APPENDIX A.4

2002 NEW JERSEY CHERRY HEIRLOOM TOMATO OBSERVATION TRIAL RESULTS[1]

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INTRODUCTION

Heirloom tomatoes are an expanding niche in the produce industry. Growers are trying to determine which heirlooms consumers prefer, but there are several hundred possibilities. Yields, plant and fruit characteristics vary widely among the different varieties and heirlooms need special post harvest handling. The tomato program enhancement grant is evaluating heirloom tomatoes to help growers make determinations as to which varieties have acceptable horticultural characteristics for New Jersey conditions. This report is one of five from 2002.

MATERIALS AND METHODS

Culture

Seeds were sown on April 15 in 200 cell trays and transplanted into 48 cell trays. The media contained peat-vermiculite formulated for tomato transplant production at Snyder Research and Extension Farm on May 10. Plants were transferred to the Rutgers Agricultural Research and Extension Center (RAREC) and maintained in the greenhouse until one week before transplanting when they were placed in an outside protected area to harden off. Beds on 5-ft centers were formed and black plastic mulch with drip irrigation tube was laid. Plants were set in the field on May 26 by hand 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 rest of the strings (5 – 7) where placed at 8 – 12 inches apart.

Before bed making a pre-plant fertilizer was applied at 60-lbs/A nitrogen as calcium nitrate. All additional fertilizer was applied through the drip system four times during the growing season with Peters 20-20-20 at a rate of 62 lbs/A of nitrogen (N), phosphorus (P_2O_5), and potassium (K_2O) for three applications and 1 application at the rate of 30 lbs/A for total nutrients of 216 lbs/A of N, P_2O_5 and K_2O per mulched acre. A total of three-pounds boron was applied with the other nutrients through the drip system.

The herbicide *Napropamide* (Devrinol 50DF - 3 lbs/A) was applied broadcast prior to bedding. This was followed with *metolachlor* (Dual Magnum II - 1.9 oz/A) and *paraquat* (Gramoxone Extra - 0.25 pts/A) between the beds after the plastic was laid. Insects and diseases were controlled using Rutgers commercial recommendations for tomatoes. *Imidacloprid* (Admire - 3ml/flat) was applied as a drench to the seedling flats before transplanting in enough water to saturate the growing media without draining off. The following materials were applied to the

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foliage with an air blast sprayer: A*vermectin-B* (Agri-mek 0,15EC – 8 oz/A), *azoxystrobin* (Quadris - 6 oz/A) and *lambdacyhalothrin* (Warrior – 4 oz/A) – August 23 and *cyfluthrin* (Baythriod 2 – 2.8 oz/A) and *chlorothalonil* (Bravo Weather Stik – 3.0 pt/A) – August 27.

Overall the temperature throughout the growing season was warm and dry. With the monthly high average temperatures of 67, 76, 82, 87, 96, 80 and 64 degrees fahrenheit for months April, May, June, July, August, September and October, respectively. With the monthly low average temperatures of 45, 51, 62, 66, 66, 58 and 48 degrees fahrenheit for months April, May, June, July, August, September and October, respectively. The monthly rainfall (in inches) for April, May, June, July, August, September and October was; 3.32, 3.86, 6.10, 2.08, 2.96, 2.53 and 5.78, respectively for a season total of 26.63 inches. Tensiometers were placed in each replication at the 12-inch depth to schedule supplemental irrigation.

Experimental Design, Harvesting and Evaluation

The cultivars were arranged in a randomized complete block design with four plants per plot and two replications. Tomatoes were hand harvested on July 26, August 1, 9, 15, 24, 30, September 6, 12, 19, 25 and October 7. Fruits were graded into marketable and culls; both were counted and weighed. Culls were further divided by type of defect (blossom end rot, insect damage, green shoulder, cat facing, zipper, rot, small, misshapen; radial, concentric, and transversal cracks, sunburn, rain checking, and miscellaneous) and counted.

At the seventh harvest, five fruit were randomly selected from marketable fruit for each replication to evaluate internal and external fruit characteristics. Data was collected on vine vigor, fruit cover and plant height on October 25. Data were statistically analyzed using ANOVA and compared with Least Significant Difference (LSD) Test at the 5% level. 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

Cultivar	Source
Anna Aasa	Marianna's Heirloom
Isis Candy	Tomato Grower's Seed Co.
Red Pear	The Cook's Garden
Snow White	Territorial Seed Co.
Yellow Pear	Shepherd's Garden Seeds

Table 2 Fruit Characteristics Key

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

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

Firmness:
1- Firm
2- Medium / Firm
3- Medium
4- Medium / Soft
5- Soft

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

Stem Scar:
1- Small
2- Small / Medium
3- Medium
4- Medium / Large
5- Large

External Color (cont):
13- Purple
14- Black
15- Mahogany
16- Red Mahogany
17- Orange Mahogany

Internal Flesh Color:
1- Red
2- Yellow / Red
3- Yellow
4- Yellow / Green
5- Green

Jelly Color:
1- Red
2- Yellow / Red
3- Yellow
4- Yellow / Green
5- Green

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

Overall External:
1- Excellent
2- Very Good
3- Good / Average
4- Fair
5- Poor

Overall Internal:
1- Excellent
2- Very Good
3- Good / Average
4- Fair
5- Poor

Table 3. Field Observations Key

Plant Color:
1- Dark Green
2- Green
3- Light Green

Stem Attachment:
1- Jointed
2- Jointless

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

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

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

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

RESULTS AND DISCUSSION

Table 4 contains yield results from the early harvest (1,2 and 3). All the cherry cultivars were ready to harvest in 61 days from transplanting. There were no statistical differences among the cultivars for total yield, marketable yield or percent marketable fruit. Weight per fruit varied between 0.2 and 0.8 ounces with Isis Candy having the largest fruit, which was significantly larger than all the other cultivars.

Cull fruit yield was low, but there were statistically more culls for 'Anna Aasa' than any of the other cultivars. When culls were separated by type (data not shown) there only were statistical differences for radial cracking. 'Anna Aasa' had more cracking than the other cultivars.

Table 4. Cherry heirloom yield and fruit size for first, second, and third harvest (early) – RAREC Bridgeton, NJ - 2002.

Cultivar	Days to Harvest	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Marketable Fruit Wt. Oz.
Anna Aasa	61	167	156	11	94	0.2
Isis Candy	61	100	100	0	100	0.8
Red Pear	61	187	185	2	99	0.4
Snow White	61	144	138	7	96	0.4
Yellow Pear	61	196	194	1	100	0.4
LSD 0.05	**---------**	**123**	**121**	**8**	**5**	**0.2**

Table 5 summarizes the yield and fruit size data for mid season harvest (4, 5, 6 and 7). 'Anna Aasa' had the highest total and marketable yield, but was not statistically different from 'Red Pear' and 'Snow White'. 'Isis Candy' had the lowest total and marketable yield, but was not significantly different from 'Yellow Pear' for total yield or all cultivars for marketable yield except 'Anna Aasa'. The percent marketable fruit varied between 89 and 99% and were not significantly different. As with the early harvest 'Anna Aasa' had smaller size fruit than the other cultivars.

The cultivar 'Snow White' had the most cull fruit, but was not statistically different from 'Yellow Pear' or 'Red Pear'. 'Anna Aasa', 'Isis Candy' and 'Red Pear' had the lowest cull fruit and were not statistically different. When the cull numbers were analyzed (data not shown) there were only statistical differences for zippering. This may be just a cosmetic effect, but all fruit with zippers were considered culls for this trial. 'Snow White' had significantly more zippered fruit than any other cultivar. The other cultivars were not different from each other.

Table 5. Cherry Heirloom yield and fruit size for mid season harvests – RAREC, Bridgeton, New Jersey – 2002.

Cultivar	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Marketable Fruit Wt. Oz.
Anna Aasa	1361	1348	13	99	0.1
Isis Candy	353	323	30	93	0.4
Red Pear	954	903	52	95	0.3
Snow White	990	898	93	91	0.3
Yellow Pear	789	707	83	89	0.3
LSD 0.05	**571**	**606**	**54**	**10**	**0.1**

Results for the last season harvests (8, 9, 10 and 11) are presented in table 6. There were no statistical differences among the cultivars for total or marketable yield. 'Anna Aasa' and 'Red Pear' produced more cull fruit than 'Snow White', but were not statistically different from the other cultivars. When the culls were separated by type (data not shown) only with rain checked fruit were there statistical differences. 'Snow White' had statistically more checked fruit than 'Anna Aasa' had and it had more than all the other cultivars. With percent marketable fruit, the cultivar 'Snow White' had the lowest percentage of marketable fruit, but it was only significantly lower than 'Red Pear'. As with the other two harvest periods, 'Anna Aasa' had the smallest fruit size and was statistically smaller than 'Isis Candy' and 'Yellow Pear'.

Table 6. Cherry Heirloom yield and fruit size for late season harvests – RAREC, Bridgeton, New Jersey – 2002.

Cultivar	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Marketable Fruit Wt. Oz.
Anna Aasa	623	590	42	93	0.1
Isis Candy	1069	969	100	91	0.4
Red Pear	1023	981	42	96	0.2
Snow White	1416	1245	171	88	0.2
Yellow Pear	1367	1269	98	93	0.3
LSD 0.05	**857**	**783**	**90**	**6**	**0.1**

Table 7 summarizes the yield components and fruit size for all harvests. All cultivars were harvested for 74 days and could have been harvested longer except for a frost, which ended the season. There were no statistical differences among the cultivars for total or marketable yield. The percent marketable fruit varied from 89 to 97% with 'Anna Aasa', 'Red Pear' and 'Yellow Pear' having statistically equal percentage. The other two cultivars were not different from one another. Fruit size varied from 0.1 to 0.4 ounces. The largest size was 'Isis Candy' which was statistically equal to 'Red Pear' and 'Yellow Pear'. 'Anna Aasa' and Snow White had the smallest size fruit.

'Snow White' had the largest amount of cull fruit among the cultivars and it was statistically different from all other cultivars. 'Anna Aasa' had the fewest culls, but did not different statistically from 'Isis Candy' or 'Red Pear'. When culls were analyzed (data not shown) 'Snow White' had significantly more radial cracks than the other cultivars. Among the other cultivars only 'Anna Aasa' and 'Isis Candy were different from the others with 'Isis Candy' having the fewest cracks. 'Snow White' had statistically more zippered fruit than the other cultivars. There were no statistical differences among the cultivars for blossom end rot, insect damage, green shoulders, rots, small fruit, misshapen fruit, concentric cracks, transversal cracks, sunburn or rain checking.

Table 7. Cherry Heirloom yield and fruit size for total seasonal harvests – RAREC, Bridgeton, New Jersey – 2002.

Cultivar	Total Harvest Days	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Marketable Fruit Wt. Oz.
Anna Aasa	74	2158	2093	65	97	0.1
Isis Candy	74	1520	1391	130	92	0.4
Red Pear	74	2164	2068	96	97	0.3
Snow White	74	2550	2281	270	89	0.2
Yellow Pear	74	2352	2170	182	93	0.3
LSD 0.05	**-------**	**1254**	**1216**	**80**	**4**	**0.1**

Table 8 summarizes the fruit characteristics collected from five marketable fruit from each replication at the seventh harvest. All cultivars were round except the 'red and yellow Pear', which were Pear shaped. This is reflected in the length/width ratio where three of the cultivars 'Anna Aasa', 'Isis Candy' and 'Snow White' had ratios of 1.0 – 1.1 indicating round fruit and the other two higher numbers, which indicates elongated fruit. All five cultivars had a distinct color. 'Isis Candy' was pink to yellow pink depending on the maturity of the fruit. It also had a small yellow cross on the blossom end. 'Snow White' was more of a light or pale yellow than White. All the cultivars would be acceptable for firmness, blossom scar, stem scar, overall external and internal characteristics for the wholesale market. Jelly and internal flesh color ranged from red to yellow/green with most being red to yellow. 'Isis Candy' did have a yellow/green jelly color, but it was not an objectionable color. All cultivars had a medium or smaller core, which again did not detract from the fruit.

Table 8. Cherry Heirloom fruit characteristics for the seventh harvest – RAREC, Bridgeton, New Jersey – 2002.

Cultivar	Length (in) [1]	Width (in) [1]	L/W[1]	Shape[2]	Ext. Color[2]	Firmness[3]	Stem Scar[4]	Blossom Scar [4]	Overall Ext.[5]	Overall Int. [5]	Jelly Color[6]	Intern. Flesh[6]	Core Size[4]
Anna Aasa	0.7	0.7	1.0	3	9	1	1	1	1	1	2	1	1
Isis Candy	1.1	1.1	1.0	3	11	3	1	1	1	2	4	2	3
Red Pear	1.3	1.0	1.3	7	8	2	1	1	1	2	2	2	3
Snow White	1.0	0.9	1.1	3	3	2	1	1	1	1	3	1	2
Yellow Pear	1.5	0.9	1.6	7	4	3	1	1	1	1	3	1	3
LSD 0.05	**0.1**	**0.2**	**0.3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

[1]-Mean of 5 fruit; [2] – see table 2; [3] – 1=firm, 5=soft; [4] – 1=small, 5=large; [5] – 1=excellent, 5=poor; [6] – 1=red, 5 =green

The plant characteristics for the five cherry heirloom cultivars are summarized in table 9. All the cultivars had green to dark green foliage, very good to excellent plant vigor, a regular narrow tomato leaf, and medium large to large growth habit. The cultivars were very tall which required eight-foot stakes and even then, most grew over top the stakes. Only 'Red Pear' was jointless for stem attachment.

Table 9. Cherry heirloom tomato plant characteristics – RAREC, Bridgeton, New Jersey – 2002.

Cultivar	Plant Color [1]	Plant Vigor [2]	Avg. Plant Height (ft)[3]	Fruit Cover[2]	Leaf Type [4]	Vine Size[5]	Stem Attachment[6]
Anna Aasa	1	1	7.5	4	2	5	1
Isis Candy	2	1	8.4	3	2	5	1
Red Pear	1	1	7.6	2	2	5	2
Snow White	2	2	6.9	3	2	4	1
Yellow Pear	1	1	7.8	3	2	5	1
LSD	-	-	0.8	-	-	-	-

[1] – 1=dark green, 3=light green; [2] – 1=excellent, 5=poor; [3] – mean two plants; [4] – 1=regular, 5=potato; [5] – 1=small, 5=large; [6] – 1=jointed, 2=jointless

SUMMARY

All five cultivars would be acceptable for the wholesale or retail market depending on the consumer. They have distinct colors and shapes for different occasions. 'Anna Aasa would be difficult for growers to harvest and make a profit based on fruit size and the time it takes to harvest. 'Isis Candy' was the most unusual cultivar in this group.

NOTES