

STATEWIDE TOMATO VARIETY TRIALS—A THREE-YEAR STUDY

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Abstract. Six tomato (*Lycopersicon esculentum* Mill) genotypes were evaluated for marketable yields (25-lb boxes/acre) and average fruit size (oz/fruit) from 1994 to 1997. Trials were conducted in Bradenton, Fort Pierce, Homestead, and Quincy, Florida. Interactions between genotypes and environments were significant for marketable yields and average fruit size. 'Equinox' (2,123 25-lb boxes/acre), 'Fla. 7578' (2,106 25-lb boxes/acre), or 'Agriset 761' (2,076 25-lb boxes/acre) produced the highest or next to the highest marketable yields in at least 43% of all trials. 'Merced' had the largest fruit size (6.6 oz/fruit) when compared with the other genotypes in 13 out of 14 trials.

Tomato (*Lycopersicon esculentum* Mill) variety trials in Florida generally include commercially grown cultivars and/or advanced breeding lines. Statewide tomato variety trials are of great importance to growers, seed companies, researchers, and extension personnel. Variety selection is an important decision a commercial grower must make (Maynard and Hochmuth, 1995). There are several specific geographical areas in Florida with large tomato acreage. Production and cultural practices, soil type, and climate vary among these locations (Stoffella et al., 1984). Tomato variety trials were conducted in several geographical areas of the state including Quincy (north), Bradenton (west), Fort Pierce (east), and Homestead (south). These areas differ in climatic and edaphic conditions and in cultural practices used by commercial tomato growers (Maynard and Hochmuth, 1995). Performance

variety trials have included a large number of varieties, although not all the same varieties have been evaluated in each trial (Howe and Maynard, 1996; Maynard, 1997; Maynard and Howe, 1995). Differences in climate and cultural practices contribute to environment (location and season) \times genotype interactions for fruit yields (Stoffella et al., 1984) and fruit quality (Gull et al., 1988) in statewide tomato performance trials. In these trials, varieties display varying stability in yield and fruit quality stability between environments. The purpose of this investigation was to compile and evaluate results of six tomato varieties for marketable yield and fruit size at four Florida locations over a three-year period.

Materials and Methods

Tomato variety trials were conducted in Quincy (spring seasons of 1994 and 1995), Bradenton (spring and fall seasons of 1994, 1995, and 1996), Fort Pierce (fall seasons of 1994, 1995, and 1996, and spring season of 1996), and Homestead (spring seasons of 1995 and 1997). Soil type, irrigation methods, and cultural practices used at each location are presented in Tables 1 and 2.

Yield data of 'Agriset 761', 'Bonita', 'Equinox', 'Merced', 'Solar Set', and 'Fla. 7578', an advanced breeding line, were extracted from larger trials conducted at each location. A randomized complete-block experimental design was used at each location with each variety replicated four times, except in the spring 1997 trial in Homestead which had three replications. Recommended pesticides were used to control disease, insects, and weeds (Maynard and Hochmuth, 1995).

In each trial, plots ranged from 10 to 12 plants, with 8 to 10 plants used for data collection. Marketable fruit weight and number were measured for each plot and average fruit size (oz/fruit) calculated.

Each measured variable was subjected to a combined analysis of variance (ANOVA). Since variety \times environment interactions were significant for marketable fruit yield and size (Table 3), a separate ANOVA was performed for each trial. If main effect of variety was significant, means were separated by least significant difference (LSD) test. Correlation coefficients (r) were calculated between marketable yield (25-lb cartons/acre) and number of marketable fruit (number/acre) and mean fruit size (g/fruit) within each environment as well as overall for the entire data set. Statistical analyses were conducted using the Statistical Analysis System (SAS) computer program (SAS Institute, 1988).

Marketable tomato yield and fruit size for each cultivar within each environment were ranked from 1 (the highest) to

Table 1. Soil type, irrigation methods, and harvesting stage used at each experimental trial location.

Location	Soil type	Irrigation	Harvesting
Bradenton	EauGallie fine sand	seepage	mature green
Ft. Pierce	Oldsmar fine sand	seepage	breakers
Homestead	Krome very gravelly loam (Rockdale soil)	drip	breakers
Quincy	Orangeburg loamy fine sand	drip	mature green

Table 2. Fertilizer rates and cultural practices used for each tomato performance trial.

Location	Fertilizer (lb/acre)			Polyethylene mulch color	Spacing		Transplant age (days)	Plant population (plants/acre) ^a	Staked ^b	Number of harvests
	N	P	K		Beds (ft)	Plants (inches)				
Bradenton										
Spring 1994	261	38	434	black	5.0	24	43	4356	+	3
Fall 1994	261	15	434	white	5.0	24	43	4356	+	3
Spring 1995	261	31	434	black	5.0	24	43	4356	+	3
Fall 1995	261	15	434	white	5.0	24	43	4356	+	4
Spring 1996	261	31	434	black	5.0	24	49	4356	+	3
Fall 1996	261	15	434	white	5.0	24	43	4356	+	3
Ft. Pierce										
Fall 1994	137	120	250	white	7.0	24	35	3112	-	3
Fall 1995	137	120	250	white	7.0	24	31	3112	-	3
Spring 1996	137	120	250	white	7.0	24	48	3112	-	3
Fall 1996	137	120	250	white	7.0	24	29	3112	-	6
Homestead										
Spring 1995	140	52	232	white	6.0	15	36	5808	+	3
Spring 1997	140	52	232	white	6.0	15	49	5808	+	3
Quincy										
Spring 1994	195	26	162	black	6.0	20	39	4356	+	3
Spring 1995	195	26	162	black	6.0	20	41	4356	+	4

^aEach trial had 1 row per bed.^b(+) or (-) indicate staked or unstaked trials, respectively.

Table 3. Mean squares from combined analysis of variance for yield and size of marketable fruit.

Source of variation	df	Mean squares	
		Fruit yield ($\times 10^3$)	Fruit size
Environments (Env)	13	12382.3**	10.49**
Replication/Env	41	94.8	0.22
Variety (Var)	5	947.8**	5.41**
Var \times Env	65	166.0**	0.24**
Experimental error	205	60.8	0.12

* **Indicates significance at the 5% and 1% level of probability, respectively.

6 (the lowest). Variety rankings were then averaged over each location and over the entire data set.

Results and Discussion

Mean yield of marketable fruit among environments ranged from 3,125 25-lb boxes/acre in Homestead during the spring 1997 trial to 507 25-lb boxes/acre in Homestead during the spring 1995 trial (Table 4). The large range in marketable yield was due to a combination of differences in cultural practices, climate, number of harvests, soil variability, harvesting stages, and disease incidences among trials. These factors may have also contributed to the significant variety \times environ-

Table 4. Mean yields (25-lb boxes/acre) of marketable fruit for each variety grown at several Florida locations.

Environment	'Agriset 761'	'Bonita'	'Equinox'	'Fla. 7578'	'Merced'	'Solar Set'	Mean	LSD (0.05) ^a
Bradenton								
Spring 1994	2890	2483	3114	3114	2818	3088	2918	
Fall 1994	1368	1084	2025	2059	1969	1800	1718	371
Spring 1995	2376	1857	2644	2451	2424	2323	2346	
Fall 1995	1861	1056	2285	2237	1927	2144	1918	294
Spring 1996	2056	1840	1984	2048	2059	1830	1969	
Fall 1996	2915	2336	2850	2733	2635	2594	2677	
Ft. Pierce								
Fall 1994	1097	634	717	856	879	710	815	161
Fall 1995	1853	1330	1549	1519	1524	1786	1594	
Spring 1996	2238	2242	2153	2078	2243	1934	2148	
Fall 1996	2594	2920	2570	2433	2672	2581	2628	
Homestead								
Spring 1995	414	294	412	659	605	659	507	183
Spring 1997	3161	3146	3425	3179	2884	2956	3125	239
Quincy								
Spring 1994	2402	2079	2023	2303	2058	2376	2207	
Spring 1995	2116	1695	2297	2076	1881	1965	2005	341
Mean	2076	1761	2123	2106	2026	2037		

^aLSD_(0.05) values were calculated for trials with significant main effects of variety.

Table 5. Variety ranking for marketable fruit yields within each trial.

Environment	'Agriset 761'	'Bonita'	'Equinox'	'Fla. 7578'	'Merced'	'Solar Set'
Bradenton						
Spring 1994	4	6	1	2	5	3
Fall 1994	5	6	2	1	3	4
Spring 1995	4	6	1	2	3	5
Fall 1995	5	6	1	2	4	3
Spring 1996	2	5	4	3	1	6
Fall 1996	1	6	2	3	4	5
Average rank	3.50	5.83	1.83	2.17	3.33	4.33
Ft. Pierce						
Fall 1994	1	6	4	3	2	5
Fall 1995	1	6	3	5	4	2
Spring 1996	3	2	4	5	1	6
Fall 1996	3	1	5	6	2	4
Average rank	2.00	3.75	4.00	4.75	2.25	4.25
Homestead						
Spring 1995	4	6	5	1	3	2
Spring 1997	3	4	1	2	6	5
Average rank	3.50	5.00	3.00	1.50	4.50	3.50
Quincy						
Spring 1994	1	4	6	3	5	2
Spring 1995	2	6	1	3	5	4
Average rank	1.50	5.00	3.50	3.00	5.00	3.00
Overall rank	2.79	5.00	2.86	2.93	3.43	4.00

'Ranking scale is based on 1 (highest marketable fruit yield) to 6 (lowest marketable fruit yield).

ment interaction for marketable fruit yield and fruit size (Table 3).

Yields of marketable fruit among varieties were significantly different in only 43% of the environments (Table 4). Yields of marketable fruit by variety across all environments ranged from 2,123 25-lb boxes/acre for 'Equinox' to 1,761 25-lb boxes/acre for 'Bonita'. Mean marketable fruit yields, pooled over all the trials, were higher than 2,000 25-lb boxes/acre for each variety except for 'Bonita'. Overall variety ranking for marketable fruit yields resulted in 'Agriset 761', 'Equi-

nox', and 'Fla. 7578' with the highest yields and 'Bonita' with the lowest yields (Table 5).

Mean weights of marketable fruit (oz/fruit) among environments ranged from 7.12 oz in Fort Pierce during the spring 1996 trial to 5.18 oz in Homestead during the spring of 1995 trial (Table 6). Mean weight of marketable fruit among varieties was significantly different among varieties in 79% of the environments. Mean marketable fruit weights (oz/fruit) averaged over all environments ranged from 6.60 oz for 'Merced' to 5.68 oz for 'Bonita'. Mean weights were higher than 5.85 oz/fruit for each variety except for 'Bonita'. Overall

Table 6. Average weight (oz/fruit) of marketable fruit for each variety grown at several Florida locations.

Environment	'Agriset 761'	'Bonita'	'Equinox'	'Fla. 7578'	'Merced'	'Solar Set'	Mean	LSD (0.05)
Bradenton								
Spring 1994	5.70	5.18	5.57	5.74	6.47	5.90	5.76	0.53
Fall 1994	5.12	4.95	4.83	5.19	5.61	5.45	5.19	
Spring 1995	5.94	5.48	6.09	6.26	6.69	6.21	6.11	0.32
Fall 1995	5.05	5.01	5.22	5.43	5.89	5.38	5.33	0.34
Spring 1996	5.21	5.30	5.76	5.85	6.22	5.77	5.68	0.39
Fall 1996	5.13	5.21	5.23	4.96	5.92	5.23	5.28	0.37
Ft. Pierce								
Fall 1994	6.17	5.63	5.69	5.14	6.19	5.34	5.69	0.51
Fall 1995	7.26	6.54	6.45	6.33	7.22	6.74	6.76	0.67
Spring 1996	7.31	6.76	7.09	7.18	7.50	6.91	7.12	0.46
Fall 1996	6.44	6.90	6.48	6.18	7.35	6.51	6.64	0.41
Homestead								
Spring 1995	5.16	4.82	4.90	5.13	5.91	5.15	5.18	
Spring 1997	5.41	5.49	6.60	5.41	6.76	6.08	5.96	
Quincy								
Spring 1994	6.39	5.96	6.60	6.44	7.00	6.48	6.48	0.50
Spring 1995	6.58	6.23	6.79	6.73	7.65	6.82	6.80	0.47
Mean	5.93	5.68	5.94	5.86	6.60	6.00		

'LSD_(0.05)' values were calculated for trials with significant main effects of variety.

Table 7. Variety ranking for average fruit size of marketable yields within each trial.

Environment	'Agriset 761'	'Bonita'	'Equinox'	'Fla. 7578'	'Merced'	'Solar Set'
Bradenton						
Spring 1994	4'	6	5	3	1	2
Fall 1994	4	5	6	3	1	2
Spring 1995	5	6	4	2	1	3
Fall 1995	5	6	4	2	1	3
Spring 1996	6	5	4	2	1	3
Fall 1996	5	4	3	6	1	2
Average rank	4.83	5.33	4.33	3.00	1.00	2.50
Ft. Pierce						
Fall 1994	2	4	3	6	1	5
Fall 1995	1	4	5	6	2	3
Spring 1996	2	6	4	3	1	5
Fall 1996	5	2	4	6	1	3
Average rank	2.50	4.00	4.00	5.25	1.25	4.00
Homestead						
Spring 1995	2	6	5	4	1	3
Spring 1997	6	4	2	5	1	3
Average rank	4.00	5.00	3.50	4.50	1.00	3.00
Quincy						
Spring 1994	5	6	2	4	1	3
Spring 1995	5	6	3	4	1	2
Average rank	5.00	6.00	2.50	4.00	1.00	2.50
Overall rank	4.07	5.00	3.86	4.00	1.07	3.00

Ranking scale is based on 1 (largest average fruit size) to 6 (smallest average fruit size).

Table 8. Correlation coefficients (r) of marketable tomato yields (25-lb cartons/acre) with marketable fruit number (number/acre) and mean fruit size (oz/fruit).

Environment	Marketable fruit number'	Mean fruit size
Bradenton		
Spring 1994	0.81**	0.34
Fall 1994	0.96**	0.19
Spring 1995	0.91**	0.38
Fall 1995	0.97**	0.40
Spring 1996	0.84**	0.11
Fall 1996	0.83**	0.01
Ft. Pierce		
Fall 1994	0.92**	0.64**
Fall 1995	0.91**	0.58**
Spring 1996	0.93**	0.29
Fall 1996	0.70**	0.43*
Homestead		
Spring 1995	0.96**	0.31
Spring 1997	0.36	0.22
Quincy		
Spring 1994	0.92**	-0.14
Spring 1995	0.87**	0.15
Overall total	0.94**	0.25**

*. ** Indicates significance at the 5 and 1% levels of probability, respectively. Number of observations (n) within each environment was 24 except for Homestead Spring 1997 which was 18. Overall n was 330.

variety ranking for average fruit size of marketable yields resulted in 'Merced' with the largest average fruit size and 'Bonita' with the smallest (Table 7).

Our results indicate that the tomato varieties evaluated in different environments had different marketable yields and fruit sizes. High producing varieties ('Equinox', 'Agriset 761',

and 'Fla. 7578') were adapted to specific environments. However, 'Bonita' performed poorly across all environments.

A significant correlation coefficient occurred between marketable tomato yields (25-lb cartons/acre) and marketable fruit number/acre in all but one of the 14 environments (Table 8), with number of marketable fruit per acre accounting for 89% of the variability in tomato yield averaged across all environments. However, only three of the environments expressed a significant correlation between marketable tomato yields and marketable fruit size (Table 8). These results indicate number of fruit per acre rather than fruit size has the greatest influence on overall marketable yield. However, varieties producing larger fruit typically generate a higher market value because of their premium price. Therefore, commercial tomato growers should select varieties that are adaptable to their specific location and cultural practices.

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