
Evaluation of Several Greenhouse Cluster and Beefsteak Tomato Cultivars in Florida 97-03

Robert C. Hochmuth, Lei Lani Leon, George J. Hochmuth¹

Introduction

The size of greenhouse vegetable industry in Florida in 1996 was 57 acres (Hochmuth and Hochmuth, 1996b). The Florida greenhouse tomato acreage in 1996 was reported at five acres, primarily in the northeastern part of Florida. Essentially all greenhouse tomato production in Florida up to 1997 has been beefsteak cultivars. The beefsteak cultivar, 'Trust', has been a top performer in earlier Florida cultivar trials and has become the industry standard for beefsteak tomatoes (Hochmuth, et. al., 1993).

A new and popular tomato product is a cluster of vine ripened fruit still attached to the stem. These products are known as cluster tomatoes, cluster-harvested tomatoes, truss tomatoes, or on-the-vine tomatoes. The term truss tomato is frequently used in Europe and cluster tomatoes in the United States. Cluster tomatoes are currently grown as a greenhouse crop throughout the world, although some limited trials are being conducted with outdoor production. The new way of marketing tomatoes is credited to Italian producers who first began testing in 1989. The popularity of this vine ripened product quickly swept through the European greenhouse tomato industry, and more recently in the North American industry (Naegely, 1997). The large greenhouse tomato industry in Holland began its shift toward cluster tomatoes in 1992 and 1993 (Anon., 1995). Holland production of cluster tomatoes was 900 acres in 1996 which was 38% of the greenhouse tomato industry (Anon., 1996). It is reported over half of the greenhouse tomatoes to be grown in Holland and three quarters of the greenhouse tomatoes in Italy in the 1997-98 season will be cluster type. Other major European countries producing cluster tomatoes include Israel, Spain, and Portugal. Production in Canada, the United States, and Mexico has also expanded in the last three years. An estimated 150 acres of greenhouse space will be dedicated to cluster cultivars in Canada and the United States in the 1997-98 season. Major cluster tomato producing states in the United States include: Texas, Arizona, California, and Colorado. A few growers in

¹ Robert C. Hochmuth, Multi County Extension Agent, North Florida Research and Education Center - Suwannee Valley, University of Florida, IFAS, Live Oak, FL 32060
Lei Lani Leon, Lab Technician, North Florida Research and Education Center - Suwannee Valley, University of Florida, IFAS, Live Oak, FL 32060
George J. Hochmuth, Professor, Horticultural Sciences Department, University of Florida, IFAS, Gainesville, FL 32611

Florida have grown cluster tomatoes in the last two years and more space is planned for 1997-98.

Materials and Methods

This trial was conducted at the North Florida Research and Education Center - Suwannee Valley, University of Florida, near Live Oak, Florida in a single 22' x 60' stand-alone greenhouse with 8' high sidewalls. The structure was covered with two layers of 6 mil polyethylene and they are between the two layers was inflated with air. The greenhouse was equipped with an evaporative cooling pad on one endwall and ventilation fans on the opposite endwall. Propane gas was used to heat the greenhouse and provide a minimum temperature of 62°F. Warm air was conveyed by 12: ventilation tubes along the floor between the double rows of tomatoes. The same ventilation tubes were used to recirculate greenhouse air in the crop canopy to minimize free water from forming on the tomato plants. In addition, horizontal air-flow fans were located above the crop and also used as recommended, primarily to reduce moisture and disease on the plants (Bartok, 1994).

Seeds of fifteen cultivars (Table 1 and Table 4) were planted into rockwool seeding cubes (1.5 x 1.5 x 1.5 inches) on 3 September 1996. The transplants were grown in these cubes using water and nutrient solution as needed until transplanting. The transplants were planted into lay-flat bags of perlite on 25 September 1996. The crop was grown in accordance with the University of Florida perlite production practices (Hochmuth, 1991; Hochmuth and Hochmuth, 1996a). Nutrient management followed the program as outlined by the University of Florida (Hochmuth, 1990). The nitrogen level was 70 ppm N at the beginning of the season and raised to 150 ppm by first harvest and was maintained at 150 ppm for the remainder of the crop season.

The tomato crop was maintained with standard practices for training, suckering, pruning lower leaves, and cluster pruning (Hochmuth, 1991). Fruit were harvested at a "breaker" stage of maturity on beefsteak cultivars. Clusters of fruit from cluster cultivars were harvested at a range of fruit maturity from "breaker" to "ripe". The determination of class, beefsteak or cluster, was made by the seed company. Beefsteak fruit were harvested individually at the breaker stage and graded by size; large (over 8 ounces), medium (6 to 8 ounces), and small (4 to 6 ounces). Cull fruit were those fruit less than four ounces or with other defects. Cluster cultivars were harvested by clipping entire clusters, counting fruit on each cluster, and weighing each cluster. An overall rating for size uniformity was given to each cluster.

Results and Discussion

Beefsteak Cultivars. Early yield was determined by using the first seven harvests, 6 Dec. to 31 Dec. 1996. Total early marketable yields were similar in all cultivars,

however, significant differences were found in each grade. Highest early yield of large tomato fruit was found in 'Blitz', '7289 RZ', 'Red Giant', and 'Trust' (Table 1). High early yield of small tomato fruit was found in 'T1019' and 'T0577'.

Highest total season marketable yield was found in 'Blitz', 'Trust', and '7289 RZ' (Table 2). Highest large (greater than 8 ounces) and medium (6 to 8 ounces) fruit yield was found in 'Blitz', 'Trust', and '7289 RZ'. Small fruit yield was found in 'T1019' and 'T0577', 9.8 and 7.8 lbs/per plant respectively. Most of the cull yield in these two cultivars was due to very small fruit, less than 4 ounces per fruit. These two cultivars are too small to be considered in the beefsteak class. In addition, high cull fruit yield due to small fruit size was high in 'E29315' and 'E29411'. These cultivars were also too small for the beefsteak class.

Average fruit weights were calculated on all harvested fruit including culls. Average fruit weight ranged from 0.23 lbs to 0.38 lbs. Highest average fruit weight was found in 'Trust', 'Blitz', and '7280 RZ'. The lowest average fruit size was found in 'T1019' and 'T0577'. 'E29315', 'T1019', and 'T0577' were each highly susceptible to leaf mold (Fulvia fulvum). Plants of these three cultivars were severely affected beginning in March of 1997.

In addition to the beefsteak cultivars reported in Table 1, Table 2, and Table 3, an observational plot of the Asgrow cultivar 'B9271' was also grown in the same greenhouse. 'B9271' was observed to have similar fruit size and yield to 'Trust', but needs further evaluation.

Postharvest evaluations for the beefsteak cultivars are presented in Table 3. Exterior red color was excellent in all cultivars; however, 'E29315' was the darkest red. Russet ratings showed 'Red Giant' had the highest level of russeting and 'T0577' was very resistant to russet. '7289 RZ' showed only low levels of russet in February; however, it had very high levels of russet later in the spring season. The smallest calyx scar was found in 'E29411', 'T1019', and 'Trust'.

Fruit were cut open to evaluate internal quality. Interior red color was best in 'Red Giant', 'E29315', and 'B92-71'. The stem end core can be large and a negative characteristic in certain cultivars. Large stem end core was found in '7289 RZ', and the smallest in 'Red Giant'. Internal white tissue was most prevalent in 'T0577', 'Blitz', and 'Trust' and the least prevalent in 'Red Giant'. Best flavor was found in 'Red Giant', 'Blitz', and 'Trust'. Poorest flavor was found in 'T0577', 'E29411', and 'E29315'.

Best overall performance in this trial was found in 'Blitz', 'Trust', and '7289 RZ'. The cultivars 'T1019', 'T0577', 'E29315', and 'E29411' each produced fruit too small for consideration as a beefsteak cultivar for Florida.

Cluster Cultivars. Total season yields of the cluster cultivars ranged from 15.2 to 21.3 lbs per plant (Table 4). The highest yield was found in 'Ambiance', 'Jamaica', 'Durasol', 'Tradiro', and '73-15 RZ'. The number of clusters per plant ranged from 30.3 for 'Aranca' to 20.3 for 'Durasol'. A similar number of clusters per plant was found in 'Ambiance', '73-15 RZ', 'Triton', and 'Jamaica'. 'Aranca' provided the highest number of clusters in the early harvest.

The largest fruits were found in 'Durasol', 'Tradiro', and 'Ambiance'. The smallest fruit size was found in 'Aranca'. Most cultivars produced clusters with four or five fruits per cluster; however, 'Aranca' had an average of 7.5 fruits per cluster.

Several fruit quality evaluations were also made (Table 5). Fruit with the highest luster was found in '73-15 RZ' and the poorest in 'Triton'. All other cultivars were intermediate in fruit luster. Fruit russet ratings were made on three dates in May of 1997. All cultivars had similar levels of russetting on 23 May and 28 May, however, on 1 May differences between cultivars were found. 'Durasol' and 'Jamaica' had the highest level of russetting on 1 May. 'Tradiro' and '73-15 RZ' and 'Aranca' consistently tended to have the least amount of russetting across all three rating dates.

Fruit calyx quality after harvest is very important in cluster cultivars. Some cultivars have a calyx that dries quickly after harvest and others maintain a fresh green calyx for several days. The cultivars with the best calyx quality included: 'Ambiance', 'Durasol', and 'Aranca'. Poor calyx quality was generally found in '73-15 RZ' and 'Jamaica'. Uniformity of fruit size was rated highest in '73-15 RZ', 'Tradiro', and 'Aranca'.

Observational taste tests conducted on each cluster cultivar showed 'Aranca' with the best flavor and 'Tradiro' with the poorest. 'Ambiance' and 'Triton' were slightly better than 'Jamaica', 'Durasol', and '73-15 RZ' (Table 5).

In addition to the cultivars reported in Table 4 and Table 5, one other cluster cultivar 'Dynamo' (Sunseeds) was grown in a small observational plot. Early season observations were encouraging as 'Dynamo' produced large, uniform fruit on the first few clusters. However, 'Dynamo' is very susceptible to leaf mold, (*Fulvia fulvum*). Spring plant vigor, production, and fruit size were all reduced with the high incidence of leaf mold on all 'Dynamo' plants. In addition, the other Sunseeds cultivars 'T0577' and 'T1019' entered in the beefsteak trial were highly susceptible to leaf mold. The

incidence of leaf mold began in early March 1997, and continued to the end of the season.

Overall best performers in the cluster tomato trial were 'Ambiance', 'Tradiro', and '73-15 RZ'. The cultivar '73-15 RZ' had good production and fruit quality, but poor calyx quality. '73-15 RZ' also was the only cluster cultivar with extended shelf life resulting in a fruit with a very firm fruit wall.

Literature Cited

- Anon. 1995. *Truss Tomatoes*. In DeRuiter Seeds Greenhouse Newsletter 95:3, Columbus, OH. pp. 3-7.
- Anon. 1996. *Acreage in the Netherlands*. In DeRuiter Seeds Greenhouse Newsletter 96:1, Columbus, OH p 1.
- Bartok, J. L. 1994. *Don't Overlook Benefits of Horizontal Air Flow Fans*. Greenhouse Manager. Feb, 1994. p 90-92.
- Hochmuth, George and Robert Hochmuth. 1990/Updated 2001.. [Nutrient Solution Formulation for Hydroponic \(Rockwool and NFT\) Tomatoes in Florida](#). Fla. Coop. Ext. Serv., EDIS Pub CV216.
- Hochmuth, George. 1991. *Florida Greenhouse Vegetable Production Handbook, Vol. 3*. Fla. Coop. Ext. Serv. Circular SP48. 98 pp.
- Hochmuth, George and Robert Hochmuth. 1996a. [Keys to Successful Tomato and Cucumber Production in Perlite Media](#). Fla. Coop. Ext. Serv., Misc. Report. 9pp
- Hochmuth, George and Robert Hochmuth. 1996b. [Survey of Greenhouse Vegetable Production in Florida](#). Fla. Coop. Ext. Serv. SVREC Report 96-12. 12 pp
- Hochmuth, Robert, George Hochmuth, and Michael Ross. 1993. *Evaluation of Greenhouse Tomato Cultivars for Production and Quality in North Florida in 1992 and 1993 Season*. Fla. Coop. Ext. Serv., SVREC 93-2. 12 pp.
- Naegely, Stella. 1997. *Greenhouse Vegetables, Business is Booming*. In Greenhouse Grower, June 1997, Meister Publ. Co., Willoughby, OH. pp. 14-18
-

Table 1. Early fruit yields and size for several beefsteak tomato cultivars at Live Oak, FL.

Cultivar	Seed Source	Greenback trait ^x	Early fruit yield per plant (lbs)			
			Total Marketable	Large ^y	Medium ^y	Small ^y
Blitz	DeRuiter	N	4.1	1.7	1.9	0.5
T1019	Sunseeds	N	3.4	0.0	0.9	2.5
E29315	Enza Zaden	GB	3.3	0.6	1.6	1.1
Red Giant	Asgrow	N	3.1	1.2	1.5	0.4
E29411	Enza Zaden	N	3.1	0.6	1.4	1.1
Trust	DeRuiter	N	2.9	1.0	1.4	0.5
7289 RZ	Rijk Zwaan	N	2.8	1.4	1.1	0.3
T0577	Sunseeds	GB	2.6	0.0	0.3	2.3
LSD (p=0.05)			NS	0.90	0.47	0.53

^z Early fruit yields were calculated using the seven harvests in the month of December, 1996.
^y Fruit was graded by weight; large=over 8 oz, medium=6 to 8 oz, and small=4 to 6 oz.
^x Greenback trait is either greenback (GB) or non-greenback (N).

Table 2. Total season fruit yields, size, and average fruit weight for several beefsteak cultivars at Live Oak, FL.

Cultivar	Total seasonal yield per plant (lbs)					Average Fruit Weight ^y (lbs)	
	Total Marketable	Large ^z	Medium ^z	Small ^z	Cull		
Blitz	23.1	3.8	9.8	9.5	2.4	0.36	
Trust	21.6	3.7	9.9	8.0	1.6	0.38	
7289 RZ	20.6	4.2	8.6	7.8	1.9	0.36	
E29411	14.7	1.3	4.4	9.0	4.1	0.30	
Red Giant	13.8	1.9	5.6	6.3	2.5	0.34	
E29315	12.9	1.2	3.8	7.9	5.9	0.29	
T0577	10.7	0.0	0.8	9.9	7.8	0.24	
T1019	8.8	0.0	0.9	7.8	9.8	0.23	
LSD (P=0.05)		5.10	1.82	2.30	NS	1.32	0.03

^z Fruit was graded by weight; large=over 8 oz, medium=6 to 8 oz, and small=4 to 6 oz.
^y Average fruit weight was calculated on all fruit harvested, marketable and cull.

Table 3. Observational postharvest quality evaluations for several beefsteak tomato cultivars.

Cultivar	Observational ratings (1-5) ^z						
	Exterior Red Color ^x	Russet ^w	Calyx Scar ^v	Interior Red Color ^x	Core Size ^u	Internal White Tissue ^t	Taste ^s
Red Giant	4	4	3	5	1	1	4
T0577	4	1	2	2	3	3	2
Blitz	4	2	2	4	3	4	4
7289 RZ	4	2	3	3	4	4	3
E29411	4	2	1	3	3	3	2
E29315	5	2	2	5	2	2	2
T1019	4	2	1	3	2	3	3
Trust	4	2	1	4	3	4	4
B92-71 RZ ^y	4	2	3	5	2	2	3

^z Observations made on 28 February 1997 after harvested fruit had been held at room temperature for one week.

^y B927-71 RZ, Asgrow cultivar is included in this evaluation. Fruit was from plants in the same greenhouse.

^x Color rating; 1=poor red color, 5=deep red color.

^w Russet rating: 1=no russet, 5=severe russet.

^v Calyx scar rating: 1=no scar, 5=large scare area.

^u Stem end core size rating: 1=small core, 5=large core.

^t Internal white tissue: 1=very little white tissue, 5=high level of white tissue.

^s Taste rating: 1=poor, 5=excellent.

Table 4. Evaluation of seven cluster tomato cultivars for early yield, total yield, and fruit size.

Cultivar	Seed Source	Greenback Trait ^z	Total Yield Per Plant (lbs)	Total No. Cluster Per Plant	Early No. ^y Clusters Per Plant	Average Fruit Wt. (lbs)	Average No. Fruit Per Cluster
Ambiance	DeRuiter	N	21.3	24.9	1.8	0.22	4.0
Jamaica	Rijk Zwaan	N	19.7	22.0	2.2	0.21	4.4
Durasol (E29194)	Enza Zaden	N	19.5	20.3	1.4	0.24	4.0
Tradiro	DeRuiter	N	19.3	21.2	2.1	0.23	3.9
73-15 RZ ^w	Rijk Zwaan	N	18.8	21.8	1.8	0.16	4.6
Triton (E29351)	Enza Zaden	N	18.1	24.4	2.8	0.16	4.6
Aranca	Enza Zaden	GB	15.2	30.3	3.9	0.07	7.5
LSD (P=0.05)			3.0	3.4	0.9	0.02	

^z Greenback trait is either greenback (GB) or non-greenback (N).
^y Early yield is from first ten harvest dates (December 2-31, 1996).
^x Average number of fruit per cluster was calculated by dividing total number of fruit by total number of clusters.
^w '73-15 RZ' is the only extended life (ESL) cultivar of those reported.

Table 5. Evaluation of several fruit quality parameters for seven cluster tomato cultivars at Live Oak, FL.

Cultivar	Fruit Luster Rating ^z (1-5)	Russet Rating ^y (1-5)			Observational Ratings		
		1 May	23 May	28 May	Calyx Rating ^x (1-5)	Fruit Size Uniformity Rating ^w (1-5)	Taste Rating ^v (1-5)
Ambiance	3.0	4.7	3.7	3.0	5.0	2.9	4
Jamaica	3.0	3.7	4.0	2.3	2.5	2.5	3
Durasol (E29194)	3.0	3.0	4.3	3.7	5.0	2.9	3
Tradiro	3.0	5.0	5.0	4.0	3.5	2.7	2
73-15 RZ	4.3	5.0	5.0	4.0	1.5	3.4	3
Triton (E29351)	2.3	5.0	3.7	2.7	4.0	3.2	4
Aranca	3.0	5.0	5.0	5.0	5.0	3.1	5
LSD (P=0.05)	0.6	1.3	NS	NS			

^z Luster rating scale was 1-5, 1=poor luster, 5=excellent luster.

^y Fruit russet rating was made on fruit from three harvest dates in May 1997. Rating scale was 1-5; 1=excessive russet, 5=no russet.

^x Calyx rating scale was 1-5; 1=poor calyx appearance, 5=excellent calyx appearance.

^w Observational ratings were taken on uniformity of tomato size within clusters. Ratings were 1=poor uniformity of size, 5=excellent uniformity of size.

^v Taste ratings were 1-5; 1=poor taste, 5=excellent taste.

Industry Cooperators^z

Airlite Processing Corporation of Florida (perlite)
3505 65th Street, Vero Beach, FL 32967

DeRuiters Seeds (seed)
PO Box 20228, Columbus, OH 43220

Growers Supply Center (seed)
3000 S Hwy 77 - Unit 214, Lynn Haven, FL 32444

Rijk Zwaan (seed)
PO Box 40, 2678 ZG De Leir, The Netherlands

Asgrow/Bruinsma Seeds (seed)
RR #3 Site 39-C, Summerland BC, Canada V0H 1Z0

Enza Zaden (seed)
1188 Padre Dr. #150, Salinas, CA 93901

Paramount Seeds (seed)
PO Box 1866, Palm City, FL 34990

Sunseeds (seed)
7087 E Peltier Rd, Acampo, CA 95220

^z Contact Extension Service for names and addresses of current Florida representatives. Mention of a specific company or product does not constitute endorsement over other companies or equivalent products.