2003 NEW JERSEY HEIRLOOM TOMATO CULTIVAR 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. tomato 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

The trial was arranged in a randomized complete block design with three replications and five plants per 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

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fruit were randomly selected from marketable fruit to evaluate 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
Big Rainbow	Tomato Grower's Supply
Georgia Streak	Tomato Grower's Supply
Hawaiian Pineapple	Tomato Grower's Supply
Hill Billy	Tomato Grower's Supply
Mammouth German Gold	Tomato Grower's Supply
Marvel Stripe	Garden State Heirloom Seed Society
Marizol Gold	Tomato Grower's Supply
Mortgage Lifter Bicolor	Tomato Grower's Supply
Old German	Tomato Grower's Supply
Olympic Flame	Garden State Heirloom Seed Society
Regina Yellow	Garden State Heirloom Seed Society
Malinowski	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 and 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

Early season harvests (1-3) are summarized in Table 4. There were no statistical differences among the cultivars for total, marketable or cull yield; percentage marketable fruit or average fruit weight. Total yield varied between 1483 boxes/A for 'Hill Billy' to 1941 boxes/A for 'Regina Yellow'. 'Hill Billy' also had the lowest marketable yield at 736 boxes/A and 'Hawaiian Pineapple' the highest at 1309 boxes/A. Most cultivars had less than 60% marketable fruit which would make them unacceptable for at least the wholesale market. Fruit were considered marketable even if cracked as long as the crack was dry. All cultivars had large fruit except 'Malinowski' which was medium.

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

Variety	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Fruit Wt. Oz.
Big Rainbow	1582	940	642	60	12.2
Georgia Streak	1633	844	789	49	16.1
Hawaiian Pineapple	1576	1309	267	82	17.0
Hill Billy	1483	736	747	48	13.9
Mammouth German Gold	1810	1140	670	60	11.7
Marvel Stripe	1652	802	850	48	13.0
Marizol Gold	1550	825	725	55	11.3
Mortgage Lifter Bicolor	1628	1270	358	77	18.8
Old German	1943	1078	865	55	14.6
Olympic Flame	1719	1026	693	58	13.1
Regina Yellow	1941	1138	804	54	14.2
Malinowski	1497	1128	370	75	8.6
HSD 0.05	**NS**	**NS**	**NS**	**NS**	**NS**

Table 5 summarizes the mid season yield data (4-6). As with the early harvest period there were no statistical differences for yield among the cultivars. All cultivars had lower total and marketable yield and percent marketable fruit than during the early harvest period. Fruit size was also smaller for all cultivars when compared with the early harvest.

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

Variety	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Fruit Wt. Oz.
Big Rainbow	914	363	551	40	9.8
Georgia Streak	1026	429	597	43	12.8
Hawaiian Pineapple	616	295	321	48	12.0
Hill Billy	623	201	422	28	11.6
Mammouth German Gold	854	299	556	35	10.3
Marvel Stripe	1185	369	816	31	11.5
Marizol Gold	1002	358	643	32	8.1
Mortgage Lifter Bicolor	611	320	291	50	14.2
Old German	765	255	509	33	11.4
Olympic Flame	1084	342	742	29	13.9
Regina Yellow	659	309	350	44	11.4
Malinowski	1355	614	741	48	7.1
HSD 0.05	**NS**	**NS**	**NS**	**NS**	**NS**

Table 6 summarizes the yield and fruit size data for the late harvest period. Total and marketable cultivar yields were not statistically different among the entries and continued to decrease compared to earlier harvests. The cultivar 'Regina Yellow' did have a higher total yield in the late harvest period than the mid season harvest, but it was not statistically different from the other cultivars. 'Hawaiian Pineapple' had a statistically higher percentage (67%) marketable fruit than all other cultivars. As with the yield numbers fruit size continued to decrease.

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

Variety	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Fruit Wt. Oz.
Big Rainbow	676	98	578	15	8.6
Georgia Streak	666	45	621	7	4.0
Hawaiian Pineapple	331	203	128	67	10.8
Hill Billy	568	34	533	4	2.5
Mammouth German Gold	541	140	400	25	5.9
Marvel Stripe	722	52	670	7	6.4
Marizol Gold	552	122	430	23	7.6
Mortgage Lifter Bicolor	342	47	294	11	4.6
Old German	470	61	408	13	10.3
Olympic Flame	685	58	627	8	9.6
Regina Yellow	789	227	562	28	8.7
Malinowski	620	217	403	36	5.0
HSD 0.05	**NS**	**NS**	**521**	**30**	**NS**

Total season yield and fruit size data is summarized in Table 7. Total yields ranged from 2748 boxes/A for 'Hawaiian Pineapple' to 4352 boxes/A for 'Marvel Stripe'. There were no statistical differences among the cultivars for total or marketable yield. The cultivar 'Hill Billy had the lowest marketable yield at 1329 boxes/A and 'Malinowski' had the highest at 2162 boxes/A. There were differences among the cultivars as to percent marketable fruit. 'Hawaiian Pineapple' (67%) had the highest percent of marketable fruit and it was statistically different from all cultivars except 'Big Rainbow', 'Mammouth German Gold', 'Mortgage Lifter Bicolor', 'Regina Yellow' and 'Malinowski'. All other cultivars were not different from one another. Fruit size ranged from 6.9 ounces

for ‘Malinowski’ to 14.9 ounces for ‘Mortgage Lifter Bicolor’. As with all harvest periods the fruit size did not differ statistically.

Table 7. Large heirloom tomato yield and fruit size for all harvests. – Rutgers Agricultural Research and Extension Center, Bridgeton, New Jersey – 2003.

Variety	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Fruit Wt. Oz.
Big Rainbow	3840	1638	2202	44	10.4
Georgia Streak	3976	1591	2385	40	11.9
Hawaiian Pineapple	2748	1859	889	67	14.3
Hill Billy	3514	1329	2185	37	11.3
Mammouth German Gold	3840	1669	2171	43	9.7
Marvel Stripe	4352	1453	2898	33	10.9
Marizol Gold	3739	1535	2203	41	8.9
Mortgage Lifter Bicolor	3013	1786	1227	57	14.9
Old German	3762	1523	2239	41	12.5
Olympic Flame	4068	1604	2464	40	12.6
Regina Yellow	3897	1815	2082	46	11.1
Malinowski	4015	2162	1853	53	6.9
HSD 0.05	**NS**	**NS**	**1419**	**24**	**NS**

External fruit characteristics are summarized in Table 8. All the cultivars even thought listed as large fruit types in the seed catalogs are medium to large. ‘Mortgage Lifter Bicolor’ had the largest fruit measuring over 3 ½ inches. All the cultivars had a flattened globe shape except ‘Georgia Streak’ which tended to have a very deep round. Overall, external appearance was good to excellent except ‘Hawaiian Pineapple’ which rated poor. The cultivars with medium to very firm fruit included ‘Georgia Streak’, ‘Hawaiian Pineapple’, ‘Mammouth German Gold’, ‘Marizol Gold’, ‘Mortgage Lifter Bicolor’, ‘Regina Yellow’ and ‘Malinowski’. There were no statistical differences among the cultivars for firmness because of variability. The importance of firmness depends on the market and when the fruit is picked. Less firm fruit should be picked before completely ripe for longer shelf life. All cultivars had a medium/large to large stem scar except ‘Malinowski’. Stem scar are not as important as with non-heirloom cultivars. Some consumers will look for the large stem and blossom scars to assure they are purchasing heirloom tomatoes. Two cultivars (‘Bib Rainbow’ and ‘Malinowski’) had small to medium small blossom scars. All cultivars were bicolor (red gold, yellow red, orange yellow, gold red) except ‘Malinowski’ which was red.

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

Variety	Length (in)	Width (in)	L/W	Overall External	Shape	Firmness	Stem Scar	Blossom Scar	External Color
Big Rainbow	3.1	3.1	1.0	5	2	2.0	4.5	2.0	18
Georgia Streak	3.4	3.1	1.1	4	6	3.5	4.5	3.5	21
Hawaiian Pineapple	2.8	2.5	1.1	2	2	4.5	4.0	4.0	6
Hill Billy	3.4	3.3	1.0	3	2	2.5	4.5	3.5	18
Mammouth German Gold	3.2	3.1	1.0	3	2	3.0	3.5	3.5	18
Marvel Stripe	3.4	3.3	1.0	4	2	2.5	3.5	4.5	18
Marizol Gold	2.4	3.0	0.8	3	2	4.0	5.0	4.0	19
Mortgage Lifter Bicolor	3.6	3.7	1.0	4	2	3.0	5.0	3.0	19
Old German	3.2	3.2	1.0	3	2	2.5	4.0	3.0	19
Olympic Flame	3.2	3.2	1.0	3	2	2.0	4.5	3.5	18/19
Regina Yellow	3.3	3.3	1.0	3	2	3.5	5.0	4.0	19
Malinowski	2.3	2.3	1.0	5	2	4.0	2.0	1.0	9
HSD 0.05	**---**	**---**	**NS**	**2.5**	**1.7**	**NS**	**NS**	**NS**	**----**

Internal fruit characteristics are summarized in Table 9. Internal pulp color was a yellow/red or red/yellow for most cultivars. The exceptions were 'Hawaiian Pineapple' with a bright orange color and 'Malinowski' with a uniform red color. The same pattern followed for the jelly color. The orange color of the 'Hawaiian Pineapple' was very distinct and made for an attractive fruit. All the cultivars had moderate to abundant cracking except 'Hawaiian Pineapple' and 'Malinowski' which had slight cracking. As with stem and blossom scars, cracking may not be a problem for selling heirloom especially at a local market. Consumers may look for the cracks as a sign the cultivars are heirlooms. The overall rating for internal characteristics show that the cultivars would be acceptable for markets except possibly 'Mortgage Lifter Bicolor' which rated fair.

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
Big Rainbow	2	3	4.5	2.5	4.0
Georgia Streak	2	3	5.0	2.0	4.0
Hawaiian Pineapple	7	6	4.0	4.0	4.0
Hill Billy	2/6	3	5.0	2.5	3.0
Mammouth German Gold	2/6	3	5.0	2.0	2.5
Marvel Stripe	2	3	4.5	2.5	3.5
Marizol Gold	2	3	4.0	2.0	3.0
Mortgage Lifter Bicolor	2	3	5.0	2.0	2.0
Old German	2	3	4.5	3.0	3.0
Olympic Flame	2	3	4.5	2.0	2.5
Regina Yellow	2	3	5.0	2.5	5.0
Malinowski	1	2	5.0	4.0	3.0
HSD 0.05	**NS**	**2.5**	**NS**	**NS**	**NS**

Plant characteristics are summarized in Table 10. All cultivars had good to excellent plant vigor. The plant height ranged from 6.5 to 7.1 feet requiring the use of

tall stakes (7 or 8 foot) to grow these cultivars. Vine size relates to the plant height and plant vigor. Even those cultivars with a medium rating would be large to compared to commercial round cultivars.

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
Big Rainbow	1.7	4.3	7.0	1.3	3.0
Georgia Streak	1.3	3.6	6.9	1.3	3.7
Hawaiian Pineapple	2.3	3.6	7.1	1.0	2.7
Hill Billy	1.3	5.0	6.8	1.0	3.3
Mammouth German Gold	1.7	4.0	6.8	1.0	3.0
Marvel Stripe	1.0	4.0	6.8	1.0	3.3
Marizol Gold	1.3	3.3	6.8	1.0	3.3
Mortgage Lifter Bicolor	1.3	4.6	6.5	1.3	3.7
Old German	1.0	3.6	6.8	1.7	3.3
Olympic Flame	1.0	4.0	6.6	1.3	2.7
Regina Yellow	2.3	3.0	6.8	1.7	2.7
Malinowski	2.3	3.0	6.6	1.3	2.7
HSD 0.05	**NS**	**NS**	**NS**	**NS**	**NS**

Conclusion

Based on the marketable yield and fruit characteristics six cultivars ‘Georgia Streak’, ‘Hawaiian Pineapple’, ‘Marizol Gold’, ‘Mortgage Lifter Bicolor’, ‘Regina Yellow’ and ‘Malinowski’ should be evaluated further. The best of this group is ‘Hawaiian Pineapple’.


BIG RAINBOW


GEORGIA STREAK


HAWAIIAN PINEAPPLE


HILLBILLY


MANMOUTH GERMAN GOLD


MARVEL STRIPE


MARIZOL GOLD


MORTGAGE LIFTER BICOLOR


OLYMPIC FLAME


REGINA YELLOW


Malinowski


Malinowski