

Specialty Tomato Cultivar Trial for Indiana, 2001

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Colorful tomato salads are a seasonal menu item for some restaurants. The many colors of tomato fruit available include orange, green, white, yellow and, of course, red. Producers growing for this market have a choice of several cultivars of each color, and sometimes several fruit shapes within a color. Many of the cultivars are open-pollinated but some hybrids are available. Prior experience at Rhoads Farm and elsewhere has shown that many open-pollinated cultivars yield poorly under Indiana conditions, making them an unprofitable crop. The trials presented in this report were established to evaluate tomato cultivars for the restaurant salad market.

Materials and Methods

Sixteen cultivars were chosen for inclusion in the trial based on prior experience at Rhoads Farm and published reports (Table 1). Red, yellow, orange, green and white fruit colors were each represented by at least two cultivars. When promising open-pollinated and hybrid cultivars for a particular fruit color had been identified from prior experience, a point was made to include both in the trial. Four roma types were included because the long shape is easy to slice and so is preferred by some restaurants.

Replicated trials were conducted at the Pinney-Purdue Agricultural Center in Wanatah, Indiana, and at Rhoads Farm in Nashville, Indiana. In both locations the experiment followed a randomized complete block design with three replications.

At Nashville, trials were conducted in a hoop-style, unheated, 22' x 100' greenhouse and in the field. The greenhouse trial was conducted on a Berks channery silt loam soil. Transplants were started in a different greenhouse and transplanted to the trials greenhouse the week of April 23. This was two weeks later than typical due to some transplant problems. The trial was planted on 3-ft. rows with drip irrigation. Cultivar plots consisted of 6 plants spaced 2.5 ft. apart in the rows (5808 plants/A). In some cases 6 plants were not available due to poor seedling emergence and so fewer plants were used. Plants were supported with twine suspended from the greenhouse framing. Each plant received one cup of an organic fertilizer blend incorporated into the soil at transplanting. The fertilizer blend consisted of 50 lb. Fertell 5-1-1, 50 lb. crab meal (5-2-5), 50 lb. 2-4-2 fertilizer and 40 lb. gypsum. Rotenone was applied once in early May for what was thought to be an aphid infestation but was later diagnosed as mites. The mites on the lower leaves did considerable leaf damage. No fungicides were applied. Weeds were controlled by hand-weeding. Harvest began on July 16 and continued until Sept. 3, when the plants were removed to make room for a fall salad greens planting. In the second week of blossom set the greenhouse was inadvertently not ventilated one afternoon, killing all blooms that had not set fruit. We believe this had an impact on early harvests. Torrential rains experienced throughout the season caused excessive moisture in portions of the greenhouse.

The field trials at Nashville were conducted on a Beanblossum channery silt loam, which has deeper topsoil, but is not as well drained as the Berks soil of the greenhouse trials. All factors were similar to the greenhouse trials except the Florida stake and weave method of support was used and black landscaping cloth was used for weed control. Seedlings were transplanted to the field the week of May 21, two weeks later than typical due to heavy rainfall. No pesticide or fungicide sprays were applied. First harvest was July 31 and last harvest was August 30. Torrential rains caused excessive soil moisture for much of the season.

At Wanatah trials were conducted on a Tracy sandy loam soil. Prior to planting 120 lb./A N from urea and 170 lb./A K₂O from 0-0-60 were applied and incorporated. Transplants were seeded in the greenhouse on April 17 and transplanted to the field on May 30. Wet weather delayed transplanting

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and seedlings were overgrown and leggy. Transplant starter solution supplied 1.2 lb./A N, 5.9 lb./A P₂O₅, and 2.0 lb./A K₂O from 9-45-15 (1.5 lb. in 50 gal. water). The trial was planted on beds centered 5 ft. apart and covered with black plastic. Cultivar plots consisted of 8 plants spaced 2 ft. apart in the rows (4356 plants/A). Plants were supported using a trellis-weave system. Irrigation was applied as needed through drip tape beneath the plastic mulch. Weeds were controlled by the plastic mulch, Sencor 4F applied between plastic at 0.5 pt./A June 11 and hand-weeding. Diseases were managed with applications of Quadris, 5 oz./A on July 6 and Aug. 14; Bravo Weather Stik, 2 pt./A, on July 18 and Aug. 3; and Kocide, 2 pt./A, on July 18, 27, Aug. 3 and 20. Bacterial spot was the primary disease present and affected all cultivars. Tomato fruitworms were managed with applications of Dipel (1 lb./A) on Aug. 3 and 20. Harvest began on Aug. 10 and continued until Sept. 11. One replication only was also harvested on Oct. 6.

At both locations harvested fruit were graded into marketable (generally equivalent to U.S. No. 1 and No. 2) and cull fruit and weight in each category determined. The minimum diameter for marketable fruit of non-roma varieties was 1.5 in. At Wanatah the following data were also collected: number of marketable fruit; number and weight of No. 1 and No. 2 fruit (for 8/30 harvest only); length and width of four to twenty fruit (one harvest only). For the Oct. 6 harvest at Wanatah fruit were not graded and only total weight was recorded. Plant height was measured and ratings of plant vigor were made once during the season in each trial. Ratings were on a scale of 1 to 9, with 1 being least vigorous and 9 being most vigorous. At Nashville observations on fruit color and quality ratings were recorded for both trials.

The number of plants harvested differed among plots because of plant death during the season and because some cultivars had poor emergence and there were not enough seedlings to fill the plot. For this reason yields were converted to pounds and number of fruit per plant prior to analysis. Early marketable yield (through Aug. 6 in Nashville and Aug. 28 in Wanatah) was determined and the percentage of total yield calculated. Yield of culls was converted to a percentage of total yield. For Wanatah, average weight, length, and width per marketable fruit was calculated. Data from the three trials were analyzed separately using ANOVA following transformation of dependent variables as necessary to stabilize variances. In the field at Nashville Persimmon plants did not survive to produce fruit and the cultivar labeled Lemon Boy was not Lemon Boy, so those cultivars were not included in analysis for that trial. For some measurements variances could not be stabilized by transformation due to 0 values, and so one or two cultivars were omitted from analysis for those measurements only. Comparisons of interest were tested for statistical significance using linear contrasts. Untransformed means are presented.

Results and Discussion

The cultivar Elberta Peach included plants that varied in size from 4 ft. to over 6 ft. at Wanatah, varied in the hairiness of foliage, and produced fruit ranging in size from a large cherry tomato to a small beefsteak and in color from red with orange-yellow stripes to solid red. Because of this variability, the cultivar was omitted from analyses and no data for it are presented. The cultivar Goliath was acquired from Tomato Growers Supply (TGS) for the Wanatah trial and from Totally Tomatoes (TT) for the Nashville trials. The line from TGS was reported to be an open-pollinated heirloom and the line from TT a hybrid. Field observations also suggested that these were two different varieties: the line from TGS produced large, flat, pinkish, and often cat-faced fruit while the line from TT produced rounder fruit more red in color. Both lines were included in analysis, the one from TGS as an open-pollinated type and the one from TT as a hybrid. The fruit color and size of one other cultivar, Persimmon, led to questions about its identity. In these trials, Persimmon produced a red or pale-orange fruit, while in prior years at Nashville the variety had produced orange fruit. Persimmon was also noted for having poor emergence. These problems emphasize the importance of identifying seed sources that reliably provide high quality seed producing plants true to type for named cultivars.

Results for Nashville are reported in Table 2 and for Wanatah in Table 3. Marketable yield ranged from 0.9 to 6.6 lb. per plant in the field at Nashville (NF), from 1.4 to 11 lb. per plant in the greenhouse at Nashville (NGH), and from 1.8 to 18 lb. per plant at Wanatah (W). The top four producers included

Big Beef and Super Marzano in all three trials; Banana Legs at W and NF, Lemon Boy and Goliath TT at NGH, Carolina Gold at W, and Italian Gold at NF. On average hybrid cultivars outyielded open-pollinated cultivars in all three trials, producing 1.8 times more at NF, 2.3 times more at NGH, and 1.7 times more at W.

Cultivars among the top four for early yield (fruit harvest by Aug. 6 at Nashville and Aug. 28 at W) included Big Beef in all three trials, Tangella and Lemon Boy at NGH and W, Banana Legs at NF and W, Goliath TT and Super Marzano at NGH, and Carolina Gold and Green Zebra at NF. Hybrids produced nearly twice the early yield of open-pollinated cultivars at W, but there was no difference at NGH or NF.

Big Beef produced the greatest total yield in all three trials. Other cultivars among the top four included Lemon Boy at NGH and W, Banana Legs at NF and W, Super Marzano at NGH and NF, Italian Gold at NF, Carolina Gold at W, and Goliath TT at NGH. Hybrids averaged 14% greater yield than open-pollinated cultivars at W, 1.7 times greater at NF, and more than 2 times greater at NGH.

Fruit quality varied among cultivars, as indicated by the percentage of total yield in the cull category. This percentage ranged from 0% to 41% at NGH, 29% to 58% at NF, and 7% to 85% at W. At all three locations Italian Gold was among the four cultivars with the lowest percentage of culls. Other cultivars in this group included San Marzano at W and NGH, Banana Legs at W and NF, Orange Banana at W, Big Beef and Dorothy's Green at NF, and Green Zebra and Carolina Gold at NGH. On average, a smaller percentage of total yield was culled for hybrids than for open-pollinated cultivars at W and NGH (15% vs. 44% and 6% vs. 21%, respectively). At NF similar percentages of total yield were culled for open-pollinated and hybrid cultivars.

A second indication of fruit quality is the percentage of marketable fruit classified as U.S. No. 2 on Aug. 30 at W. Using this measurement, Orange Banana, Italian Gold, Persimmon and Super Marzano were the four cultivars with the highest fruit quality. With the exception of Persimmon, these cultivars were also among those with the lowest percentage of culls in total yield.

Average weight per marketable fruit at W ranged from 0.10 lb. for Tangella to 0.90 lb. for Great White. Because several fruit types, from beefsteak, to large cherry, to roma, were included in the trial, comparison of the average fruit size of hybrids with the average fruit size for open-pollinated cultivars is not of much interest.

Part of the purpose of this project was to compare cultivars of similar fruit color and when possible, shape, to determine the best mix of cultivars to grow for a restaurant salad market, based on yield and quality considerations. A summary of these comparisons follows.

Among the green-fruited cultivars, the hybrid Granny Smith produced 1.5 to 4 times greater marketable yield than the open-pollinated cultivars at W and NGH, respectively but there was no difference at NF. Total yield was 30% less for the hybrid at W, 4 times greater for the hybrid at NGH, but showed no difference at NF. The open-pollinated cultivars had a higher percentage of culls than the hybrid at NGH and W, but not at NF. Despite the greater marketable yield of Granny Smith in two of the trials, this cultivar was judged to be unsatisfactory because it was extremely firm, did not soften, and seemed to maintain the flavor of an unripe tomato even after color change. The two open-pollinated cultivars produced similar marketable, early, and total yields in both trials at Nashville, but at W Green Zebra produced 3 times greater marketable yield than Dorothy's Green. The poorer performance of Dorothy's Green at W was due to a high percentage of culls (85%) at that location which was not the case at Nashville. Many of the Dorothy's Green fruit at W were culled due to catfacing. Of the three green cultivars, Green Zebra was the most promising for sales to restaurants for use in tomato salads. Although it yielded relatively poorly compared to many of the other cultivars, the distinctive color of light green ripening to orange overlaid with dark green stripes, the juiciness, and the tart tomato flavor make it an important addition to a salad mix.

Two yellow cultivars were tested: the hybrid Lemon Boy and the open-pollinated roma Banana Legs. With one exception, they produced statistically similar marketable, early, and total yields at NGH and W. The exception was that at W, marketable yield of Banana Legs was about 17% greater. At W, Banana Legs also produced a smaller percentage of culls than Lemon Boy. Lemon Boy was not included in the field trial at Nashville. The quality of Banana Legs was judged to be somewhat less than in previous years at Rhoads Farm, when it produced a better-tasting, blockier fruit with fewer cracks and more uniform yellow color. Both of these cultivars were promising for the restaurant salad market. In addition to being among the most productive cultivars in the trials, the roma shape of Banana Legs is desirable because it is easy to slice, and customers know and ask for the cultivar by name. The color, shape, smooth skin and flavor of Lemon Boy make it attractive for uses where a round tomato is desired.

The white-fruited cultivars White Queen and Great White are both open-pollinated. At W, White Queen produced about 80% greater marketable yield than Great White, but there were no differences in early or total yield at W, and no significant differences at all in the Nashville trials. Great White had a greater percentage of cull fruit at W, which explains its lower marketable yield. Many fruit were culled due to catfacing or cracking. Severe catfacing was especially a problem in Great White. Both cultivars were difficult to pick because they were jointless and the calyx did not separate easily from the fruit. Especially with Great White, if the calyx was torn from the fruit, an open wound was created. Both cultivars were very soft and tender when ripe and cracked easily. Of these two cultivars, White Queen appears to be the better choice if only one white cultivar is grown. There is certainly room for a better-performing tomato cultivar with white fruit.

Red-fruited beefsteak cultivars included the hybrids Big Beef and Goliath TT, and the open-pollinated Goliath TGS. At W, Big Beef produced 4 times the marketable yield of Goliath TGS, 9 times the early marketable yield, and 1.7 times the total yield. Goliath TGS performed poorly in large part because many of the fruit were catfaced, leading to a high percentage of total yield that was culled (69%). At Nashville, no significant differences in yield were found in the greenhouse, but in the field Big Beef produced 2.6 times greater marketable yield, 3.6 times greater early yield, and twice the total yield of Goliath TT. Of these cultivars, Big Beef appears to be the most widely adapted. Fruit were uniformly red, smooth-skinned, and attractive. The hybrid Goliath from TT also performed well in the greenhouse, and would be recommended if a second red-fruited cultivar more suited for slicing were desired. The open-pollinated Goliath TGS produced large, soft, pinkish fruit. It would not be recommended for the restaurant salad tomato market.

Super Marzano, an indeterminate hybrid, was the only red roma cultivar in the trial. As discussed above, it was among the highest yielding cultivars in all three trials. It was easy to harvest because fruit practically falls off as it begins to ripen. The color ranges from orange red to red, providing a subtle mix of color with one cultivar. It would be recommended when a red roma is desired.

Four orange-fruited cultivars were evaluated. Two were romas: the hybrid Italian Gold and the open-pollinated cultivar Orange Banana. Marketable yield was significantly greater for Italian Gold only at NF, although a similar trend was observed in the other trials. At W, Italian Gold produced nearly 6 times the early yield of Orange Banana, but at Nashville early yield did not differ between the cultivars. Total yield did not differ significantly for the two cultivars in any trial, although Italian Gold consistently produced greater yield. At W, Italian Gold had a lower percentage of cull fruit. Italian Gold appears to be a slightly better-yielding cultivar, and could be recommended on that basis. Other factors to consider would include the color of the fruit—Italian Gold is yellow-orange and Orange Banana is salmony-orange; the growth habit—Italian Gold is determinate and Orange Banana is indeterminate; eating quality—informal taste evaluations suggested that Orange Banana has better flavor; and earliness—Italian Gold produced fruit much earlier at one site, while Orange Banana yield increased later in the season.

The two other orange cultivars were Carolina Gold, a determinate hybrid producing yellow-orange beefsteak fruit; and Tangella, an indeterminate open-pollinated cultivar producing small orange fruit the

size of a very large cherry tomato. Carolina Gold produced twice the marketable yield of Tangella at W, but at Nashville no significant differences were found. Early yield of Tangella was 2 and 4 times that of Carolina Gold at W and NGH, respectively. At NGH and W Tangella produced a greater percentage of cull fruit. Many of the Tangella culls had split skins. Later in the season Tangella fruit often developed small, 1/16-inch breaks in the skin causing a spotted appearance on the fruit. No disease was associated with these splits. Despite the lower yield of Tangella, both of these cultivars would likely have a place in the restaurant salad market. The earliness of Tangella, together with its true orange color, small size, and excellent flavor help it to claim a special niche for growers and chefs who can properly handle the juicy and delicate-skinned fruit. Carolina Gold does not require the special handling and would fit well where a yellow-orange, round tomato is desired. There is also currently an established market for the yellow-orange beefsteak in standard grocery stores.

The cultivar Persimmon was chosen because it produced high quality orange fruit at Rhoads Farm in previous years, but in these trials it produced pale orange/pink to red fruit. Compared to the cultivar Big Beef, Persimmon produced less marketable yield and was not as early. The color of Persimmon was less intense and clear than of Big Beef, making it less attractive.

These trials have provided an initial evaluation of specialty tomato cultivars for the restaurant salad market. Out of sixteen cultivars tested, we have identified eleven that could be recommended for this use, and Rhoads Farm has identified seven or eight that provide a mix suitable for their particular markets.

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Table 1. Fruit and plant characteristics of tomato cultivars in trials at Wanatah and Nashville, Indiana, 2001.

Cultivar	Genetics	Plant Type	Fruit Type	Fruit Color
<i>Red Fruit</i>				
Big Beef	Hybrid	Indeterminate	Beefsteak	Red
Goliath (TT)	Hybrid	Indeterminate	Beefsteak	Pale red to Red
Goliath (TGS)	Open-pollinated	Indeterminate	Beefsteak	Pinkish red
Super Marzano	Hybrid	Indeterminate	Roma	Red, Orange-red
Persimmon	Open-pollinated	Indeterminate	Beefsteak	Pale orange to Red
Elberta Peach	Open-pollinated	Indeterminate	Globe	Red, Red-orange, Red with yellow stripes
<i>Yellow Fruit</i>				
Lemon Boy	Hybrid	Indeterminate	Globe	Pale yellow
Banana Legs	Open-pollinated	Determinate	Roma	Pale yellow, some with green shoulders or pale green stripes prior to full ripeness
<i>Orange Fruit</i>				
Carolina Gold	Hybrid	Determinate	Beefsteak	Yellow-orange
Tangella	Open-pollinated	Indeterminate	Small globe	Orange
Italian Gold	Hybrid	Determinate	Roma	Yellow-orange
Orange Banana	Open-pollinated	Indeterminate	Roma	Salmon-orange
<i>Green Fruit</i>				
Granny Smith	Hybrid	Determinate	Beefsteak	Yellow-green
Green Zebra	Open-pollinated	Indeterminate	Globe	Light green turning to yellow with dark green stripes
Dorothy's Green	Open-pollinated	Indeterminate	Globe	Green turning gold
<i>White Fruit</i>				
Great White	Open-pollinated	Indeterminate	Beefsteak	Ivory
White Queen	Open-pollinated	Indeterminate	Beefsteak	Ivory

Table 2. Yield of tomato cultivars grown in an unheated greenhouse and in the field, Rhoads Farm, Nashville, Indiana, 2001.

Cultivar	Co.	Greenhouse					Field				
		Marketable Fruit			All Fruit		Marketable Fruit			All Fruit	
		Yield per Plant (lb.)	Early Yield per Plant (7-16 to 8-6) (lb.)#	(%by Wt.)#	Total Yield per Plant (lb.)	% Culls (% by wt.)#	Yield per Plant (lb.)#	Early Yield per Plant (7-16 to 8-6) (lb.)	(%by Wt.)	Total Yield per Plant (lb.)	% Culls (% by wt.)
Dorothy's Green	TGS	1.4	0.8	74	1.8	41	2.3	0.3	14	3.8	34
Banana Legs	TGS	6.1	0.7	13	6.6	7	4.6	0.9	13	6.2	27
Goliath	TT	8.6	2.4	22	9.6	9	2.5	0.5	14	4.5	38
Persimmon	TGS	2.5	0.2	9	3.4	28					
Great White	TGS	3.0	0.6	17	3.9	28	1.7	0.3	11	2.9	38
Tangella	TGS	4.0	1.9	61	4.9	22	2.4	0.4	15	4.0	39
White Queen	TGS	5.0	0.8	17	5.5	10	0.6	0##	0##	2.1	70
Orange Banana	TGS	3.3	0.3	12	3.6	9	1.7	0.3	15	3.4	48
Green Zebra	JS/TGS	1.7	0.8	31	1.7	0##	1.4	0.7	55	1.9	29
Big Beef	JS	11.0	1.7	15	12.5	12	6.6	1.8	25	9.8	34
Italian Gold	ST	5.1	0.1	2	5.2	2	4.8	0.4	8	7.1	31
Lemon Boy	TGS	8.6	1.4	16	9.1	5					
Granny Smith	TT	6.4	0.7	12	6.8	6	1.8	0##	0##	3.8	41
Carolina Gold	RU	5.5	0.4	8	5.7	2	2.2	0.6	21	5.8	62
Super Marzano	TGS	9.8	1.4	12	10.1	3	3.7	0.3	8	7.2	48
Grand Mean		5.5	0.9	21	6.0	13	****	ns	ns	4.8	41
LSD .05###		3.7	ns	**	4.0	**				4.0	ns
Contrasts											
Hybrids		7.9	1.2	12	8.4	6	3.6	0.7	15	6.4	42
Open pollinated		3.4	0.8	29	3.9	21	2.1	0.5	21	3.5	41
Significance+		****	ns	**	****	****	****	ns	ns	***	ns
Green Hybrid (Granny Smith)		6.4	0.7	12	6.8	6	1.8			3.8	41
Green Open Pollinated		1.5	0.8	52	1.7	41	1.8			2.8	31
Significance+		**	ns	**	**	**	ns	-	-	ns	ns
Green Zebra vs. Dorothy's Green		ns	ns	**	ns	-	ns	ns	**	ns	ns
Lemon Boy vs. Banana Legs		ns	ns	ns	ns	ns	-	-	-	-	-
White Queen vs. Great White		ns	ns	ns	ns	ns	**	-	-	ns	*
Big Beef vs. Goliath		ns	ns	ns	ns	ns	**	*	ns	*	ns
Italian Gold vs. Orange Banana		ns	ns	ns	ns	ns	**	ns	ns	ns	ns
Carolina Gold vs. Tangella		ns	*	**	ns	**	ns	ns	ns	ns	ns

#For these measurements weight data were log-transformed and percentage data squareroot-transformed prior to analysis; untransformed means are presented.

##Cultivar not included in analysis for this measurement.

###Fisher's protected least significant difference, p=.05. ns=no significant cultivar effect. For analyses of transformed data, overall significance of cultivar effect is indicated.

+ns, *, **, **** and ***** indicate non-significance, and p<.05, .01, .001 and .0001 respectively.

Table 3. Yield and fruit size of fifteen tomato cultivars, Pinney Purdue Ag Center, Wanatah, Indiana, 2001.

Cultivar	Co.	Marketable Fruit										All Fruit	
		Average					Final Harvest					Yield per Plant	% Culls (% by wt.)#
		Yield per Plant	Wt. per Fruit	Fruit Length	Fruit Width#	% No. 2 on 8/30	Early Yield per Plant (8-10 to 8-28)	Yield per Plant	Weight (lb.)#	Harvest (Rep 1 only)			
Number#	Weight (lb.)	(lb.)	(in.)		Number#	Weight (lb.)#	(%by Wt.)	Weight (lb.)	(% by wt.)#				
Dorothy's Green##	TGS	4	1.8	0.47	2.1	3.3	59	0.5	0.2	11	12.1	85	3.0
Banana Legs	TGS	154	18.0	0.12	3.2	1.5	19	27.8	3.6	20	19.3	7	3.3
Goliath	TGS	5	3.8	0.79	2.5	3.8	52	0.8	16	16	12.3	69	2.5
Persimmon##	TGS	20	9.8	0.48	2.3	2.9	8	5.2	2.6	24	11.5	16	7.8
Great White##	TGS	5	4.5	0.90	2.5	3.9	43	1.0	0.6	15	18.4	75	0.4
Tangella	TGS	90	8.8	0.10	1.6	1.7	58	52.9	5.1	58	16.0	45	3.1
White Queen	TGS	17	8.2	0.49	2.2	3.3	52	1.1	0.4	5	16.8	52	2.5
Orange Banana	TGS	51	9.0	0.18	3.2	1.9	3	2.7	0.4	5	10.3	14	4.3
Green Zebra	JS	24	6.0	0.25	2.1	2.4	30	0.3	0.1	1	9.4	36	5.2
Big Beef	JS	33	16.5	0.50	2.7	2.9	17	10.6	5.6	34	19.8	16	2.1
Italian Gold	JS	60	11.3	0.19	3.2	1.8	5	12.0	2.3	19	12.1	7	4.2
Lemon Boy	ST	38	15.4	0.40	2.6	3.2	31	9.9	4.1	27	18.7	18	2.9
Granny Smith	TT	14	6.1	0.43	2.3	3.0	21	0.8	0.4	7	8.0	23	6.9
Carolina Gold	RU	32	16.1	0.51	2.8	3.3	20	3.8	2.5	16	19.0	15	3.5
Super Marzano	TGS	80	16.4	0.21	4.0	1.7	12	14.1	2.8	16	18.4	11	5.1
Grand Mean		42	10.1	0.40	2.6	2.7	29	9.6	2.1	18	14.8	32	3.8
LSD .05###		****	3.0	0.06	0.3	***	17	****	****	-	3.5	****	-
<i>Contrasts</i>													
Hybrids		43	13.6	0.37	2.9	2.6	18	8.5	2.9	20	16.0	15	4.1
Open pollinated		41	7.8	0.42	2.4	2.8	36	10.2	1.5	17	14.0	44	3.6
Significance+		****	****	****	****	ns	****	**	****	****	****	****	****
Green Hybrid (Granny Smith)		14.3	6.1	0.43	2.3	3.0	20.6	0.8	0.4	7	8.0	23	6.9
Green Open Pollinated		13.8	3.9	0.36	2.1	2.9	44.2	0.4	0.1	6	10.7	60	4.1
Significance+		*	†	*	†	ns	**	ns	ns	ns	†	****	****
Green Zebra vs. Dorothy's Green		****	**	****	ns	****	**	ns	ns	ns	ns	****	****
Lemon Boy vs. Banana Legs		****	†	****	****	****	ns	****	ns	ns	ns	****	**
White Queen vs. Great White		****	*	****	ns	*	ns	ns	ns	ns	ns	****	****
Big Beef vs. Goliath		****	****	****	†	****	****	****	****	****	****	****	****
Italian Gold vs. Orange Banana		ns	ns	ns	ns	ns	ns	****	**	**	ns	*	*
Carolina Gold vs. Tangella		****	****	****	****	****	****	****	*	*	†	****	****

#For these measurements data were transformed prior to analysis to stabilize variances; untransformed means are presented.

##Length and width measurements for only 1 rep (Great White) or 2 reps (Dorothy's Green and Persimmon).

###Fisher's protected least significant difference, p=0.05. ns=no significant cultivar effect. For analyses of transformed data, overall significance of cultivar effect is indicated. - analysis not performed.

+ns, †, *, **, *** and **** indicate non-significance, and p<.1, .05, .01, .001 and .0001 respectively.