2003 NEW JERSEY HEIRLOOM TOMATO OBSERVATION TRIAL RESULTS[1]

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Introduction

This the second year evaluating heirloom tomatoes for New Jersey growers under the Program Enhancement Grant funded by the New Jersey Agricultural Experiment Station. New Jersey growers are looking for new markets which will help maintain the agricultural viability on their farms. There is increasing demand for heirloom tomatoes in the market place at roadside stands, tailgate markets, restaurants and in the wholesale market. It is difficult for growers to evaluate heirloom tomatoes since there are hundreds of varieties. The objective of this study is to help growers narrow down the number of varieties to consider.

Materials and Methods

Culture

Plants were grown at the Snyder Research and Extension Farm in a peat-vermiculite media formulated for tomato transplant production. Seeds were sown on April 16 in 200 cell trays containing peat vermiculite media and transplanted into 48 cell trays on May 16. The transplants were transferred to the Rutgers Agricultural Research and Extension Center at Bridgeton and placed in an outside-protected area to harden off. Beds on 6-ft centers were formed and black plastic mulch with drip irrigation tube was laid. Plants were set by hand in the field on June 11 in single rows with 24 inches between plants. Plants were staked with 8 ft. tomatoes stakes with one stake between every two plants. Tomato string was used to hold the plants on the stakes. The first string was placed at 6 inches off the ground and the remaining strings (5 – 7) were placed at 8 – 12 inches apart.

Before bed making, based on soil test, 65 lbs/A of nitrogen plus phosphorus (P_2O_5) and potassium (K_2O) were disked into the sandy loam soil. Devrinol 50DF (3 lb/A) and Sencor 4F (0.33 lbs/A) were applied and incorporated during bedding. Three applications of 40 lbs/A of N, P_2O_5 and K_2O were applied through the drip system during the growing season. A total of two pounds per acre boron was applied with the other nutrients through the drip system. *Imidacloprid* (Admire – 3 ml/flat) was applied as a drench to the seedling flats two days before transplanting in sufficient water to saturate the growing media without run off for early season insect control. Insects and diseases were controlled using Rutgers Commercial Recommendations for tomatoes. Rainfall was 3.25, 6.19, 4.72, 4.69, 4.73 and 3.80 inches in May, June, July, August, September and October, respectively. Tensiometers were placed in the plots at the 12-inch depth to schedule supplemental irrigation.

Experimental Design, Harvesting and Evaluations

There were five plants in single row plots with no replication. Tomatoes were hand harvested on August 15 and 25, September 5, 17 and 25, October 1, 9, 16 and 22. Fruits were graded into marketable and culls then counted and weighed. Culls were further divided by type of defect (blossom end rot, insect damage, green shoulder, cat facing zipper, rot small, misshapen, cracks, sunburn and rain checking) and counted. At the fifth harvest, five fruit were randomly selected from marketable fruit to evaluate

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internal and external characteristics. Data was collected on vine vigor, fruit cover, and plant height on October 21. All yield data is recorded in 25 lb boxes.

The cultivars and seed sources are listed in table 1 followed by the key for fruit characteristics in table 2 and plant characteristics in table 3.

Table 1. Seed Source

Variety	Seed Source
Bicolor Cherry	Garden State Heirloom Seed Society
Fruity Orange	Garden State Heirloom Seed Society
Fruity Yellow	Garden State Heirloom Seed Society
Chello	Garden State Heirloom Seed Society
Lollipop	Garden State Heirloom Seed Society
Pixie Stripe	Garden State Heirloom Seed Society
Purple Smudge	Garden State Heirloom Seed Society
Marvel Stripped	Tomato Grower's Supply
Yellow Out Red In	Garden State Heirloom Seed Society
Marizol Magic	Garden State Heirloom Seed Society

Table 2. Fruit Characteristics Key

Shape
1 – Beef Steak
2 – Flattened Globe
3 – Round
4 – Blocky
5 – Long Blocky
6 – Very Deep-Round
7 – Pear
8 – Plum
9 – Oxheart
10 – Bell
11 – Flat
12 Elongated Oxheart

Stem Scar
1 – Small
2 – Small/Medium
3 – Medium
4 – Medium/Large
5 – Large

Jelly Color
1 – Red
2 – Yellow/Red
3 – Yellow
4 – Yellow/Green
5 – Green
6 – Orange

Cracking
1 – Severe
2 – Abundant
3 – Moderate
4 – Light
5 – No

External Color
1 – White
2 – Green
3 – Light Yellow
4. – Yellow
5 – Dark Yellow
6 – Orange Yellow
7 – Orange
8 – Red Orange
9 – Red
10 – Light Pink
11 – Pink
12 – Dark Pink
13 - Purple
14 – Black
15 – Mahogany
16 – Red Mahogany
17 – Orange Mahogany
18 – Red Gold
19 – Gold Red
20 – Red Green
21 – Yellow Red
22 – Gold

Core Size
1 - Small
2 – Small/Medium
3 – Medium
4 – Medium/Large
5 – Large

Firmness
1 – Very Soft
2 - Soft
3 - Medium
4 – Firm
5 – Very Firm

Blossom Scar
1 - Small
2 – Small/Medium
3 - Medium
4 – Medium/Large
5 - Large

Internal Color
1 - Red
2 – Yellow/Red
3 - Yellow
4 – Yellow/Green
5 - Green
6 – Red/Yellow
7 - Orange
8 - Pink
9 - Gold
10 – Light Pink

Overall External & Internal
1 - Poor
2 – Fair
3 – Good/Average
4 – Good
5 - Excellent

Table 3. Plant Characteristics Key

Plant Color
1 – Dark Green
2 – Green
3 – Light Green
4 – Blue Green

Stem Attachment
1 – Jointed
2 – Jointless

Plant Vigor
1 – Poor
2 – Fair
3 – Good/Average
4 – Very Good
5- Excellent

Leaf Type
1 – Regular
2 – Regular/Narrow
3 – Regular/Curled
4 – Regular/Fuzzy
5 – Potato

Fruit Cover
1 - Poor
2 - Fair
3 - Good/Average
4 -Very Good
5 - Excellent

Vine Size
1 - Small
2 – Small/Medium
3 - Medium
4 – Medium/Large
5 - Large

Results and Discussion

The days to harvest from transplanting, total, marketable, cull and percent market yield and average marketable fruit size for harvest 1, 2 and 3 (early yield) are shown in table 4.

The cultivars 'Lollipop', 'Chello', 'Fruity Yellow', 'Fruity Orange' and 'Purple Smudge' yielded more total and marketable boxes of fruit than the overall average for the trial. All these cultivars had the fewest days to harvest except 'Purple Smudge'. The cultivar 'Yellow Out Red In' is a storage type tomato for late harvest which explains why there were few early fruit. All cultivars were cherry type except for 'Marvel Stripped' (large fruited) and 'Purple Smudge' (medium fruited). The percentage of marketable fruit ranged from 0 to 100%. All cultivars had acceptable marketable yields except 'Yellow Out Red In' and 'Marizol Magic'

Table 4. Heirloom tomato yield and fruit size for first, second and third harvest (early) – Rutgers Agricultural Research and Extension Center, Bridgeton, New Jersey – 2003.

Variety	Days to Harvest*	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Marketable Fruit Wt. Oz.
Bicolor Cherry	65	438	396	43	90	0.54
Fruity Orange	65	919	790	129	86	0.19
Fruity Yellow	65	898	819	78	91	0.26
Chello	65	1411	844	567	60	0.77
Lollipop	65	1192	1131	61	95	0.35
Pixie Stripe	86	267	267	0	100	3.31
Purple Smudge	75	717	634	83	88	1.44
Marvel Stripped	86	513	353	160	69	26.99
Yellow Out Red In	98	13	0	13	0	-----
Marizol Magic	75	649	340	309	52	1.64
Mean	**-----**	**702**	**557**	**144**	**-----**	**-----**

* Days from transplanting

Table 5 summarizes the combined yield and fruit size for the mid season harvests (4, 5, and 6). The total yield varied between 598 and 2352 boxes/A. 'Pixie Stripe', 'Purple Smudge', Marvel Stripped', 'Yellow Out Red In' and 'Marizol Magic' yielded more total boxes of fruit than the average for all cultivars. However, only Pixie Stripe, Purple Smudge and Yellow Out Red In had more marketable fruit than the average among all cultivars. All cultivars had a lower percent marketable fruit except for 'Bicolor Cherry', Purple Smudge or 'Yellow Out Red In' which had the same or more. 'Yellow Out Red In' had no marketable fruit for the first harvest. Fruit size varied little

between the early and mid season harvest periods except for the cultivars 'Pixie Stripe' and 'Marvel Stripped' which were smaller.

Table 5. Heirloom tomato yield and fruit size for fourth, fifth and sixth harvest (mid season) – Rutgers Agricultural Research and Extension Center, Bridgeton, New Jersey – 2003.

Variety	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Marketable Fruit Wt. Oz.
Bicolor Cherry	598	537	61	90	0.50
Fruity Orange	658	429	229	65	0.17
Fruity Yellow	877	768	109	88	0.21
Chello	313	135	178	43	0.73
Lollipop	1039	844	195	81	0.34
Pixie Stripe	1533	1086	447	71	2.64
Purple Smudge	2028	1827	201	90	1.09
Marvel Stripped	1652	605	1048	37	14.61
Yellow Out Red In	2352	2014	338	86	4.09
Marizol Magic	1395	614	782	44	1.29
Mean	**1246**	**886**	**359**	**-----**	**-----**

Table 6 summarizes the total, marketable, cull yield, percent marketable fruit and fruit size for the late harvest period. Four cultivars ('Bicolor Cherry', 'Purple Smudge', 'Yellow Out Red In' and 'Marizol Magic') yielded more total and marketable boxes of fruit than the overall average for all cultivars. Most cultivars had smaller fruit than for the early and mid season harvests. There were no marketable fruit for 'Marvel Stripped' to evaluate.

Table 6. Heirloom tomato yield and fruit size for seventh, eighth and ninth harvest (late) – Rutgers Agricultural Research and Extension Center, Bridgeton, New Jersey – 2003.

Variety	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Marketable Fruit Wt. Oz.
Bicolor Cherry	594	540	54	91	0.42
Fruity Orange	187	175	12	94	0.15
Fruity Yellow	367	353	14	96	0.24
Chello	147	99	48	67	0.67
Lollipop	333	276	57	83	0.31
Pixie Stripe	446	270	176	61	2.39
Purple Smudge	566	483	83	85	0.98
Marvel Stripped	441	0	441	0	-----
Yellow Out Red In	1067	964	103	90	3.78
Marizol Magic	683	384	299	56	1.12
Mean	**483**	**354**	**129**	**-----**	**-----**

Table 7 summarizes the total days fruit was harvested, total, marketable and cull yields, percentage and size of marketable fruit. Total harvest days ranged from 26 to 68 days. It was not until the third harvest that all cultivars had ripe fruit and the cultivar 'Marvel Stripped' did not produce any marketable fruit after the sixth harvest date. 'Yellow Out Red In', 'Purple Smudge', Marizol Magic' and 'Lollipop' had a higher total yield than the average for all cultivars for the full season production. Four cultivars ('Yellow Out Red In', 'Purple Smudge', 'Lollipop' and 'Fruity Yellow') had more marketable fruit than the average. 'Bicolor Cherry', 'Fruity Yellow', 'Purple Smudge' 'Lollipop' and 'Yellow Out Red In' maintained the percentage marketable fruit above 85%. Two cultivars ('Marvel Stripped' and 'Marizol Magic') had below 50% marketable fruit. All cultivars had small fruit except 'Marvel Stripped', 'Pixie Stripe' and 'Yellow Out Red In' which were medium to large.

Table 7. Heirloom tomato yield and fruit size for full season – Rutgers Agricultural Research and Extension Center, Bridgeton, New Jersey – 2003.

Variety	Total Harvest Days	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Marketable Fruit Wt. Oz.
Bicolor Cherry	68	1630	1473	158	90	0.48
Fruity Orange	68	1764	1394	370	79	0.18
Fruity Yellow	68	2142	1940	201	91	0.25
Chello	68	1871	1078	793	58	0.75
Lollipop	68	2564	2251	313	88	0.34
Pixie Stripe	47	2246	1623	623	72	2.68
Purple Smudge	58	3311	2944	367	89	1.13
Marvel Stripped	26	2606	958	1649	37	17.58
Yellow Out Red In	35	3432	2978	454	87	3.99
Marizol Magic	58	2727	1338	1390	49	1.34
Mean	**-----**	**2429**	**1798**	**632**	**-----**	**-----**

Table 8 summarizes the external fruit characteristics for all cultivars. Most of the cultivars were round with two 'Marvel Stripped' and 'Marizol Magic' being somewhat elongated. Only one cultivar had excellent overall external characteristics ('Pixie Stripe) while 'Yellow Out Red In' and Marizol Magic were fair. The 'Yellow Out Red In' is a storage type tomato which means it does not turn the red for at least a month. The fruit are green to an orange yellow which is not appealing. 'Pixie Stripe' and 'Marvel Stripped' had soft or very soft fruit. These would not be acceptable for shipping or roadside stands. Most of the cultivars would be acceptable for firmness. All cultivars had small to medium stem and blossom scars except 'Marvel Stripped' and 'Marizol Magic'. Some buyers look for the larger scars since they think that is the characteristic of heirloom tomatoes. External color varied among the cultivars. The fruit color is based for consumer preference. It some cases it is better to have a mixture of colors from which the consumers can select.

Table 8. Heirloom tomato external fruit characteristics - Rutgers Agricultural Research and Extension Center, Bridgeton, New Jersey – 2003.

Variety	Length (cm)	Width (cm)	L/W	Overall External	Shape	Firmness	Stem Scar	Blossom Scar	External Color
Bicolor Cherry	3.2	3.0	1.1	3	6	4	1	1	18
Fruity Orange	2.4	2.4	1.0	4	3	3	1	1	22/9
Fruity Yellow	2.7	2.6	1.0	4	3	3	1	1	4/7
Chello	3.2	3.5	0.9	3	3	4	2	1	21
Lollipop	2.7	2.7	1.0	4	3	4	1	1	3
Pixie Stripe	6.7	5.1	1.3	5	4	1	3	1	8
Purple Smudge	4.0	3.9	1.0	4	7	3	2	1	11
Marvel Stripped	9.9	7.2	1.4	4	2	2	5	4	12
Yellow Out Red In	---	---	---	2	3	5	4	3	2/6
Marizol Magic	6.6	4.7	1.4	2	2	5	3	5	18
Mean									

The internal fruit characteristics are summarized in table 9. Jelly color varied from red to a yellow/green with most being yellow/red to yellow. The cultivars with the small core were 'Fruity Orange', ' and Fruity Yellow'. 'Chello', 'Marvel Stripped'. 'Yellow Out Red In' and 'Marizol Magic had the largest core size. This may not affect consumer acceptance since they may equate a large core with heirloom tomatoes. Cracking will reduce the amount of marketable product. All cultivars had moderate to no cracking except 'Marvel Stripped' which was severe. All cultivars were average or above for internal appearance except 'Bicolor Cherry' and 'Marizol Magic' which had fair internal appearance.

Table 9. Heirloom tomato internal fruit characteristics – Rutgers Agricultural Research and Extension Center, Bridgeton, New Jersey – 2003.

Variety	Internal Color	Jelly Color	Core Size	Cracking	Overall Internal
Bicolor Cherry	2	4	3	5	2
Fruity Orange	9/3	3	1	5	4
Fruity Yellow	3/7	3	1	5	4
Chello	2	3	4	4	3
Lollipop	3	3	2	5	5
Pixie Stripe	8	1	4	5	3
Purple Smudge	1	2	2	5	4
Marvel Stripped	8	2	5	1	3
Yellow Out Red In	10	3	5	3	3
Marizol Magic	2	4	4	3	2
Mean					

Plant characteristics are summarized in table 10. Three cultivars had fair plant vigor, 'Chello', 'Pixie Stripe' and 'Yellow Out Red In'. All the cultivars could be grown on standard four/five foot tomato stakes except 'Bicolor Cherry' which needs a seven/eight foot stake. All the cultivars had small to medium vine size.

Table 10. Heirloom tomato plant characteristics – Rutgers Agricultural Research and Extension Center, Bridgeton, New Jersey – 2003.

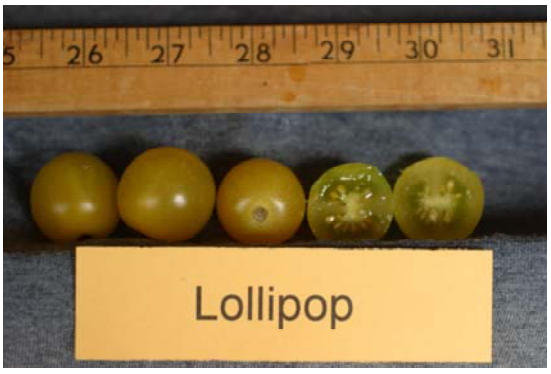
Variety	Plant Color	Plant Vigor	Avg. Plant Height (ft)	Leaf Type	Vine Size
Bicolor Cherry	2	5	7.83	1	4
Fruity Orange	1	4	6.83	2	2
Fruity Yellow	2	5	7.33	2	2
Chello	2	2	2.83	2	1
Lollipop	1	4	6.83	2	1
Pixie Stripe	1	2	4.00	3	4
Purple Smudge	2	3	6.17	1	3
Marvel Stripped	1	5	6.33	1	2
Yellow Out Red In	2	2	5.67	1	3
Marizol Magic	2	5	7.17	1	3
Mean					

Conclusion

Based on the yield data and fruit characteristics the best full season cultivars were 'Purple Smudge', 'Lollipop' and 'Fruity Yellow'. For early production, four cultivars 'Bicolor Cherry', 'Lollipop', Fruity Orange' and Pixie Stripe' should be evaluated. The cultivar 'Yellow Out Red In' would only have appeal as a novelty. It must be stored for at least a month for eating.

Appendix A.05

2003 NJ Heirloom Tomato Observation Trial Results




Pixie Stripe


Pixie Stripe


Purple Smudge


PURPLE SMUDGE


Marvel Stripped


Marvel Stripped


Yellow Out Red In


Yellow Out Red In