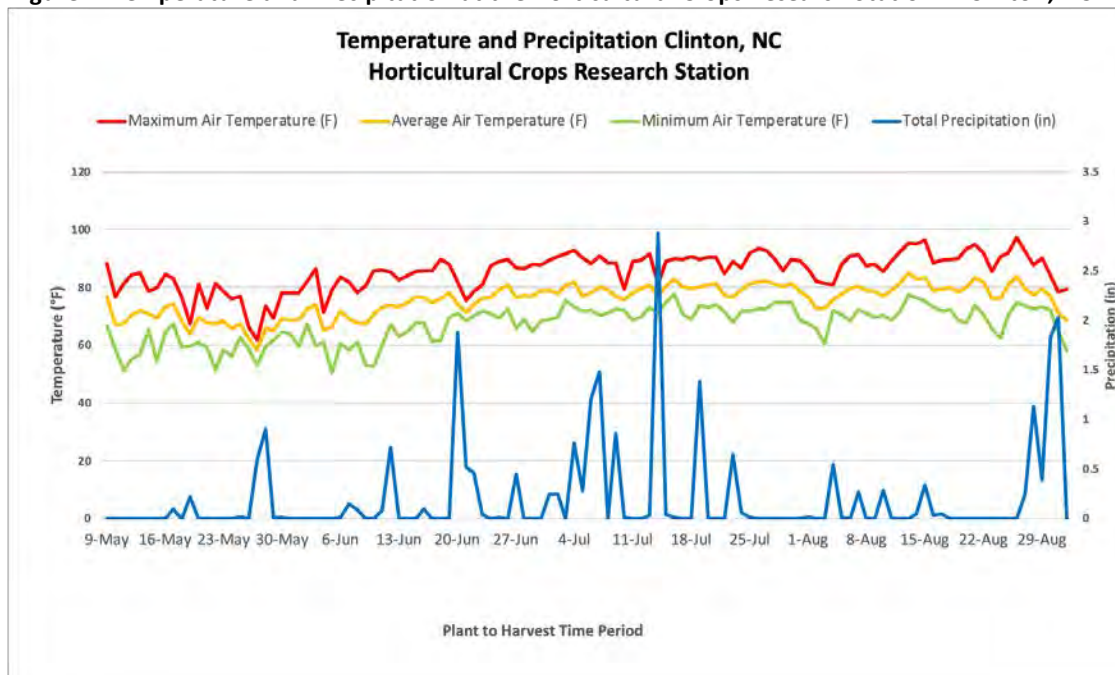
Product	Rate per acre	Application Date(s)
Admire	10 fl oz	22-May
Asana	8 fl oz	2-Jun, 9-Jun, 28-Jun, 11-Aug
Carbaryl	1 qt	16-Jun, 18-Aug
Abba Ultra	8 fl oz	28-Jun
Sevin XLR	1 qt	28-Jul

Table 3. Fungicides Standard Size Seedless Watermelon Study 2023

Product	Rate per acre	Application Date(s)
Proline	5.5 fl oz	26-May
Bravo Weather Stick	1 qt	2-Jun, 16-Jun
Quadris	15 fl oz	2-Jun, 18-Jul
Cabrio	16 oz	9-Jun, 18-Aug
Copper	1 lb	9-Jun
Manzate Pro Stick	3 lb	9-Jun, 16-Jun, 18-Jul, 18-Aug
SWITCH 62.5WG (US)	14 oz	28-Jun
Aprovia	15 fl oz	21-Jul, 28-Jul
Topsin	8 oz	28-Jul, 11-Aug
Previcur Flex	0.6 qt	11-Aug

Weather

The weather was generally favorable for the duration of the study (Figure 1). Temperatures in the spring were cool until around June when the averages rose to around 80 °F and conditions remained hot throughout the summer. We had a few periods of heavy rainfall, but precipitation was generally consistent. One exception was the 3 inches of rain in mid-July which resulted in some flooding in one of the replications. Two to three inches of rain occurred in late August at the end of the study. A total of 24 inches of rain occurred at the field planting site in Clinton, NC throughout the duration of the study.

Figure 1. Temperature and Precipitation at the Horticultural Crops Research Station in Clinton, NC

Study Design and Data Collection

The study used a randomized complete block design with 4 replications. There was a total of 5 harvests collected over 34 days (21 July through 24 August) with some harvests spanning 2-4 days. Fruits were picked when signs indicated they were ripe; yellow to tan ground spot, dead tendrils, ribbing, color. Fruits were counted and weighed individually. Fruit with pest damage and or rot were weighed and counted if the fruit was intact and representative of the rest of the plot. Vines were moved to cover unpicked fruit that were exposed during the harvests.

Quality Evaluations

Measurements were taken on 20 fruit (5 per block) of each cultigen to determine the fruit size, fruit shape, soluble solids (sweetness of Brix), interior flesh firmness, flesh color, rind thickness, seed trace size, hard seed population, and hollowheart. The most representative fruit were selected for quality measurements and measurements were retaken on another fruit if necessary. Soluble solids were measured by cutting a piece of flesh from the center of the fruit and squeezing out the fruit juice onto the digital refractometer (Atago, Vernon Hills, IL). Flesh firmness was taken using a Penetrometer FT 011 with a 7/16" plunger tip (QA Supplies LLC, Norfolk, VA), and was recorded in pounds. Samples were obtained by cutting the center of the fruit from the stem to blossom end. Pressure was then taken in five areas of the fruit: stem end, top side, ground spot side, blossom end, and center. The reported measures on flesh firmness are an average of the five sample areas; pressure was not taken on fruit with hollowheart. Hard seed in triploid fruit was determined according to the USDA standards. Fruits were cut longitudinally in half, and then the halves were cut laterally. The number of hard seeds exposed on the cut surface were counted and recorded. Most of the quality measurements were taken in the early harvests (1-2). Additional information on the quality measurements is presented in the Quality section on page 12 and in Table 8.

Financial Support

In addition to seed companies, this research was supported by the College of Life and Agricultural Sciences, North Carolina Agriculture Research, the North Carolina Cooperative Extension Services, and the North Carolina Department of Agriculture and Consumer Services. This work was in part supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2020-51181-32139 ([CucCap](#)).

Results and Discussion

Overall fruit yield and quality were good for the duration of the study. Heavy rains and a low area in the field resulted in flooding in some plots in the third rep. Plots affected were removed from the analysis to provide the best representation of the cultigen's yield and quality response. For the analysis, fruits were placed in the following categories: < 9 lb, 9-13.4 lb, 13.5-17.4 lb, 17.5-21.4 lb, and \geq 21.5 lb. The diploid (seeded) cultigen Estrella from Syngenta, the yellow flesh cultigen Buttercup from Seedway, and popular cultigen Fascination from Syngenta were included as comparison. Cracker Jack from Enza Zaden is a cultigen gaining popularity in North Carolina and more recently used as a comparison cultigen.

Cumulative Harvests (1-5)

Yield: Pounds per acre

The orange flesh cultigen Orange Crisp (Figure 2) from US Seedless had the highest marketable yield of all 33 entries in this study at 89,577 pounds per acre (Mkt lb/ac) (Table 4). Marketable fruit do not include fruit that fall into the less than 9-pound category (< 9lb). Guardsman from Seedway, a red flesh cultigen, had the second highest marketable yield at 87,027 lb/ac. The average marketable yield across all 33 entries was 59,845 lb/ac. Popular cultigens Fascination and Cracker Jack had marketable yields of 76,050 and 56,674 lb/ac, and were ranked sixth and eighteenth, respectively. The majority of the yield in this study fell into the 9-13.4 and 13.5-17.4 lb categories. 'Orange Crisp' and 'Guardsman' differed statistically in marketable yield with '53022', 'Marshall', 'Orchid Sweet', and 'Amarela' (Table 4).



Figure 2. Photo of 'Orange Crisp' from U.S. Seedless

Table 4. Total Yield (lb/acre) of Standard Size Seedless Watermelon Cultigens 2023

Pounds (lb) per acre by size category										
Cultigen	Company	Rank ¹	< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb	Total lb/ac	Mkt lb/ac ²	Group ³
Orange Crisp	US Seedless	1	4890	18725	30579	19794	20479	94467	89577	A
Guardman	Seedway	2	2677	17825	20938	19939	28326	89705	87027	A
Miramonte (XWT9161)	Sakata	3	3247	18435	27106	15496	22494	86777	83531	AB
Warrior	BASF/Nunhems	4	6975	16111	31607	24986	5651	85331	78356	ABC
Virtue	Syngenta	5	3351	13614	18690	25968	17976	79599	76247	ABCD
Fascination	Syngenta	6	2730	20096	29255	15879	10820	78780	76050	ABCD
Valor	Syngenta	7	2648	19718	31183	17709	5430	76689	74040	ABCD
Nun 32002	BASF/Nunhems	8	3694	19329	28453	17790	8108	77374	73680	ABCD
7197HQ	BASF/Nunhems	9	4095	23331	24742	14683	5489	72339	68244	ABCD
Sweet Trick	Bayer/Seminis	10	7887	31009	15507	17848	2689	74941	67053	ABCD
Estrella	Syngenta	11	889	10007	12661	19033	25183	67774	66885	ABCD
SVWA7826	Bayer/Seminis	12	3009	26804	17534	7835	11564	66746	63737	ABCD
HMC633239	HM Clause	13	1260	16431	22942	14566	8305	63505	62244	ABCD
Nun 32126	BASF/Nunhems	14	11790	36306	22587	3293	0	73976	62186	ABCD
Buttercup	Seedway	15	7934	32374	24475	4385	0	69167	61234	ABCD
Cato (WDL9432)	Syngenta	16	2811	20125	22709	10077	6168	61890	59079	ABCD
Essence	Origene	17	2358	16681	10152	19010	11895	60095	57737	ABCD
Cracker Jack	Enza Zaden	18	2532	18655	23592	9142	5285	59207	56674	ABCD
Embassy	BASF/Nunhems	19	2648	21826	23488	5686	5547	59195	56547	ABCD
Red Amber	Enza Zaden	20	1464	18830	22489	11117	2689	56587	55124	ABCD
HMC633248	HM Clause	21	4008	10931	20990	14497	8085	58510	54502	ABCD
Rio Grande	Enza Zaden	22	5436	15414	24219	10896	1307	57273	51836	ABCD
Eleanor (HMC633802)	HM Clause	23	5001	17912	16030	13207	4553	56704	51703	ABCD
53021	Hazera	24	4490	17076	15658	8840	9606	55670	51180	ABCD
WDL9454	Syngenta	25	4060	15589	21449	8857	4048	54003	49943	ABCD
3F93-2487	Known You Seed	26	2178	16001	22442	8921	2556	52098	49920	ABCD
Lajoya	Origene	27	11732	33593	11558	4269	0	61152	49420	ABCD
FWT 1427	Sakata	28	10391	32984	11360	1208	0	55943	45552	ABCD
HMC633800	HM Clause	29	2759	12795	12795	7701	11883	47933	45175	ABCD
53022	Hazera	30	1777	14677	13870	7963	4490	42776	40999	BCD
Marshall	Known You Seed	31	11029	17883	17598	3299	1301	51110	40081	BCD
Orchid Sweet	Known You Seed	32	8143	24539	10745	1045	0	44472	36329	CD
Amarela	Seedway	33	16059	23575	7086	1051	1289	49060	33001	D
Average:			5029	20279	20197	11697	7673	64874	59845	
LSD (0.05) ⁴			8815	22171	24424	20165	23868	45732	44870	

Yield data were collected over 5 harvests (21 July through 24 August) with some harvests collected over 2-4 days.

1. Ranked by marketable pounds per acre (Mkt lb/ac).

2. Marketable pounds per acre (Mkt lb/ac) includes all size categories except the less than 9 lb (< 9 lb) category.

3. Entries with the same letter groups were not different statistically in marketable yield (Mkt lb/ac).

4. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $P < 0.05$.

Yield: Number of fruit per acre and number of fruit per plant

'Orange Crisp' from US Seedless had the highest number of marketable fruit per acre (Mkt no/ac) at 5518 (Table 5). 'Guardman' from Seedway had the second highest number of marketable fruit per acre at 5169. The average number of fruit per acre across all entries was 4050. 'Cracker Jack' and 'Fascination' had 3833 and 3775 fruit per acre, and were ranked eighteenth and twentieth, respectively. 'Nun 32126' (Figure 3) from BASF/Nunhems had the highest number of fruit per plant (Fruit no/plant) at 3.7. Most of the fruit harvested in this study were in the 9-13.0 lb category.



Figure 3. Photo of 'Nun 32126' from BASF/Nunhems

Table 5. Total Yield (no/acre) and Number of Fruit Per Plant of Standard Size Seedless Watermelon Cultigens 2023

Cultigen	Company	Rank ¹	Number (no) of fruit per size category					Total no/ac	Mkt no/ac ²	Fruit no/plant ³
			< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb			
Orange Crisp	US Seedless	1	639	1626	1975	1045	871	6156	5518	3.5
Guardman	Seedway	2	348	1626	1394	1045	1104	5518	5169	3.2
Miramonte (XWT9161)	Sakata	3	407	1626	1742	813	929	5518	5111	3.2
Warrior	BASF/Nunhems	4	871	1394	2033	1278	232	5808	4937	3.3
FWT 1427	Sakata	4	348	1742	1917	813	465	5285	4937	3.0
Nun 32126	BASF/Nunhems	4	1510	3252	1510	174	0	6447	4937	3.7
Nun 32002	BASF/Nunhems	7	465	1742	1859	929	348	5343	4879	3.1
Sweet Trick	Bayer/Seminis	7	1045	2788	1045	929	116	5924	4879	3.4
Valor	Syngenta	7	348	1684	2033	929	232	5227	4879	3.0
Buttercup	Seedway	10	987	2904	1626	232	0	5750	4763	3.3
7197HQ	BASF/Nunhems	11	523	2033	1568	755	232	5111	4588	2.9
Virtue	Syngenta	12	407	1220	1220	1336	697	4879	4472	2.8
SVWA7826	Bayer/Seminis	13	407	2381	1162	407	465	4821	4414	2.8
Cato (WDL9432)	Syngenta	14	348	1800	1510	523	232	4414	4066	2.5
Embassy	BASF/Nunhems	14	348	1975	1568	290	232	4414	4066	2.5
HMC633239	HM Clause	14	174	1452	1510	755	348	4240	4066	2.4
Lajoya	Origene	17	1568	3020	755	232	0	5576	4008	3.2
Cracker Jack	Enza Zaden	18	348	1626	1510	465	232	4182	3833	2.4
Red Amber	Enza Zaden	18	174	1684	1452	581	116	4008	3833	2.3
Fascination	Syngenta	20	1394	2962	755	58	0	5169	3775	3.0
Estrella	Syngenta	21	116	871	813	987	987	3775	3659	2.2
Essence	Origene	22	290	1452	639	987	465	3833	3543	2.2
Rio Grande	Enza Zaden	22	697	1336	1568	581	58	4240	3543	2.4
HMC633248	HM Clause	24	523	987	1394	755	348	4008	3485	2.3
Eleanor (HMC633802)	HM Clause	25	639	1510	1045	697	174	4066	3427	2.3
WDL9454	Syngenta	25	523	1394	1394	465	174	3949	3427	2.3
3F93-2487	Known You Seed	25	290	1394	1452	465	116	3717	3427	2.1
53021	Hazera	25	581	1510	1045	465	407	4008	3427	2.3
Marshall	Known You Seed	29	1452	1626	1162	174	58	4472	3020	2.6
Orchid Sweet	Known You Seed	29	1104	2265	697	58	0	4124	3020	2.4
Amarela	Seedway	31	2091	2265	465	58	58	4937	2846	2.8
HMC633800	HM Clause	31	348	1162	813	407	465	3194	2846	1.8
53022	Hazera	31	232	1336	929	407	174	3078	2846	1.8
Average:			653	1807	1320	609	369	4703	4050	2.7
LSD (0.05) ⁴ :			1146	2039	1575	1047	947	2940	2677	1.7

Yield data were collected over 5 harvests (21 July through 24 August) with some harvests collected over 2-4 days.

1. Ranked by marketable number per acre (Mkt no/ac).

2. Marketable number per acre (Mkt no/ac) includes all size categories except the less than 9 lb (< 9 lb) category.

3. Average number of fruit per plant (Fruit no/plant).

3. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $P < 0.05$.

Yield: Bins per acre

'Orange Crisp', the orange flesh entry from US Seedless, had the highest number of bins with marketable fruit per acre (Mkt bins/ac) across all entries with 128 bins (Table 6). Marketable bins does not include fruit in the less than 9-pound category (< 9lb). 'Guardman' from Seedway had the second highest number of bins at 124. The average number of bins per acre across all cultigens was 85. Cultigens Fascination and Cracker Jack had 109 and 81 bins with marketable fruit per acre and were ranked sixth and eighteenth, respectively. The majority of bins were of fruit in the 9-13.4 and 13.5-17.4 lb categories.

Table 6. Total Bins Per Acre of Standard Size Seedless Watermelon Cultigens 2023

Cultigen	Company	Rank ¹	Bins per acre by size category					Mkt bins/ac ²
			< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb	
Orange Crisp	US Seedless	1	7	27	44	28	29	128
Guardman	Seedway	2	4	25	30	28	40	124
Miramonte (XWT9161)	Sakata	3	5	26	39	22	32	119
Warrior	BASF/Nunhems	4	10	23	45	36	8	112
Virtue	Syngenta	5	5	19	27	37	26	109
Fascination	Syngenta	5	4	29	42	23	15	109
Valor	Syngenta	7	4	28	45	25	8	106
Nun 32002	BASF/Nunhems	8	5	28	41	25	12	105
7197HQ	BASF/Nunhems	9	6	33	35	21	8	97
Sweet Trick	Bayer/Seminis	10	11	44	22	25	4	96
Estrella	Syngenta	10	1	14	18	27	36	96
SVWA7826	Bayer/Seminis	12	4	38	25	11	17	91
HMC633239	HM Clause	13	2	23	33	21	12	89
Nun 32126	BASF/Nunhems	13	17	52	32	5	0	89
Buttercup	Seedway	15	11	46	35	6	0	87
Cato (WDL9432)	Syngenta	16	4	29	32	14	9	84
Essence	Origene	17	3	24	15	27	17	82
Cracker Jack	Enza Zaden	18	4	27	34	13	8	81
Embassy	BASF/Nunhems	18	4	31	34	8	8	81
Red Amber	Enza Zaden	20	2	27	32	16	4	79
HMC633248	HM Clause	21	6	16	30	21	12	78
Rio Grande	Enza Zaden	22	8	22	35	16	2	74
Eleanor (HMC633802)	HM Clause	22	7	26	23	19	7	74
53021	Hazera	24	6	24	22	13	14	73
WDL9454	Syngenta	25	6	22	31	13	6	71
3F93-2487	Known You Seed	25	3	23	32	13	4	71
Lajoya	Origene	25	17	48	17	6	0	71
FWT 1427	Sakata	28	15	47	16	2	0	65
HMC633800	HM Clause	28	4	18	18	11	17	65
53022	Hazera	30	3	21	20	11	6	59
Marshall	Known You Seed	31	16	26	25	5	2	57
Orchid Sweet	Known You Seed	32	12	35	15	1	0	52
Amarela	Seedway	33	23	34	10	2	2	47
Average:			7	29	29	17	13	85
LSD (0.05) ³ :			13	32	35	29	34	64

Yield data were collected over 5 harvests (21 July through 24 August) with some harvests collected over 2-4 days.

1. Ranked by marketable bins per acre (Mkt bins/ac).

2. Marketable bins per acre (Mkt bins/ac) includes all size categories except the less than 9 lb (< 9 lb) category.

3. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at P < 0.05.

Yield: Average fruit size and bin size distribution

The diploid (seeded) cultigen Estrella from Syngenta produced the largest fruit in the study with an average of 18.1 pounds per fruit (Table 7). 'Guardisman' (Figure 4) produced the second largest fruit with an average weight of 16.3 pounds per fruit. 'Guardisman' had 54% of its fruit in the 30 and 36-count bin categories. The average fruit weight across all 33 entries was 13.8 pounds with a range from 18.1 to 9.9 pounds per fruit. Cultigens Fascination and Cracker Jack had average fruit weights of 14.9 and 14.0 pounds per fruit, and were ranked eighth and seventeenth, respectively.

'Estrella' also had the largest percentage of fruit in the 30-count bin category at 38% followed by 'Guardisman' at 31%. 'Virtue' from Syngenta and 'Essence' from Origene had the highest percentage of fruit in the 36-count bin category at 32% for both entries. '3F93-2487' from Known You Seed and 'Rio Grande' from Enza Zaden had the highest percentage of fruit in the 45-count bin category at 43%.



Figure 4. Photo of 'Guardisman' from Seedway

Table 7. Average Fruit Size and Bin Size Distribution of Standard Size Seedless Watermelon Cultigens 2023

Cultigen	Company	Rank ¹	Avg lb/fruit	L/D ²	Percent of fruit per bin size category			
					% 30 ct ³	% 36 ct ⁴	% 45 ct ⁵	% 60 ct ⁶
Estrella	Syngenta	1	18.1	1.4	38	28	18	15
Guardsman	Seedway	2	16.3	1.2	31	23	24	20
Virtue	Syngenta	3	16.2	1.2	21	32	26	17
Miramonte (XWT9161)	Sakata	4	15.7	1.2	26	18	32	22
Essence	Origene	5	15.5	1.0	18	32	16	30
Orange Crisp	US Seedless	6	15.3	1.0	21	21	32	21
HMC633239	HM Clause	7	15.0	1.2	13	23	36	26
Fascination	Syngenta	8	14.9	1.1	14	20	37	26
HMC633800	HM Clause	9	14.7	1.2	21	18	23	33
Valor	Syngenta	9	14.7	1.1	7	24	40	25
HMC633248	HM Clause	11	14.6	1.1	14	24	37	18
Warrior	BASF/Nunhems	11	14.6	1.2	7	28	36	21
Nun 32002	BASF/Nunhems	11	14.6	1.1	11	23	37	25
Eleanor (HMC633802)	HM Clause	14	14.3	1.1	7	24	32	30
7197HQ	BASF/Nunhems	15	14.2	1.1	7	20	36	32
SVWA7826	Bayer/Seminis	16	14.1	1.2	17	11	27	40
Cracker Jack	Enza Zaden	17	14.0	1.2	7	15	39	34
Cato (WDL9432)	Syngenta	17	14.0	1.1	10	16	36	33
Red Amber	Enza Zaden	19	13.9	1.2	3	18	39	36
3F93-2487	Known You Seed	19	13.9	1.1	5	15	43	32
53021	Hazera	21	13.7	1.0	15	14	30	33
53022	Hazera	22	13.6	1.0	8	18	34	32
WDL9454	Syngenta	22	13.6	1.1	7	17	40	29
Rio Grande	Enza Zaden	24	13.5	1.1	2	19	43	27
Embassy	BASF/Nunhems	25	13.2	1.2	8	8	40	40
Sweet Trick	Bayer/Seminis	26	12.6	1.1	4	24	20	42
Buttercup	Seedway	27	12.0	1.0	0	6	35	47
Nun 32126	BASF/Nunhems	29	11.6	1.1	0	5	32	48
Marshall	Known You Seed	28	11.5	1.0	2	7	34	35
Lajoya	Origene	30	11.0	1.0	0	7	19	55
Orchid Sweet	Known You Seed	31	10.9	1.0	0	3	24	56
FWT 1427	Sakata	32	10.8	1.1	0	2	20	59
Amarela	Seedway	33	9.9	0.9	3	2	13	48
Average:			13.8	1.1	12	17	31	33
LSD (0.05) ⁷ :			3.7	0.1	30	24	32	35

Yield data were collected over 5 harvests (21 July through 24 August) with some harvests collected over 2-4 days.

1. Ranked by average weight (lb) of the fruit (Avg lb/fruit).
2. The ratio of the length of the fruit over the width/diameter of the fruit (L/D).
3. Percent of fruit in the 30-count bin size category; fruit ≥ 21.5 lb.
4. Percent of fruit in the 36-count bin size category; fruit 17.5-21.4 lb.
5. Percent of fruit in the 45-count bin size category; fruit 13.5-17.4 lb.
6. Percent of fruit in the 60-count bin size category; fruit 9-13.4 lb.
7. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant in that category at $P < 0.05$.

Quality:

'HMC633800' from HM Clause was the sweetest of all 33 entries with an average Brix of 12.5 (Table 8). Brix is a measure of sweetness, and the units equate to 1 gram of sucrose in 100 grams of solution. All four of HM Clause's entries were the top cultigens for sugar content in this study; HMC633800, Eleanor, HMC633248, and HMC633239. The average sugar content across all 33 entries was 11.6 with the majority of fruit having a rating above 11.0.

The two entries with the firmest flesh were 'Cato (WDL9432)' (Figure 5) from Syngenta and 'Sweet Trick' from Bayer/Seminis with an average firmness of 5.0 and 4.8 pounds, respectively (Table 8). These two cultigens were also the lowest for sweetness.

'Cato (WDL9432)' and 'Virtue' from Syngenta had the highest color ratings out of all entries with an average color rating of 4.9 for both entries; color is based on a 1 to 5 scale with 1 being pale or white and 5 being a deep blood red (Table 8). Flesh color was good in this study, with an average color rating of 4.5.

'Sweet Trick' from Bayer/Seminis had the thinnest rind at 14.4 mm (Table 8). The cultigen with the thickest rind was Warrior from BASF/Nunhems at 19.9 mm. The average rind thickness across all cultigens was 16.3 mm.

The cultigens Essence from Origene, 3F93-2487 from Known You Seed, and Buttercup from Seedway had the lowest population of hard seeds with an average of 0.2 hard seeds per fruit (Table 8). 'WDL9454' from Syngenta had the highest population of hard seeds at 6.8 seeds per fruit, the average across all cultigens was 2.0 hard seeds per fruit.

'Eleanor (HMC633802)' from HM Clause had smallest seed trace in the study at a rating of 0.7; seed trace was measured on a 1-5 scale with 1 being small and 5 being large (Table 8). Overall, seed trace size was small across all entries with an average rating of 1.3.



Figure 5. Photo of 'Cato' from Syngenta

Table 8. Quality of Standard Size Watermelon Cultigens 2023

Cultigen	Company	Rank ¹	Brix (% Sugar) ²	Firmness (lb) ³	Flesh Color ⁴	Rind (mm) ⁵	Hard Seed Pop. ⁶	Seed Trace Size ⁷
HMC633800	HM Clause	1	12.5	3.1	4.5	16.7	1.3	1.0
Eleanor (HMC633802)	HM Clause	2	12.2	2.9	4.7	16.4	2.0	0.7
HMC633248	HM Clause	2	12.2	2.8	4.6	15.0	3.0	1.1
HMC633239	HM Clause	4	12.1	3.0	4.4	15.0	6.0	1.0
Cracker Jack	Enza Zaden	4	12.1	2.9	4.6	16.6	0.7	1.4
7197HQ	BASF/Nunhems	4	12.1	3.0	4.4	16.9	3.0	1.2
SVWA7826	Bayer/Seminis	7	12.0	3.6	4.4	16.8	1.3	0.9
Lajoya	Origene	8	11.9	3.7	4.7	16.0	2.2	1.3
Essence	Origene	8	11.9	3.5	4.7	17.1	0.2	1.7
Red Amber	Enza Zaden	10	11.8	3.3	4.4	16.6	0.5	1.7
3F93-2487	Known You Seed	11	11.7	2.9	4.4	18.0	0.2	1.7
Buttercup	Seedway	11	11.7	3.0	yellow	17.6	0.2	1.0
Amarela	Seedway	11	11.7	3.2	yellow	14.7	0.6	1.1
Rio Grande	Enza Zaden	11	11.7	3.1	4.6	17.3	2.7	1.3
Embasy	BASF/Nunhems	15	11.6	3.2	4.3	17.1	1.3	1.0
FWT 1427	Sakata	15	11.6	3.3	4.6	15.8	1.8	0.8
53022	Hazera	15	11.6	3.0	4.8	15.8	1.7	1.7
Orchid Sweet	Known You Seed	18	11.5	2.3	yellow	14.6	0.7	1.4
Warrior	BASF/Nunhems	18	11.5	2.8	4.3	19.9	1.1	1.4
Miramonte (XWT9161)	Sakata	18	11.5	3.0	4.5	17.2	0.6	0.9
Fascination	Syngenta	21	11.4	2.9	4.4	19.8	3.3	1.0
Guardman	Seedway	22	11.3	2.9	4.3	17.3	2.1	1.2
Nun 32002	BASF/Nunhems	22	11.3	3.0	4.8	15.6	2.0	1.3
Estrella	Syngenta	22	11.3	2.4	4.4	16.4	N/A	N/A
WDL9454	Syngenta	22	11.3	3.3	4.8	11.9	6.8	1.1
53021	Hazera	22	11.3	2.6	4.7	17.4	4.0	1.8
Marshall	Known You Seed	27	11.2	2.9	4.3	14.0	1.3	1.5
Virtue	Syngenta	28	11.1	3.1	4.6	15.1	1.5	1.2
Valor	Syngenta	28	11.1	2.9	4.9	15.1	1.0	1.1
Orange Crisp	US Seedless	30	11.0	3.0	orange	17.9	5.2	1.2
Nun 32126	BASF/Nunhems	30	11.0	3.5	4.6	15.5	3.3	1.1
Cato (WDL9432)	Syngenta	32	10.8	5.0	4.9	16.4	0.3	1.4
Sweet Trick	Bayer/Seminis	33	10.6	4.8	4.3	14.4	1.6	1.4
Average:			11.6	3.1	4.5	16.3	2.0	1.3
LSD (0.05) ⁸ :			1.4	0.9	0.4	4.8	6.7	0.6

Quality data were collected over 5 harvests (21 July through 24 August) with some harvests collected over 2-4 days.

1. Ranked by Brix (Sugar %).

2. Brix (Sugar %) is a measure of dissolved sugar. One degree Brix is 1 gram of sucrose in 100 grams of solution. Measurements were taken with an Atago PAL-1 refractometer.

3. Firmness is a measure of the pressure resistance of the flesh of the fruit. Taken on five places on one half of the fruit (top, bottom, blossom, end, stem end, and heart or middle of the fruit) with a QA Supplies FT 011 handheld Penetrometer with a 7/16" plunger tip and was recorded in pounds (lb).

4. Flesh color was rated on a 1-5 scale for red-fleshed fruit; 1 is pale or white, 2 is pink, 3 is red, 4 is dark red, and 5 is a blood red. Non red-fleshed fruit were not rated.

5. Rind thickness was measured from the edge of the rind to where the flesh and rind met, taken from the most representative part of the rind and was recorded in millimeters (mm).

6. Hard seed population is the average number of hard seeds counted in the fruit. Fruit were cut longitudinally in half, and a half was cut into quarters to view the seeds.

7. Seed trace size is the average size of the white seed traces (pips) and was rated on a 1-5 scale with 1 being small (i.e. tomato seed) and 5 being large. Fruit were cut longitudinally in half, and a half was cut into quarters to view the seed traces.

8. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $P < 0.05$.

Quality: Hollowheart

Nearly half of the cultigens in this study had no incidence of hollowheart (Table 9). Of those that did have hollowheart, only 6 cultigens had any fruit with a rating of 3 or higher; a rating of 3 or 4 are considered unmarketable.

Table 9. Hollowheart of Standard Size Watermelon Cultigens 2023

Cultigen	Company	Rank ¹	Hollowheart % ²	HH0 % ³	HH1 % ⁴	HH2 % ⁵	HH3 % ⁶	HH4 % ⁷
Cato (WDL9432)	Syngenta	1	0.0	100.0	0.0	0.0	0.0	0.0
Embassy	BASF/Nunhems	1	0.0	100.0	0.0	0.0	0.0	0.0
Essence	Origene	1	0.0	100.0	0.0	0.0	0.0	0.0
FWT 1427	Sakata	1	0.0	100.0	0.0	0.0	0.0	0.0
HMC633239	HM Clause	1	0.0	100.0	0.0	0.0	0.0	0.0
HMC633800	HM Clause	1	0.0	100.0	0.0	0.0	0.0	0.0
Lajoya	Origene	1	0.0	100.0	0.0	0.0	0.0	0.0
Marshall	Known You Seed	1	0.0	100.0	0.0	0.0	0.0	0.0
Miramonte (XWT9161)	Sakata	1	0.0	100.0	0.0	0.0	0.0	0.0
Rio Grande	Enza Zaden	1	0.0	100.0	0.0	0.0	0.0	0.0
SVWA7826	Bayer/Seminis	1	0.0	100.0	0.0	0.0	0.0	0.0
Sweet Trick	Bayer/Seminis	1	0.0	100.0	0.0	0.0	0.0	0.0
Virtue	Syngenta	1	0.0	100.0	0.0	0.0	0.0	0.0
WDL9454	Syngenta	1	0.0	100.0	0.0	0.0	0.0	0.0
3F93-2487	Known You Seed	1	0.0	100.0	0.0	0.0	0.0	0.0
53022	Hazera	1	0.0	100.0	0.0	0.0	0.0	0.0
53021	Hazera	17	0.1	95.0	5.0	0.0	0.0	0.0
Eleanor (HMC633802)	HM Clause	17	0.1	95.0	5.0	0.0	0.0	0.0
Estrella	Syngenta	17	0.1	95.0	5.0	0.0	0.0	0.0
HMC633248	HM Clause	17	0.1	95.0	5.0	0.0	0.0	0.0
Nun 32002	BASF/Nunhems	17	0.1	90.0	10.0	0.0	0.0	0.0
Nun 32126	BASF/Nunhems	17	0.1	95.0	5.0	0.0	0.0	0.0
Red Amber	Enza Zaden	17	0.1	95.0	5.0	0.0	0.0	0.0
Valor	Syngenta	17	0.1	95.0	0.0	5.0	0.0	0.0
Warrior	BASF/Nunhems	17	0.1	95.0	0.0	5.0	0.0	0.0
Cracker Jack	Enza Zaden	26	0.2	90.0	5.0	0.0	5.0	0.0
Guardman	Seedway	26	0.2	90.0	5.0	5.0	0.0	0.0
7197HQ	BASF/Nunhems	28	0.3	80.0	10.0	10.0	0.0	0.0
Amarela	Seedway	29	0.4	85.0	5.0	0.0	10.0	0.0
Buttercup	Seedway	29	0.4	85.0	0.0	10.0	5.0	0.0
Fascination	Syngenta	29	0.4	80.0	10.0	5.0	5.0	0.0
Orange Crisp	US Seedless	32	0.8	65.0	10.0	10.0	10.0	5.0
Orchid Sweet	Known You Seed	33	1.8	35.0	15.0	5.0	25.0	20.0
Average:			0.2	92.7	3	1.7	1.8	0.8
LSD (0.05) ⁸ :			0.9					

Hollowheart data were averages collected from 20 fruit over 5 harvests (21 July through 24 August) with some harvests collected over 2-4 days.

1. Ranked in decending order by hollowheart percent.

2. Hollowheart percent (%) is the percentage of fruit that had hollowheart incidence.

3. Hollowheart 0 percent (HH0 %) is the percent of fruit with hollowheart that had a rating of 0 (no crack in flesh)

4. Hollowheart 1 percent (HH1 %) is the percent of fruit with hollowheart that had a rating of 1 (hairline crack in flesh).

5. Hollowheart 2 percent (HH2 %) is the percent of fruit with hollowheart that had a rating of 2 (obvious crack, marketable)

6. Hollowheart 3 percent (HH3 %) is the percent of fruit with hollowheart that had a rating of 3 (moderate cracking, unmarketable)

7. Hollowheart 4 percent (HH4 %) is the percent of fruit with hollowheart that had a rating of 4 (complete separation in flesh to rind, unmarketable)

8. Least Significant Difference (LSD) is the minumum difference required between two cultigens for a significant difference in that category at $P < 0.05$.

Early Harvests (1-2): 21 and 24 July (harvest 1); 28 July and 1 August (harvest 2)

Early Yield: Pounds per acre

The orange flesh cultigen Orange Crisp from US Seedless had the highest marketable yield in the early harvests with 54,113 pounds per acre (lb/ac) (Table 10). 'Fascination' was ranked third with 40,017 lb/ac. The average marketable yield for the early harvests was 28,469 lb/ac. The majority of the yield in the early harvest fell into the 13.5-17.4 pound category. 'Orange Crisp' differed statistically in marketable yield in the early harvests with 'Cato (WDL9432)' and with the 17 entries that followed it in Table 10.

Table 10. Early Yield (lb/acre) of Standard Size Seedless Watermelon Cultigens 2023

Pounds (lb) per acre by size category										
Cultigen	Company	Rank ¹	< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb	Total lb/ac	Mkt lb/ac ²	Group ³
Orange Crisp	US Seedless	1	923	5913	19573	12261	16367	55037	54113	A
Estrella	Syngenta	2	0	2724	6371	12749	21275	43119	43119	AB
Fascination	Syngenta	3	482	6191	14137	10263	9426	40499	40017	ABC
Virtue	Syngenta	4	0	4745	9711	12650	12522	39628	39628	ABC
HMC633239	HM Clause	5	430	6569	15165	13434	4257	39854	39425	ABC
7197HQ	BASF/Nunhems	6	0	9961	15496	10269	1260	36985	36985	ABC
Warrior	BASF/Nunhems	7	1371	4612	18917	8201	4350	37450	36079	ABC
Valor	Syngenta	8	860	5378	16123	11192	2712	36265	35406	ABC
Eleanor (HMC633802)	HM Clause	9	476	7870	14166	8724	3142	34378	33901	ABCD
Red Amber	Enza Zaden	10	488	7864	16257	6685	2689	33983	33495	ABCD
Nun 32002	BASF/Nunhems	11	0	3084	13149	10048	6859	33140	33140	ABCD
WDL9454	Syngenta	12	447	6232	16094	6737	4048	33559	33111	ABCD
HMC633248	HM Clause	13	1313	3340	10367	12388	3897	31305	29993	ABCD
Guardman	Seedway	14	0	1946	3473	9856	13974	29249	29249	ABCD
HMC633800	HM Clause	15	1388	5285	9124	6656	7446	29900	28511	ABCD
Cato (WDL9432)	Syngenta	16	511	6906	9827	6749	3043	27036	26525	BCD
Miramonte (XWT9161)	Sakata	17	0	3235	9206	6766	7103	26310	26310	BCD
Rio Grande	Enza Zaden	18	912	5454	11970	7492	1307	27135	26223	BCD
Orchid Sweet	Known You Seed	19	2213	15107	9839	1045	0	28204	25991	BCD
Essence	Origene	20	0	4164	2608	11186	7701	25660	25660	BCD
53021	Hazera	21	517	5884	8636	5471	5442	25950	25433	BCD
SVWA7826	Bayer/Seminis	22	807	11906	4344	3340	5465	25863	25056	BCD
3F93-2487	Known You Seed	23	1330	7539	11570	4490	1278	26206	24876	BCD
Cracker Jack	Enza Zaden	24	0	7969	10042	3525	2579	24115	24115	BCD
Nun 32126	BASF/Nunhems	25	1789	7167	15815	1092	0	25863	24074	BCD
Sweet Trick	Bayer/Seminis	26	424	10170	6923	5483	0	23000	22576	BCD
Embassy	BASF/Nunhems	27	511	5825	9508	4513	2724	23081	22570	BCD
Marshall	Known You Seed	28	2358	10460	10693	0	1301	24812	22454	BCD
Buttercup	Seedway	29	958	4850	10478	2161	0	18446	17488	BCD
Lajoya	Origene	30	2654	10751	3560	1051	0	18016	15362	CD
Amarela	Seedway	31	7730	9055	3514	1051	1289	22640	14909	CD
53022	Hazera	32	0	3154	5314	3421	2933	14822	14822	CD
FWT 1427	Sakata	33	0	5332	3537	0	0	8869	8869	D
Average:			936	6565	10470	6695	4739	29405	28469	
LSD (0.05) ⁴ :			4677	14022	16977	14171	20213	26748	26465	

Early yield data were collected for harvests 1 (21 and 24 July) and 2 (28 July and 1 August) with harvests collected over 3-4 days.

1. Ranked by marketable pounds per acre (Mkt lb/ac).
2. Marketable pounds per acre (Mkt lb/ac) includes all size categories except the less than 9 lb (< 9 lb) category.
3. Entries with the same letter groups were not different statistically in marketable yield (Mkt lb/ac).
4. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $P < 0.05$.

Early Yield: Number of fruit per acre and number of fruit per plant

'Orange Crisp' had the highest number of marketable fruit per acre (Mkt no/ac) at 3136 and also had the highest number of fruit per plant (Fruit no/plant) at 1.9 for the early harvests (Table 11).

'HMC633239' from HM Clause ranked second for highest number of marketable fruit per acre and was the leader among the red-fleshed cultigens with 2439 fruit per acre. The average number of marketable fruit across all entries was 1797 fruit per acre and the average number of fruit per plant was 1.1

Table 11. Early Yield (no/acre) and Number of Fruit Per Plant of Standard Size Seedless Watermelon Cultigens 2023

Cultigen	Company	Rank ¹	Number (no) of fruit per size category					Total no/ac	Mkt no/ac ²	Fruit no/plant ³
			< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb			
Orange Crisp	US Seedless	1	116	523	1278	639	697	3252	3136	1.9
HMC633239	HM Clause	2	58	581	987	697	174	2497	2439	1.4
7197HQ	BASF/Nunhems	3	0	813	987	523	58	2381	2381	1.4
Fascination	Syngenta	3	58	523	929	523	407	2439	2381	1.4
Red Amber	Enza Zaden	5	58	697	1045	348	116	2265	2207	1.3
Valor	Syngenta	5	116	465	1045	581	116	2323	2207	1.3
Warrior	BASF/Nunhems	5	174	407	1220	407	174	2381	2207	1.4
Eleanor (HMC633802)	HM Clause	8	58	639	929	465	116	2207	2149	1.3
Virtue	Syngenta	8	0	407	639	639	465	2149	2149	1.2
Estrella	Syngenta	10	0	232	407	639	813	2091	2091	1.2
Orchid Sweet	Known You Seed	10	290	1394	639	58	0	2381	2091	1.4
WDL9454	Syngenta	10	58	523	1045	348	174	2149	2091	1.2
Nun 32002	BASF/Nunhems	13	0	290	871	523	290	1975	1975	1.1
HMC633248	HM Clause	14	174	290	697	639	174	1975	1800	1.1
SVWA7826	Bayer/Seminis	15	116	1045	290	174	232	1859	1742	1.1
Cato (WDL9432)	Syngenta	16	58	581	639	348	116	1742	1684	1.0
HMC633800	HM Clause	16	174	465	581	348	290	1859	1684	1.1
Marshall	Known You Seed	16	290	929	697	0	58	1975	1684	1.1
Nun 32126	BASF/Nunhems	16	232	581	1045	58	0	1917	1684	1.1
Rio Grande	Enza Zaden	16	116	465	755	407	58	1800	1684	1.0
Sweet Trick	Bayer/Seminis	16	58	929	465	290	0	1742	1684	1.0
3F93-2487	Known You Seed	16	174	639	755	232	58	1859	1684	1.1
53021	Hazera	23	58	523	581	290	232	1684	1626	1.0
Cracker Jack	Enza Zaden	23	0	697	639	174	116	1626	1626	0.9
Embassy	BASF/Nunhems	25	58	523	639	232	116	1568	1510	0.9
Guardsman	Seedway	25	0	174	232	523	581	1510	1510	0.9
Miramonte (XWT9161)	Sakata	25	0	290	581	348	290	1510	1510	0.9
Essence	Origene	28	0	348	174	581	290	1394	1394	0.8
Amarela	Seedway	29	987	871	232	58	58	2207	1220	1.3
Buttercup	Seedway	29	116	407	697	116	0	1336	1220	0.8
Lajoya	Origene	29	348	929	232	58	0	1568	1220	0.9
53022	Hazera	32	0	290	348	174	116	929	929	0.5
FWT 1427	Sakata	33	0	465	232	0	0	697	697	0.0
Average:			120	574	683	347	193	1917	1797	1.1
LSD (0.05) ⁴ :			613	1261	1100	733	806	1638	1549	1.0

Early yield data were collected for harvests 1 (21 and 24 July) and 2 (28 July and 1 August) with harvests collected over 3-4 days.

1. Ranked by marketable number per acre (Mkt no/ac).

2. Marketable number per acre (Mkt no/ac) includes all size categories except the less than 9 lb (< 9 lb) category.

3. Average number of fruit per plant (Fruit no/plant).

4. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $p < 0.05$.

Early Yield: Bins per acre

'Orange Crisp' from US Seedless and 'Estrella', 'Fascination', and 'Virtue' from Syngenta had the highest number of bins with marketable fruit per acre for the early harvests at 77, 62, 57, and 57 bins/ac, respectively (Table 12). The average number of bins per acre in the early harvests was 41. Most of the fruit fell into the 13.5-17.4 lb category.

Table 12. Early Bins Per Acre of Standard Size Seedless Watermelon Cultigens 2023

Bins per acre by size category								
Cultigen	Company	Rank ¹	< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb	Mkt bins/ac ²
Orange Crisp	US Seedless	1	1	8	28	18	23	77
Estrella	Syngenta	2	0	4	9	18	30	62
Fascination	Syngenta	3	1	9	20	15	13	57
Virtue	Syngenta	3	0	7	14	18	18	57
HMC633239	HM Clause	5	1	9	22	19	6	56
7197HQ	BASF/Nunhems	6	0	14	22	15	2	53
Warrior	BASF/Nunhems	7	2	7	27	12	6	52
Valor	Syngenta	8	1	8	23	16	4	51
Eleanor (HMC633802)	HM Clause	9	1	11	20	12	4	48
Red Amber	Enza Zaden	9	1	11	23	10	4	48
Nun 32002	BASF/Nunhems	11	0	4	19	14	10	47
WDL9454	Syngenta	11	1	9	23	10	6	47
HMC633248	HM Clause	13	2	5	15	18	6	43
Guardzman	Seedway	14	0	3	5	14	20	42
HMC633800	HM Clause	15	2	8	13	10	11	41
Cato (WDL9432)	Syngenta	16	1	10	14	10	4	38
Miramonte (XWT9161)	Sakata	16	0	5	13	10	10	38
Essence	Origene	18	0	6	4	16	11	37
Orchid Sweet	Known You Seed	18	3	22	14	1	0	37
Rio Grande	Enza Zaden	18	1	8	17	11	2	37
53021	Hazera	21	1	8	12	8	8	36
SVWA7826	Bayer/Seminis	21	1	17	6	5	8	36
3F93-2487	Known You Seed	21	2	11	17	6	2	36
Cracker Jack	Enza Zaden	24	0	11	14	5	4	34
Nun 32126	BASF/Nunhems	24	3	10	23	2	0	34
Embassy	BASF/Nunhems	26	1	8	14	6	4	32
Marshall	Known You Seed	26	3	15	15	0	2	32
Sweet Trick	Bayer/Seminis	26	1	15	10	8	0	32
Buttercup	Seedway	29	1	7	15	3	0	25
Lajoya	Origene	30	4	15	5	2	0	22
53022	Hazera	31	0	5	8	5	4	21
Amarela	Seedway	31	11	13	5	2	2	21
FWT 1427	Sakata	33	0	8	5	0	0	13
Average:			1	9	15	10	7	41
LSD (0.05) ³ :			13	32	35	29	34	64

Early yield data were collected for harvests 1 (21 and 24 July) and 2 (28 July and 1 August) with harvests collected over 3-4 days.

1. Ranked by marketable bins per acre (Mkt bins/ac).

2. Marketable bins per acre (Mkt bins/ac) includes all size categories except the less than 9 lb (< 9 lb) category.

3. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $p < 0.05$.

Early Yield: Average fruit size and bin size distribution

'Guardzman' from Seedway had the second largest fruit on average at 19.4 lb/fruit for the early harvest (Table 13). 'Estrella', a seeded cultigen from Syngenta, had the highest average fruit weight at 20.6 pounds per fruit. 'Guardzman' was a pound heavier than the next largest cultigen Essence (Figure 6) from Origene which was 18.4 lb/fruit. 'HMC633239' from HM Clause ranked eleventh for average fruit weight at 15.9 lb/fruit. This cultigen had the highest number of marketable fruit per acre but ranked fifth for marketable pounds per acre for the early harvests which is explained by its smaller fruit size. The average fruit size across all cultigens was 15.2 lb/fruit.

'Estrella' and 'Guardzman' both had nearly 50% of their fruit fall into the 30-count bin category in the early harvests at 48% and 47%, respectively (Table 13). 'Essence' from Origene had the highest percentage of fruit in the 36-count bin category at 46%. Most of the fruit in the early harvests were in the 45-count bin category with an average of 36% of bins falling into that category.



Figure 6. Photo of 'Essence' from Origene

Table 13. Early Average Fruit Size and Bin Size Distribution of Standard Size Seedless Watermelon Cultigens 2023

Percent of fruit per bin size category							
Cultigen	Company	Rank ¹	Avg lb/fruit	% 30 ct ²	% 36 ct ³	% 45 ct ⁴	% 60 ct ⁵
Estrella	Syngenta	1	20.6	48	31	15	6
Guardman	Seedway	2	19.4	47	31	15	7
Essence	Origene	3	18.4	24	46	11	18
Virtue	Syngenta	4	18.2	29	32	27	12
Fascination	Syngenta	5	16.9	21	26	37	16
Miramonte (XWT9161)	Sakata	6	16.6	21	22	41	15
Nun 32002	BASF/Nunhems	6	16.6	17	31	44	9
Orange Crisp	US Seedless	8	16.5	26	21	37	14
53021	Hazera	9	16.2	26	18	34	21
Eleanor (HMC633802)	HM Clause	9	16.2	8	24	46	21
HMC633239	HM Clause	11	15.9	10	34	39	17
HMC633248	HM Clause	12	15.6	15	39	33	9
Valor	Syngenta	12	15.6	8	32	43	14
WDL9454	Syngenta	12	15.6	11	19	49	20
Warrior	BASF/Nunhems	15	15.5	13	20	48	16
53022	Hazera	15	15.5	14	16	55	15
7197HQ	BASF/Nunhems	17	15.4	3	27	41	29
Cato (WDL9432)	Syngenta	17	15.4	9	24	37	28
HMC633800	HM Clause	19	15.3	18	23	27	25
Red Amber	Enza Zaden	19	15.3	5	19	46	26
Rio Grande	Enza Zaden	21	14.7	6	27	45	19
SVWA7826	Bayer/Seminis	21	14.7	20	17	20	41
Buttercup	Seedway	23	14.4	0	14	53	27
Cracker Jack	Enza Zaden	24	14.2	8	12	34	46
Embassy	BASF/Nunhems	25	14.1	7	15	49	24
Nun 32126	BASF/Nunhems	26	13.7	0	4	64	26
3F93-2487	Known You Seed	27	13.6	5	17	44	28
Sweet Trick	Bayer/Seminis	28	13.0	0	25	25	47
FWT 1427	Sakata	29	12.5	0	0	29	71
Marshall	Known You Seed	30	12.1	4	0	41	45
Orchid Sweet	Known You Seed	31	12.0	0	3	35	53
Amarela	Seedway	32	11.4	6	5	14	37
Lajoya	Origene	33	10.5	0	4	20	57
Average:			15.2	13	21	36	26
LSD (0.05) ⁶ :			3.7	53	37	63	54

Early yield data were collected for harvests 1 (21 and 24 July) and 2 (28 July and 1 August) with harvests collected over 3-4 days.

1. Ranked by average weight (lb) of the fruit (Avg lb/fruit).
2. Percent of fruit in the 30-count bin size category; fruit ≥ 21.5 lb.
3. Percent of fruit in the 36-count bin size category; fruit 17.5-21.4 lb.
4. Percent of fruit in the 45-count bin size category; fruit 13.5-17.4 lb.
5. Percent of fruit in the 60-count bin size category; fruit 9-13.4 lb.
6. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $p < 0.05$.

Mid-Season Harvests (3-4): 8 and 10 August (harvest 3) and 15 August (harvest 4)

Mid-Season Yield: Pounds per acre

The cultigen Guardsman from Seedway had the highest marketable yield at 47,091 pounds per acre (Mkt lb/ac) for the mid-season harvests (Table 14). The average marketable yield was 24,378 lb/ac. Most of the yield for the mid-season harvests fell into the 9-13.5 lb category. 'Guardsman' differed statistically in marketable yield with '7197HQ' and with 9 other entries with less yields (Table 14).

Table 14. Mid-Season Yield (lb/acre) of Standard Size Seedless Watermelon Cultigens 2023

Pounds (lb) per acre by size category										
Cultigen	Company	Rank ¹	< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb	Total lb/ac	Mkt lb/ac ²	Group ³
Guardsman	Seedway	1	2254	12040	10617	10083	14352	49345	47091	A
Miramonte (XWT9161)	Sakata	2	1388	8544	10814	7678	15391	43816	42427	AB
Sweet Trick	Bayer/Seminis	3	5825	14363	7742	12365	2689	42985	37160	ABC
Buttercup	Seedway	4	4170	22117	12214	2224	0	40726	36556	ABCD
SVWA7826	Bayer/Seminis	5	2201	11744	10652	3357	6098	34052	31851	ABCD
Orange Crisp	US Seedless	6	2224	11540	8218	7533	4112	33628	31404	ABCD
Fascination	Syngenta	7	1870	10785	12458	5616	1394	32124	30254	ABCD
Warrior	BASF/Nunhems	8	4652	8718	10820	10094	0	34285	29632	ABCD
Valor	Syngenta	9	1376	8939	10919	6517	2718	30469	29092	ABCD
Lajoya	Origene	10	7655	18655	7103	3218	0	36631	28976	ABCD
Embassy	BASF/Nunhems	11	1162	10983	13167	1173	2823	29307	28146	ABCD
Nun 32002	BASF/Nunhems	12	2707	9874	9194	7742	1249	30765	28058	ABCD
FWT 1427	Sakata	13	7318	18382	6156	1208	0	33065	25747	ABCD
Cracker Jack	Enza Zaden	14	1742	6151	9978	5616	2707	26194	24452	ABCD
Cato (WDL9432)	Syngenta	15	1394	7539	10379	3328	3125	25764	24370	ABCD
Nun 32126	BASF/Nunhems	16	5860	17354	4222	2201	0	29638	23778	ABCD
Rio Grande	Enza Zaden	17	4089	9432	9763	3403	0	26688	22599	ABCD
3F93-2487	Known You Seed	18	482	7823	8253	4432	1278	22268	21786	ABCD
Virtue	Syngenta	19	1493	5105	4670	7696	4193	23156	21664	ABCD
HMC633248	HM Clause	20	2259	5692	9781	1016	4188	22936	20676	ABCD
HMC633239	HM Clause	21	354	8677	7777	0	4048	20857	20502	ABCD
53021	Hazera	22	3520	7126	5378	3369	4164	23557	20038	ABCD
53022	Hazera	23	1777	5686	7696	4542	1557	21257	19480	ABCD
7197HQ	BASF/Nunhems	24	2718	7353	4623	4414	2950	22059	19341	BCD
Estrella	Syngenta	25	889	3473	5401	6284	3909	19956	19068	BCD
Essence	Origene	26	1394	5715	4716	4333	4193	20351	18957	BCD
Red Amber	Enza Zaden	27	976	8114	6232	4432	0	19753	18777	BCD
Amarela	Seedway	28	5343	13376	3572	0	0	22291	16948	BCD
Marshall	Known You Seed	29	7655	7423	5338	3299	0	23714	16059	BCD
HMC633800	HM Clause	30	1371	6882	1835	1045	4437	15571	14201	CD
Eleanor (HMC633802)	HM Clause	31	2683	5570	1864	4484	1411	16013	13329	CD
WDL9454	Syngenta	32	2596	6331	4484	2120	0	15531	12934	CD
Orchid Sweet	Known You Seed	33	5065	8224	906	0	0	14195	9130	D
Average:			2984	9689	7483	4389	2818	27362	24378	
LSD (0.05) ⁴ :			6642	16455	12312	13498	13737	28630	27694	

Mid-season yield data were collected for harvests 3 (8 and 10 August) and 4 (15 August)

1. Ranked by marketable pounds per acre (Mkt lb/ac).

2. Marketable pounds per acre (Mkt lb/ac) includes all size categories except the less than 9 lb (< 9 lb) category.

3. Entries with the same letter groups were not different statistically in marketable yield (Mkt lb/ac).

4. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $p < 0.05$.

Mid-Season Yield: Number of fruit per acre and number of fruit per plant

'Buttercup', a yellow flesh cultigen from Seedway, had the highest number of marketable fruit per acre (Mkt no/ac) for the mid-season harvests at 2904 (Table 15). 'Guardzman' from Seedway and 'Sweet Trick' from Bayer/Seminis were ranked second and third for the highest number of marketable fruit per acre at 2846, and 2556, respectively. The average number of marketable fruit across all entries was 1698 no/ac. 'Buttercup' also had the highest number of fruit per plant (Fruit no/plant) for the mid-season harvests at 2.0. The average number of fruit per plant was 1.2 for harvests 3 and 4.

Table 15. Mid-Season Yield (no/acre) and Number of Fruit Per Plant of Standard Size Seedless Watermelon Cultigens 2023

Cultigen	Company	Rank ¹	Number (no) of fruit per size category					Total no/ac	Mkt no/ac ²	Fruit no/plant ³
			< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb			
Buttercup	Seedway	1	523	1975	813	116	0	3427	2904	2.0
Guardzman	Seedway	2	290	1104	697	523	523	3136	2846	1.8
Sweet Trick	Bayer/Seminis	3	755	1278	523	639	116	3311	2556	1.9
Miramonte (XWT9161)	Sakata	4	174	755	697	407	639	2672	2497	1.5
Lajoya	Origene	5	1045	1684	465	174	0	3369	2323	1.9
FWT 1427	Sakata	6	987	1684	407	58	0	3136	2149	1.8
SVWA7826	Bayer/Seminis	6	290	1045	697	174	232	2439	2149	1.4
Fascination	Syngenta	8	232	929	813	290	58	2323	2091	1.3
Orange Crisp	US Seedless	8	290	987	523	407	174	2381	2091	1.4
Embassy	BASF/Nunhems	10	174	987	871	58	116	2207	2033	1.3
Nun 32126	BASF/Nunhems	11	755	1568	290	116	0	2730	1975	1.6
Warrior	BASF/Nunhems	11	581	755	697	523	0	2556	1975	1.5
Nun 32002	BASF/Nunhems	13	348	871	581	407	58	2265	1917	1.3
Valor	Syngenta	13	174	755	697	348	116	2091	1917	1.2
Cato (WDL9432)	Syngenta	15	174	697	697	174	116	1859	1684	1.1
Rio Grande	Enza Zaden	16	523	813	639	174	0	2149	1626	1.2
Cracker Jack	Enza Zaden	17	232	523	639	290	116	1800	1568	1.0
Amarela	Seedway	18	697	1278	232	0	0	2207	1510	1.3
3F93-2487	Known You Seed	18	58	697	523	232	58	1568	1510	0.9
HMC633239	HM Clause	20	58	755	523	0	174	1510	1452	0.9
HMC633248	HM Clause	21	290	523	639	58	174	1684	1394	1.0
53021	Hazera	22	465	639	348	174	174	1800	1336	1.0
53022	Hazera	22	232	523	523	232	58	1568	1336	0.9
Red Amber	Enza Zaden	22	116	697	407	232	0	1452	1336	0.8
Virtue	Syngenta	22	174	465	290	407	174	1510	1336	0.9
7197HQ	BASF/Nunhems	26	348	639	290	232	116	1626	1278	0.9
Essence	Origene	27	174	523	290	232	174	1394	1220	0.8
Marshall	Known You Seed	27	1045	697	348	174	0	2265	1220	1.3
Estrella	Syngenta	29	116	290	348	348	174	1278	1162	0.7
HMC633800	HM Clause	30	174	639	116	58	174	1162	987	0.7
WDL9454	Syngenta	30	348	581	290	116	0	1336	987	0.8
Eleanor (HMC633802)	HM Clause	32	348	465	116	232	58	1220	871	0.7
Orchid Sweet	Known You Seed	33	697	755	58	0	0	1510	813	0.9
Average:			391	866	487	230	114	2089	1698	1.2
LSD (0.05) ⁴ :			883	1480	797	701	537	2129	1853	1.2

Mid-season yield data were collected for harvests 3 (8 and 10 August) and 4 (15 August)

1. Ranked by marketable number per acre (Mkt no/ac).

2. Marketable number per acre (Mkt no/ac) includes all size categories except the less than 9 lb (< 9 lb) category.

3. Average number of fruit per plant (Fruit no/plant).

4. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $p < 0.05$.

Mid-Season Yield: Bins per acre

'Guardsman' from Seedway had the highest number of bins with marketable fruit per acre (Mkt bins/ac) with 67 for the mid-season harvests followed by 'Miramonte (XWT9161)' from Sakata and 'Sweet Trick' from Bayer/Seminis with 61 and 53 bins with marketable fruit per acre, respectively (Table 16). The average number of bins was 35 for the mid-season harvests. Most bins contained fruit in the 9-13.4 lb category.

Table 16. Mid-Season Bins Per Acre of Standard Size Seedless Watermelon Cultigens 2023

Bins per acre by size category								
Cultigen	Company	Rank ¹	< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb	Mkt bins/ac ²
Guardsman	Seedway	1	3	17	15	14	21	67
Miramonte (XWT9161)	Sakata	2	2	12	15	11	22	61
Sweet Trick	Bayer/Seminis	3	8	21	11	18	4	53
Buttercup	Seedway	4	6	32	17	3	0	52
SVWA7826	Bayer/Seminis	5	3	17	15	5	9	46
Orange Crisp	US Seedless	6	3	16	12	11	6	45
Fascination	Syngenta	7	3	15	18	8	2	43
Valor	Syngenta	8	2	13	16	9	4	42
Warrior	BASF/Nunhems	8	7	12	15	14	0	42
Lajoya	Origene	10	11	27	10	5	0	41
Embassy	BASF/Nunhems	11	2	16	19	2	4	40
Nun 32002	BASF/Nunhems	11	4	14	13	11	2	40
FWT 1427	Sakata	13	10	26	9	2	0	37
Cato (WDL9432)	Syngenta	14	2	11	15	5	4	35
Cracker Jack	Enza Zaden	14	2	9	14	8	4	35
Nun 32126	BASF/Nunhems	16	8	25	6	3	0	34
Rio Grande	Enza Zaden	17	6	13	14	5	0	32
Virtue	Syngenta	18	2	7	7	11	6	31
3F93-2487	Known You Seed	18	1	11	12	6	2	31
HMC633248	HM Clause	20	3	8	14	1	6	30
53021	Hazera	21	5	10	8	5	6	29
HMC633239	HM Clause	21	1	12	11	0	6	29
53022	Hazera	23	3	8	11	6	2	28
7197HQ	BASF/Nunhems	23	4	11	7	6	4	28
Essence	Origene	25	2	8	7	6	6	27
Estrella	Syngenta	25	1	5	8	9	6	27
Red Amber	Enza Zaden	25	1	12	9	6	0	27
Amarela	Seedway	28	8	19	5	0	0	24
Marshall	Known You Seed	29	11	11	8	5	0	23
HMC633800	HM Clause	30	2	10	3	1	6	20
Eleanor (HMC633802)	HM Clause	31	4	8	3	6	2	19
WDL9454	Syngenta	32	4	9	6	3	0	18
Orchid Sweet	Known You Seed	33	7	12	1	0	0	13
Average:			4	14	11	6	4	35
LSD (0.05) ³ :			9	24	18	19	20	40

Mid-season yield data were collected for harvests 3 (8 and 10 August) and 4 (15 August)

1. Ranked by marketable bins per acre (Mkt bins/ac).

2. Marketable bins per acre (Mkt bins/ac) includes all size categories except the less than 9 lb (< 9 lb) category.

3. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $p < 0.05$.

Mid-Season Yield: Average fruit size and bin size distribution

'Miramonte (XWT9161)' (Figure 7) from Sakata, 'Guardzman' from Seedway, and 'Estrella', the diploid (seeded) cultigen from Syngenta, had the largest fruit for the mid-season harvests at 16.5, 15.7, and 15.5 lb/fruit, respectively (Table 17). The average fruit weight across all 33 entries was 13.2 lb/fruit.

'Miramonte (XWT9161)' had the highest percentage of fruit in the 30-count bin category for the mid-season harvests with 37%. 'Estrella' had the highest percentage of fruit in the 36-count bin category at 35% followed by 'Eleanor (HMC633802)' from HM Clause with 33%. 'HMC633248' from HM Clause had the highest percentage of fruit in the 45-count bin category at 46%. The majority of cultigens had fruit in the 60-count bin category with 36% of the distribution falling into that category.



Figure 7. Photo of 'Miramonte (XWT9161)' from Origene

Table 17. Mid-Season Average Fruit Size and Bin Size Distribution of Standard Size Seedless Watermelon Cultigens 2023

Percent of fruit per bin size category							
Cultigen	Company	Rank ¹	Avg lb/fruit	% 30 ct ²	% 36 ct ³	% 45 ct ⁴	% 60 ct ⁵
Miramonte (XWT9161)	Sakata	1	16.5	37	17	24	19
Guardsman	Seedway	2	15.7	27	20	22	26
Estrella	Syngenta	3	15.5	15	35	27	20
Virtue	Syngenta	3	15.5	23	28	21	20
Cracker Jack	Enza Zaden	5	15.1	12	22	37	23
Valor	Syngenta	6	14.6	7	24	35	29
Essence	Origene	7	14.4	22	18	22	30
7197HQ	BASF/Nunhems	8	14.2	19	15	24	31
SVWA7826	Bayer/Seminis	9	14.0	12	10	36	35
HMC633239	HM Clause	10	13.9	15	0	39	44
Nun 32002	BASF/Nunhems	10	13.9	4	23	34	30
Orange Crisp	US Seedless	10	13.9	8	17	32	35
Fascination	Syngenta	13	13.8	3	18	39	34
Cato (WDL9432)	Syngenta	14	13.7	12	11	41	29
Eleanor (HMC633802)	HM Clause	14	13.7	7	33	9	36
Red Amber	Enza Zaden	14	13.7	0	17	41	38
Warrior	BASF/Nunhems	14	13.7	0	30	32	25
53022	Hazera	18	13.6	7	22	36	26
HMC633248	HM Clause	19	13.4	15	4	46	24
HMC633800	HM Clause	19	13.4	20	4	8	28
Embassy	BASF/Nunhems	21	13.2	8	3	45	40
3F93-2487	Known You Seed	21	13.2	3	9	40	47
Sweet Trick	Bayer/Seminis	23	12.9	6	29	18	32
53021	Hazera	24	12.6	12	11	22	38
Rio Grande	Enza Zaden	25	12.4	0	10	37	37
Buttercup	Seedway	26	11.9	0	5	30	55
WDL9454	Syngenta	27	11.1	0	9	21	42
Lajoya	Origene	28	10.9	0	9	19	51
Marshall	Known You Seed	28	10.9	0	16	23	29
Nun 32126	BASF/Nunhems	28	10.9	0	6	18	55
FWT 1427	Sakata	31	10.5	0	4	18	55
Amarela	Seedway	32	10.3	0	0	15	62
Orchid Sweet	Known You Seed	33	9.3	0	0	3	57
Average:			13.2	9	15	28	36
LSD (0.05) ⁶ :			5.2	43	47	48	54

Mid-season yield data were collected for harvests 3 (8 and 10 August) and 4 (15 August)

1. Ranked by average weight (lb) of the fruit (Avg lb/fruit).

2. Percent of fruit in the 30-count bin size category; fruit ≥ 21.5 lb.

3. Percent of fruit in the 36-count bin size category; fruit 17.5-21.4 lb.

4. Percent of fruit in the 45-count bin size category; fruit 13.5-17.4 lb.

5. Percent of fruit in the 60-count bin size category; fruit 9-13.4 lb.

6. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $p < 0.05$.

Late Harvest (5): 24 August

Late Yield: Pounds per acre

'Virtue' from Syngenta, 'Miramonte (XWT9161)' from Sakata, and 'Nun 32126' from BASF/Nunhems had the highest marketable yields for the late harvest with 14956, 14793, and 14,334 lb/ac, respectively (Table 18). The average marketable yield for the late harvest across all 33 entries was 6998 lb/ac. Fruit were generally smaller in the late harvest with only seven cultigens having fruit in the 17.5-21.4 lb category and only three cultigens having fruit greater than or equal to 21.5 lb. There were no statistical differences in marketable yield for the late harvest, as yields across replications varied considerably due to vine health.

Table 18. Late Yield (lb/acre) of Standard Size Seedless Watermelon Cultigens 2023

Pounds (lb) per acre by size category										
Cultigen	Company	Rank ¹	< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb	Total lb/ac	Mkt lb/ac ²	Group ³
Virtue	Syngenta	1	1859	3764	4310	5622	1260	16814	14956	A
Miramonte (XWT9161)	Sakata	2	1859	6656	7086	1051	0	16652	14793	A
Nun 32126	BASF/Nunhems	3	4141	11784	2550	0	0	18475	14334	A
Essence	Origene	4	964	6801	2828	3491	0	14084	13120	A
Warrior	BASF/Nunhems	5	953	2782	1870	6691	1301	13597	12644	A
Nun 32002	BASF/Nunhems	6	987	6371	6110	0	0	13469	12481	A
7197HQ	BASF/Nunhems	7	1376	6017	4623	0	1278	13295	11918	A
FWT 1427	Sakata	8	3072	9270	1667	0	0	14009	10936	A
Guardsman	Seedway	9	424	3839	6848	0	0	11111	10687	A
Valor	Syngenta	10	412	5401	4141	0	0	9955	9543	A
Cato (WDL9432)	Syngenta	11	906	5680	2503	0	0	9090	8183	A
Cracker Jack	Enza Zaden	12	790	4536	3572	0	0	8898	8108	A
Sweet Trick	Bayer/Seminis	13	1638	6476	842	0	0	8956	7318	A
Buttercup	Seedway	14	2805	5407	1783	0	0	9996	7190	A
SVWA7826	Bayer/Seminis	15	0	3154	2538	1138	0	6830	6830	A
53022	Hazera	16	0	5837	860	0	0	6697	6697	A
Embassy	BASF/Nunhems	17	976	5018	813	0	0	6807	5831	A
Fascination	Syngenta	18	378	3119	2660	0	0	6156	5779	A
53021	Hazera	19	453	4066	1644	0	0	6162	5709	A
Lajoya	Origene	20	1423	4188	894	0	0	6505	5082	A
Estrella	Syngenta	21	0	3810	889	0	0	4699	4699	A
Eleanor (HMC633802)	HM Clause	22	1841	4472	0	0	0	6313	4472	A
Orange Crisp	US Seedless	23	1742	1272	2788	0	0	5802	4060	A
WDL9454	Syngenta	24	1016	3026	871	0	0	4914	3897	A
HMC633248	HM Clause	25	436	1899	842	1092	0	4269	3833	A
3F93-2487	Known You Seed	26	366	639	2619	0	0	3624	3258	A
Rio Grande	Enza Zaden	27	436	529	2486	0	0	3450	3014	A
Red Amber	Enza Zaden	28	0	2852	0	0	0	2852	2852	A
HMC633800	HM Clause	29	0	627	1835	0	0	2463	2463	A
HMC633239	HM Clause	30	476	1185	0	1133	0	2794	2317	A
Marshall	Known You Seed	31	1016	0	1568	0	0	2585	1568	A
Orchid Sweet	Known You Seed	32	865	1208	0	0	0	2073	1208	A
Amarela	Seedway	33	2985	1144	0	0	0	4129	1144	A
Average:			1109	4025	2244	613	116	8107	6998	
LSD (0.05) ⁴ :			6445	10484	9657	11536	6426	20354	19056	

Late yield data were collected over 1 harvest (24 August).

1. Ranked by marketable pounds per acre (Mkt lb/ac).

2. Marketable pounds per acre (Mkt lb/ac) includes all size categories except the less than 9 lb (< 9 lb) category.

3. Entries with the same letter groups were not different statistically in marketable yield (Mkt lb/ac).

4. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at P < 0.05.

Late Yield: Number of fruit per acre and number of fruit per plant

'Nun 32126' from BASF/Nunhems had the highest number of marketable fruit per acre (Mkt no/ac) for the late harvest at 1278 (Table 19). There was less fruit overall in the late harvest compared to the early and mid-season with an average of 554 marketable fruit per acre. 'Nun 32126' from BASF/Nunhems and 'Miramonte (XWT9161)' from Sakata were the only two entries that had over 1000 marketable fruit per acre; the other entries ranged from 987 to 116. 'Nun 32126' was the only entry to have 1.0 or more fruit per plant. The average fruit per plant across all entries was 0.2. Vine health declined substantially since the fourth harvest.

Table 19. Late Yield (no/acre) and Number of Fruit Per Plant of Standard Size Seedless Watermelon Cultigens 2023

Cultigen	Company	Rank ¹	Number (no) of fruit per size category					Total no/ac	Mkt no/ac ²	Fruit no/plant ³
			< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb			
Nun 32126	BASF/Nunhems	1	523	1104	174	0	0	1800	1278	1.0
Miramonte (XWT9161)	Sakata	2	232	581	465	58	0	1336	1104	0.8
Nun 32002	BASF/Nunhems	3	116	581	407	0	0	1104	987	0.6
Virtue	Syngenta	3	232	348	290	290	58	1220	987	0.7
7197HQ	BASF/Nunhems	5	174	581	290	0	58	1104	929	0.6
Essence	Origene	5	116	581	174	174	0	1045	929	0.6
FWT 1427	Sakata	5	407	813	116	0	0	1336	929	0.8
Guardman	Seedway	8	58	348	465	0	0	871	813	0.5
Valor	Syngenta	9	58	465	290	0	0	813	755	.
Warrior	BASF/Nunhems	9	116	232	116	348	58	871	755	0.5
Cato (WDL9432)	Syngenta	11	116	523	174	0	0	813	697	.
Buttercup	Seedway	12	348	523	116	0	0	987	639	0.6
Cracker Jack	Enza Zaden	12	116	407	232	0	0	755	639	.
Sweet Trick	Bayer/Seminis	12	232	581	58	0	0	871	639	0.5
53022	Hazera	15	0	523	58	0	0	581	581	.
Embassy	BASF/Nunhems	16	116	465	58	0	0	639	523	.
SVWA7826	Bayer/Seminis	16	0	290	174	58	0	523	523	.
53021	Hazera	18	58	348	116	0	0	523	465	.
Fascination	Syngenta	18	58	290	174	0	0	523	465	.
Lajoya	Origene	18	174	407	58	0	0	639	465	.
Eleanor (HMC633802)	HM Clause	21	232	407	0	0	0	639	407	.
Estrella	Syngenta	21	0	348	58	0	0	407	407	.
WDL9454	Syngenta	23	116	290	58	0	0	465	348	.
HMC633248	HM Clause	24	58	174	58	58	0	348	290	.
Orange Crisp	US Seedless	24	232	116	174	0	0	523	290	.
Red Amber	Enza Zaden	24	0	290	0	0	0	290	290	.
Rio Grande	Enza Zaden	27	58	58	174	0	0	290	232	.
3F93-2487	Known You Seed	27	58	58	174	0	0	290	232	.
HMC633239	HM Clause	29	58	116	0	58	0	232	174	.
HMC633800	HM Clause	29	0	58	116	0	0	174	174	.
Amarela	Seedway	31	407	116	0	0	0	523	116	.
Marshall	Known You Seed	31	116	0	116	0	0	232	116	.
Orchid Sweet	Known You Seed	31	116	116	0	0	0	232	116	.
Average:			142	368	149	32	5	697	554	0.7
LSD (0.05) ⁴ :			823	941	641	598	293	1668	1396	1.1

Late yield data were collected over 1 harvest (24 August).

1. Ranked by marketable number per acre (Mkt no/ac).

2. Marketable number per acre (Mkt no/ac) includes all size categories except the less than 9 lb (< 9 lb) category.

3. Average number of fruit per plant (Fruit no/plant). Several entries could not be analyzed for fruit number per plant in the late harvest due to variability between replications.

4. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $P < 0.05$.

Late Yield: Bins per acre

'Miramonte (XWT9161)' from Sakata and 'Virtue' from Syngenta had the highest number of bins with marketable fruit per acre (Mkt bins/ac) for the late harvest at 21 bins/ac (Table 20). The average number of bins per acre was 10 across all entries. Most entries did not have fruit in the 17.5 to 21.4 lb category and only three entries had fruit in the greater than or equal to 21.5 lb category.

Table 17. Late Bins Per Acre of Standard Size Seedless Watermelon Cultigens 2023

Bins per acre by size category								
Cultigen	Company	Rank ¹	< 9 lb	9-13.4 lb	13.5-17.4 lb	17.5-21.4 lb	≥ 21.5 lb	Mkt bins/ac ²
Miramonte (XWT9161)	Sakata	1	3	10	10	2	0	21
Virtue	Syngenta	1	3	5	6	8	2	21
Nun 32126	BASF/Nunhems	3	6	17	4	0	0	20
Essence	Origene	4	1	10	4	5	0	19
Nun 32002	BASF/Nunhems	5	1	9	9	0	0	18
Warrior	BASF/Nunhems	5	1	4	3	10	2	18
7197HQ	BASF/Nunhems	7	2	9	7	0	2	17
FWT 1427	Sakata	8	4	13	2	0	0	16
Guardman	Seedway	9	1	5	10	0	0	15
Valor	Syngenta	10	1	8	6	0	0	14
Cato (WDL9432)	Syngenta	11	1	8	4	0	0	12
Cracker Jack	Enza Zaden	11	1	6	5	0	0	12
53022	Hazera	13	0	8	1	0	0	10
Buttercup	Seedway	13	4	8	3	0	0	10
SVWA7826	Bayer/Seminis	13	0	5	4	2	0	10
Sweet Trick	Bayer/Seminis	13	2	9	1	0	0	10
53021	Hazera	17	1	6	2	0	0	8
Embassy	BASF/Nunhems	17	1	7	1	0	0	8
Fascination	Syngenta	17	1	4	4	0	0	8
Estrella	Syngenta	20	0	5	1	0	0	7
Lajoya	Origene	20	2	6	1	0	0	7
Eleanor (HMC633802)	HM Clause	22	3	6	0	0	0	6
Orange Crisp	US Seedless	22	2	2	4	0	0	6
WDL9454	Syngenta	22	1	4	1	0	0	6
HMC633248	HM Clause	25	1	3	1	2	0	5
3F93-2487	Known You Seed	25	1	1	4	0	0	5
HMC633800	HM Clause	27	0	1	3	0	0	4
Red Amber	Enza Zaden	27	0	4	0	0	0	4
Rio Grande	Enza Zaden	27	1	1	4	0	0	4
HMC633239	HM Clause	30	1	2	0	2	0	3
Amarela	Seedway	31	4	2	0	0	0	2
Marshall	Known You Seed	31	1	0	2	0	0	2
Orchid Sweet	Known You Seed	31	1	2	0	0	0	2
Average:			2	6	3	1	0	10
LSD (0.05) ³ :			9	15	14	16	9	27

Late yield data were collected over 1 harvest (24 August).

1. Ranked by marketable bins per acre (Mkt bins/ac).

2. Marketable bins per acre (Mkt bins/ac) includes all size categories except the less than 9 lb (< 9 lb) category.

3. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at P < 0.05.

Late Yield: Average fruit size and bin size distribution

'Warrior' from BASF/Nunhems had the highest average fruit weight for the late harvest at 14.2 lb/fruit which was nearly a pound heavier than the next largest entries 'Essence' from Origene and 'HMC633800' from HM Clause at 13.3 lb/fruit (Table 21). The average fruit weight across all 33 entries was 11.5 lb for the late harvest with a range from 14.2 lb to 8.3 lb. Only three entries had fruit in the 30-count bin category and only seven had fruit in the 36-count bin category. Most fruit for the late harvest were in the 60-count bin category, which had an average of 46% of the fruit across all entries.

Table 21. Late Average Fruit Size and Bin Size Distribution of Standard Size Seedless Watermelon Cultigens 2023

Percent of fruit per bin size category							
Cultigen	Company	Rank ¹	Avg lb/fruit	% 30 ct ²	% 36 ct ³	% 45 ct ⁴	% 60 ct ⁵
Warrior	BASF/Nunhems	1	14.2	5	33	14	27
Essence	Origene	2	13.3	0	21	19	53
HMC633800	HM Clause	2	13.3	0	0	33	33
SVWA7826	Bayer/Seminis	4	13.2	0	11	25	31
Virtue	Syngenta	5	13.1	5	25	36	16
3F93-2487	Known You Seed	5	13.1	0	0	55	8
Valor	Syngenta	7	13.0	0	0	60	38
Miramonte (XWT9161)	Sakata	8	12.6	0	5	46	40
Rio Grande	Enza Zaden	8	12.6	0	0	55	7
Guardman	Seedway	10	12.5	0	0	52	39
Fascination	Syngenta	11	12.1	0	0	33	31
7197HQ	BASF/Nunhems	12	12.0	6	0	28	55
Orange Crisp	US Seedless	12	12.0	0	0	47	24
HMC633239	HM Clause	14	11.8	0	18	0	42
Nun 32002	BASF/Nunhems	14	11.8	0	0	37	48
Estrella	Syngenta	16	11.3	0	0	11	89
HMC633248	HM Clause	16	11.3	0	10	8	45
53022	Hazera	18	11.2	0	0	6	61
Cato (WDL9432)	Syngenta	18	11.2	0	0	28	61
53021	Hazera	20	11.1	0	0	13	74
Marshall	Known You Seed	20	11.1	0	0	33	0
Cracker Jack	Enza Zaden	22	11.0	0	0	18	72
Embassy	BASF/Nunhems	23	10.7	0	0	8	49
FWT 1427	Sakata	24	10.6	0	0	10	69
WDL9454	Syngenta	24	10.6	0	0	14	62
Buttercup	Seedway	26	10.4	0	0	12	36
Lajoya	Origene	27	10.3	0	0	14	65
Nun 32126	BASF/Nunhems	27	10.3	0	0	9	74
Sweet Trick	Bayer/Seminis	27	10.3	0	0	5	81
Red Amber	Enza Zaden	30	10.0	0	0	0	67
Eleanor (HMC633802)	HM Clause	31	9.9	0	0	0	48
Orchid Sweet	Known You Seed	32	8.8	0	0	0	26
Amarela	Seedway	33	8.3	0	0	0	39
Average:			11.5	0	4	22	46
LSD (0.05) ⁶ :			7.3	27	62	99	110

Late yield data were collected over 1 harvest (24 August).

1. Ranked by average weight (lb) of the fruit (Avg lb/fruit).

2. Percent of fruit in the 30-count bin size category; fruit \geq 21.5 lb.

3. Percent of fruit in the 36-count bin size category; fruit 17.5-21.4 lb.

4. Percent of fruit in the 45-count bin size category; fruit 13.5-17.4 lb.

5. Percent of fruit in the 60-count bin size category; fruit 9-13.4 lb.

6. Least Significant Difference (LSD) is the minimum difference required between two cultigens for a significant difference in that category at $P < 0.05$.



Figure 8. Photo of 'Amarela' from Seedway



Figure 9. Photo of 'Buttercup' from Seedway



Figure 10. Photo of 'Cracker Jack' from Enza Zaden



Figure 11. Photo of 'Eleanor (HMC633802)' from HM Clause



Figure 12. Photo of 'Embassy' from BASF/Nunhems



Figure 13. Photo of 'Estrella' from Syngenta



Figure 14. Photo of 'FWT 1427' from Sakata



Figure 15. Photo of 'Fascination' from Syngenta



Figure 16. Photo of 'HMC633239' from HM Clause



Figure 17. Photo of 'HMC633248' from HM Clause



Figure 18. Photo of 'HMC633800' from HM Clause



Figure 19. Photo of 'Lajoya' from Origene



Figure 20. Photo of 'Marshall' from Known You Seed



Figure 21. Photo of 'Nun 32002' from BASF/Nunhems



Figure 22. Photo of 'Orchid Sweet' from Known You Seed



Figure 23. Photo of 'Red Amber' from Enza Zaden



Figure 24. Photo of 'Rio Grande' from Enza Zaden



Figure 25. Photo of 'SVWA7826' from Bayer/Seminis



Figure 26. Photo of 'Sweet Trick' from Bayer/Seminis



Figure 27. Photo of 'Valor' from Syngenta

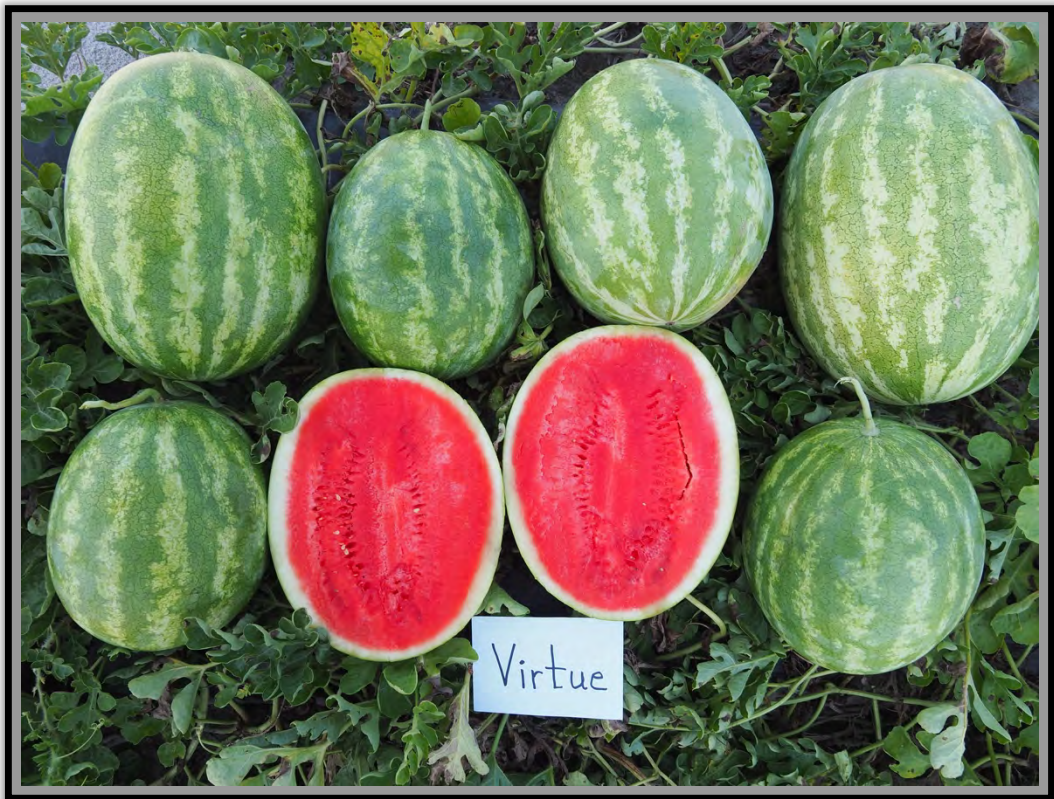


Figure 28. Photo of 'Virtue' from Syngenta



Figure 29. Photo of 'WDL9454' from Syngenta



Figure 30. Photo of 'Warrior' from BASF/Nunhems



Figure 31. Photo of '3F93-2487' from Known You Seed



Figure 32. Photo of '53021' from Hazera



Figure 33. Photo of '53022' from Hazera



Figure 34. Photo of '7197HQ' from BASF/Nunhems