ECW. This did not occur in any of the 3 seasons. However, in the spring 1982 numbers of fruit/acre at first harvest were significantly higher at all spacings with the BL than with ECW (Table 4). Although the BL produced more fruit than ECW, their average weight was somewhat less and yields (25 lb. bu/acre) were equal between the 2 cultivars at the 4 inch spacing and higher for ECW at the 8 and 12-inch spacings (Table 4).

In this 3-season study, yields per acre increased and yields per plant decreased as the within-row spacing decreased from 12 to 4 inches. In 2 of the 3 seasons average fruit weight was higher with the 12-inch than with the 4-inch spacing. In one season there was no difference in average fruit weight due to within-row spacing. Increasing the N-K_2O rates had no effect on yield, number of fruit or average fruit weight in any of the 3 seasons. Overall performance of 'Early Calwonder' was superior to the breeding line. Closer spacing, higher N-K_2O rates and cultivar all increased plant height.

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CULTURAL CONTROL OF FUSARIUM WILT RACE 3 OF TOMATO[1]

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Additional index words. lime, fertilization.

Abstract. **Following the verification of the occurrence of** Fusarium oxysporum **(Schlecht) f. sp.** lycopersici **(Sacc.) Snyder and Hansen race 3 in commercial fields in the Hillsborough-Manatee County area of Florida, 2 greenhouse experiments were carried out to determine the effect of cultural practices on disease occurrence. High soil pH and NO_3-N consistently inhibited disease devlopment. Magnesium also seemed to inhibit disease, but the results were not conclusive. A micronutrient amendment did not affect disease occurrence.**

The value of liming for the control of Fusarium wilt of tomato (*Lycopersicon esculentum* Mill.), caused by *Fusarium oxysporum* f. sp. *lycopersici* race 1, was demonstrated in 1920 by Edgerton and Moreland (1) and again in 1935 by Fisher (2). Jones and Woltz (5) found that soil amendments of hydrated lime and NO_3-N also greatly inhibited the incidence and severity of Fusarium wilt caused by race 2.

Therefore, following the discovery of race 3 of the tomato wilt fusarium in Florida in 1981 (3), 2 experiments were carried out primarily to determine the effect of lime, N source, and micronutrients on the occurrence of Fusarium wilt caused by the new race.

Materials and Methods

A 3-factor experiment was used which involved 3 soil pH values (5.5, 6.5, 7.5), 2 micronutrient regimes (FTE 503 + Mn + Zn + Fe, and none), and 4 nutrient solutions (80%:20% NO_3:NH_4-N, 80:20 + Mg, 20:80, 20:80 + Mg). Treatments were arranged in a randomized complete block design with 4 replications. Each experimental unit consisted of one 8-7/8 x 6-1/2 x 2-1/4-inch plastic tray containing 5 lb. of soil and 6 tomato plants (cv. 'Walter'). The first experiment was established in December, 1982; the second (a repeat of the first) in September, 1983.

A virgin Myakka fine sand was used in each experiment. The soil had an original pH of 3.8-4.2, a cation exchange capacity of 2.3-3.0 meq/100 g, and an organic content of 1.1-2.9%.

Calcium carbonate was used at 367 ppm and 1,483 ppm to adjust the reaction of the low and medium pH plots, respectively. A combination of calcium carbonate (1,483 ppm) and hydrated lime (667 ppm) was used in the high pH plots. Calcium sulfate was added at 2,731 ppm and 1,233 ppm to the low and medium pH plots, respectively. These were amounts calculated to result in equal amounts of Ca in all soils regardless of pH. The soil pH was determined at the start and conclusion of each experiment.

Micronutrients (FTE 503, 10.7 ppm; $FeSO_4.7\ H_2O$, 14 ppm; $MnSO_4.4\ H_2O$, 10.7 ppm; $ZnSO_4.7\ H_2O$, 10.7 ppm) were added to one-half of the soil at each pH. The remaining one-half did not receive micronutrients.

After the amendments were mixed into the dry soil, the plastic trays were filled, and the soil was moistened. 'Walter' tomato plants (2-wk-old) were transplanted into each tray 1 wk later. All trays then were flooded with 100 ml of 1 of the following 4 nutrient solutions: 80%:20% NO_3:NH_4-N + P + K, 80:20 NO_3:NH_4-N + P + K + Mg, 20:80 NO_3:NH_4-N + P + K, 20:80 NO_3:NH_4-N + P + K + Mg. N, P, K, and Mg rates were 200, 40, 200, and 40 ppm, respectively. All trays were irrigated 3 times each week with the proper nutrient solution.

The plants were grown 2 wk, then inoculated with *F. oxysporum* f. sp. *lycopersici* race 3 by adding to each tray 100 ml of a mycelial-spore suspension containing 3,275,000 spores/ml in experiment 1 and 2,500,000 spores/ml in experiment 2. The race 3 used in each experiment was grown 8 days (as a shake culture) in a high N and micronutrient

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solution (4) at room temperature and lighting. The mycelial mat was filtered off, rinsed twice with tap water, comminuted briefly in a microblendor, and suspended in tap water. Spore concentrations were determined with a haemocytometer.

Plants were evaluated twice weekly for Fusarium wilt symptoms of stunting, epinasty, yellowing, wilting, abscision of leaves, and death.

At the end of each experiment, 50 plants with Fusarium wilt symptoms were selected, small stem segments excised, surface sterilized in 10% bleach, and placed on potato dextrose agar in Petri dishes. *F. oxysporum* was isolated from each plant.

Results and Discussion

The initial soil pH values in both experiments were 5.5 (low), 6.5 (medium), and 7.5 (high) (Table 1). Nitrogen solutions, as expected, affected the soil pH. Soils flooded with NO_3-N were higher in pH than soils of the same initial pH treatment flooded with NH_4-N. In experiment 1, the initial spread in soil pH endured throughout the experiment, although some drift occurred. In experiment 2, the pH's of the low and medium pH soils ultimately adjusted to the same pH (Table 1). Additionally, the high pH soils flooded with NH_4-N decreased to pH 5.9 which was less than the final pH of the low and medium pH soils flooded with NO_3-N solutions.

Table 1. Effect of nitrate and ammonia-nitrogen on soil pH.

Original soil pH	pH at conclusion of experiment Expt. 1 NO_3-N[z]	NH_4-N[y]	Expt. 2 NO_3-N	NH_4-N
5.5	3.9	3.6	6.6	5.5
6.5	6.4	4.9	6.6	5.4
7.5	7.6	6.8	7.5	5.9

[z]NO_3-N = 80% NO_3-N:20% NH_4-N.
[y]NH_4-N = 20% NO_3-N:80% NH_4N.

Disease occurrence was greater in the first than in the second experiment (Tables 2 and 4). However, in both experiments similar trends occurred: 1) the incidence of Fusarium-wilted plants decreased with increasing soil pH (Tables 2 and 4); 2) the addition of micronutrients did not affect disease development (Tables 2 and 4); 3) NH_4-N solutions encouraged disease occurrence compared to NO_3-N solutions (Tables 3 and 5); and 4) Mg seemed to inhibit Fusarium wilt development, but these results were not conclusive (Tables 3 and 5).

Race 3 of the tomato wilt Fusarium responded to liming and N sources exactly as did race 2 (5). Apparently, the change in pathogenicity of race 3 did not alter its reaction to soil pH or to N sources of NO_3-N and NH_4-N.

Table 2. Influence of soil pH and micronutrient amendment on the occurrence of Fusarium wilt of 'Walter' tomatoes (Expt. 1).

Original soil pH	Wilt (%) Dec.	Jan.	Micro-nutrients	Wilt (%) Dec.	Jan.
5.5	74.5	82.3	Yes	54.8	62.2
6.5	61.5	67.7	No	61.5	66.7
7.5	38.5	43.4			
LSD 5%	13.5	10.9		NS	NS

Table 3. Effect of soil pH and N source ratios, with and without Mg, on the occurrence of Fusarium wilt of 'Walter' tomatoes (Expt. 1).

Nitrogen ratios[z]	Original soil pH 5.5	6.5	7.5	Original soil pH 5.5	6.5	7.5
	% wilt (Dec.)[y]			% wilt (Jan.)[y]		
80:20	70.8	50.0	39.6	87.4	68.7	43.7
80:20 + Mg	48.3	39.6	25.0	56.2	45.8	33.3
20:80	89.8	95.8	35.4	100.0	87.5	43.7
20:80 + Mg	89.2	60.4	54.2	85.4	68.8	52.7

[z]NO_3-N:NH_4-N ratios.
[y]LSD 5% to compare within columns = 13.5 and 13.6 for December and January, respectively.

Table 4. Influence of soil pH and micronutrient amendment on the occurrence of Fusarium wilt of 'Walter' tomatoes (Expt. 2).

Original soil pH	Wilt (%) Aug. 17	Aug. 29	Micro-nutrients	Wilt (%) Aug. 17	Aug. 29
5.5	29.5	53.1	Yes	20.1	39.9
6.5	18.9	26.9	No	14.2	34.0
7.5	3.2	20.8			
LSD 5%	8.2	11.3		NS	NS

Table 5. Effect of soil pH and N source ratios, with and without Mg, on the occurrence of Fusarium wilt of 'Walter' tomato (Expt. 2).

Nitrogen ratios[z]	Original soil pH 5.5	6.5	7.5	Original soil pH 5.5	6.5	7.5
	% wilt (Aug. 17)[y]			% wilt (Aug. 29)[y]		
80:20	6.3	4.2	2.1	43.7	14.6	12.5
80:20 + Mg	12.5	6.2	6.2	37.5	20.8	18.7
20:80	70.0	32.1	0.0	79.2	50.0	31.2
20:80 + Mg	16.7	0.0	4.2	51.9	62.5	20.8

[z]NO_3-N:NH_4-N ratios.
[y]LSD 5% to compare within columns = 8.9 and 12.4 for Aug. 17 and Aug. 29, respectively.

The current commercial practices of liming to a pH of 6.5 and the use of NO_3-N should help alleviate, but not eliminate, losses to *F. oxysporum* race 1, 2, and 3.

Further investigations will be carried out to clarify the rate of Mg in the development of Fusarium wilt of tomato.

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STATEWIDE TOMATO CULTIVAR TRIALS FOR 1982

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Abstract. **Ten tomato** (Lycopersicon esculentum **Mill) genotypes were evaluated for marketable yield and average fruit weight (oz/fruit) at 6 Florida locations during 1982. Studies were conducted at Bradenton, Fort Pierce, and Homestead during the spring and fall seasons, Gainesville and Quincy during the spring season and Immokalee during the fall season. Interactions between genotypes and environments were significant for yield and average fruit weight. 'Sunny', 'FTE 12' and 'Hayslip' produced higher marketable yields than the other genotypes when averaged over all the studies. Each tomato genotype at the 6 locations produced more than an average of 2000 25-lb. boxes/acre except for 'Flora-Dade', 'Walter PF', and '827015-IBK', and 'D76127'. 'Duke', 'Hayslip', 'FTE 12', and 'Sunny' had the largest fruit (oz/fruit) compared with the other genotypes.**

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Most tomato cultivar performance studies in Florida generally include commercially grown cultivars and/or several advanced breeding lines. Tomato performance trials are conducted in several geographical areas of the state including Quincy in the north, Homestead in the south, Gainesville in the center, Fort Pierce in the east and Bradenton and Immokalee in the west. These areas differ in climatic and edaphic conditions and in cultural practices used by commercial tomato growers (3). Most of the past tomato performance trials have included a large number of genotypes, although some genotypes have failed to appear in each trial (1, 4). Tomato cultivar performance studies are of great interest to growers, researchers, and extension personnel. Cultivar selection is an important decision a commercial grower must make each season (2). The purpose of this investigation was to evaluate 10 tomato genotypes for marketable yield and average fruit weight (oz/fruit) at 6 Florida locations.

Materials and Methods

Tomato cultivar evaluation studies were conducted at Homestead, Bradenton, and Fort Pierce during the spring and fall seasons of 1982, Gainesville and Quincy during the spring season of 1982, and Immokalee during the fall season of 1982. Soil type and cultural practices used at each location are presented in Table 1.

'Castlehy 1035', 'Sunny', 'Duke', 'Flora-Dade', 'FTE 12', 'Hayslip', 'Walter PF', and 'Burgis', and 2 advanced breeding lines; '827015-IBK' and 'D76127' were grown at each location in a randomized complete block design with 4 replications. Three replications were used and 'Walter PF' was not included in the Immokalee study.

Weight, number, and mean fruit weight (oz/fruit) of marketable fruit were measured in each study. Number of marketable fruit and mean fruit weight was not measured in the spring study at Homestead.

Table 1. Soil type and cultural practices used for tomato performance trials.

			Plant arrangement			Fertilizer applied				
			Spacing between:			N	P_2O_5	K_2O		
Location	Season	Soil type	Beds (ft)	Plants (inches)	Rows/bed (no.)	(lb./acre)			Number of harvests	Staking[z]
Bradenton	Spring	Myakka fine sand	4.5	24	1	410	120	499	3	+
	Fall	Myakka fine sand	4.5	24	1	434	139	532	3	+
Ft. Pierce	Spring	Oldsmar fine sand	7.0	24	1	224	474	475	4	—
	Fall	Oldsmar fine sand	7.0	24	1	224	474	475	4	—
Homestead	Spring	Rockdale fine sandy loam	6.0	15	2	155	103	288	3	—
	Fall	Rockdale fine sandy loam	6.0	15	2	132	100	245	4	—
Gainesville	Spring	Mulat fine sand	4.0	18	1	165	220	220	4	+
Quincy	Spring	Ruston loamy fine sand	6.0	24	1	219	90	225	5	+
Immokalee	Fall	Immokalee fine sand	6.0	15	1	215	41	340	3	+

[z](+) or (—) indicate staked or unstaked trials, respectively.

Analysis of variance was performed on each measured variable for each study conducted. If genotypes were significant, least significant difference (LSD) values were used for mean separation.

Results and Discussion

Mean yield of marketable fruit among locations and seasons ranged from 1,082 (25 lb.) boxes/acre in the Homestead (spring) study to 3,573 25-lb. boxes/acre in the Immokalee (fall) study (Table 2). The large range in yield was perhaps due to a combination of cultural practices, climatic, number of harvests, and soil variability.

Yields of marketable fruit among genotypes were significantly different in all studies except at Homestead (spring and fall) and Gainesville (spring) studies (Table 2). Yield of marketable fruit averaged over all studies ranged from 2,426 25-lb. boxes/acre for 'Sunny' to 1,767 25-lb. boxes/acre for 'Walter PF'. 'Sunny', 'FTE 12', and 'Hayslip' had higher yield of marketable fruit than the other genotypes. Yields of marketable fruit were higher than 2,000 25-lb. boxes/acre for each genotype except for 'D76127', 'Flora-Dade', 'Walter PF' and '827015-IBK'. Mean yields of 'Sunny', 'Castlehy 1035', 'FTE 12', and 'Burgis' were higher than the average yields of all 10 genotypes in 100, 89, 67, and 67% of all the studies, respectively (Table 4). This suggests that these genotypes possess greater yield adaptability to diverse environments.

Mean weight of marketable fruit among studies ranged from 4.27 oz in Bradenton (fall) to 6.42 oz in Quincy (spring) (Table 3). Mean weight of marketable fruit was significantly influenced by genotype in all studies except in Bradenton (fall), Immokalee (fall), and Quincy (spring). 'Duke', 'Hayslip', 'FTE 12', and 'Sunny' had larger fruit size than the other genotypes. 'Duke', 'Sunny', 'FTE 12', and 'Hayslip' had larger fruit than the average fruit weight of all 10 genotypes in 75% or more of all studies (Table 4). This suggests that these genotypes produce larger fruit in a wider range of environments.

The tomato genotypes studied produced different marketable yields and fruit sizes at different locations and seasons. However, 'Sunny', 'Castlehy 1035', 'FTE 12', and 'Hayslip' were higher yielding in a greater percentage of studies and 'Duke', 'Sunny', 'FTE 12', and 'Hayslip' produced larger fruit in a greater percentage of studies than the other genotypes. Therefore, these genotypes were considered to be more adaptable to diverse locations and seasons.

Table 4. Percent of studies in which an individual genotype produced higher yields or had larger fruit than the average of all 10 genotypes.

Genotypes	Percent of studies: Fruit yield	Fruit size
'Sunny'	100	75
'FTE 12'	67	75
'Hayslip'	56	75
'Burgis'	67	0
'Castlehy 1035'	89	25
'Duke'	56	100
'Flora-Dade'	22	0
'Walter PF'	38	14
D76127	33	13
827015-IBK	44	63

Table 2. Mean yields of marketable fruit for several tomato genotypes grown at 6 locations in Florida during 1982.

Genotype	Fruit yield (25-lb. boxes/acre) Bradenton Spring	Bradenton Fall	Fort Pierce Spring	Fort Pierce Fall	Homestead Spring	Homestead Fall	Immokalee Fall	Gainesville Spring	Quincy Spring	Mean
'Sunny'	3053	2023	1460	1791	1144	1604	3587	3964	2311	2326
'FTE 12'	2839	1835	1500	1747	1083	1167	3067	3990	1978	2134
'Hayslip'	3146	1146	1294	2006	1098	1339	3176	4184	1869	2140
'Burgis'	2896	1359	1427	1951	1144	1564	2783	3407	2258	2087
'Castlehy 1035'	2988	1520	1423	2022	1333	1553	3180	2855	2197	2119
'Duke'	2652	1634	1627	1900	927	1391	2627	3742	1851	2039
'Flora-Dade'	2839	1244	979	1879	1078	1398	2095	3445	1789	1861
'Walter PF'	2929	1529	1028	1256	655	1065	—	3828	1847	1767
D76127	3081	869	956	2213	1220	1356	2697	3057	1949	1933
827015-IBK	2530	868	1710	1869	1143	1372	2123	3253	1633	1833
Mean	2895	1403	1340	1864	1082	1381	2815	3573	1968	
(LSD 5%)	366	450	350	316	NS	NS	718	NS	359	

Table 3. Average weight per fruit for several tomato genotypes grown at 6 locations in Florida during 1982.

Genotypes	Fruit weight (oz/fruit) Bradenton Spring	Bradenton Fall	Fort Pierce Spring	Fort Pierce Fall	Homestead Fall	Immokalee Fall	Gainesville Spring	Quincy Spring	Mean
'Sunny'	4.37	4.36	5.97	5.94	5.26	5.50	5.53	6.83	5.47
'FTE 12'	4.54	4.36	6.51	5.79	5.36	5.66	5.42	6.39	5.51
'Hayslip'	4.16	4.38	5.88	6.33	5.33	5.79	5.66	6.48	5.50
'Burgis'	4.37	4.18	5.83	5.49	5.22	5.31	4.97	6.38	5.27
'Castlehy 1035'	4.16	4.19	5.82	5.64	5.23	5.51	4.67	6.10	5.13
'Duke'	4.88	4.50	6.63	6.36	5.77	5.73	5.44	6.65	5.74
'Flora-Dade'	4.09	4.18	5.32	5.41	4.86	5.04	4.72	5.76	4.91
'Walter PF'	4.25	3.95	6.13	5.39	4.98	—	4.68	6.37	5.10
D76127	4.25	4.22	5.54	5.84	5.03	5.15	4.86	6.62	5.19
827015-IBK	4.67	4.34	6.84	5.80	5.17	5.29	5.29	6.80	5.52
Mean	4.37	4.27	6.04	5.85	5.22	5.44	5.10	6.42	
LSD 5%	0.36	NS	0.60	0.51	0.48	NS	0.67	NS	

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BROCCOLI CULTIVAR PERFORMANCE TRIALS IN WEST-CENTRAL FLORIDA[1]

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Abstract. **Thirty-five broccoli (**Brassica oleracea **L. Italica group) cultivars in the fall-winter 1982 season and 34 in the winter-spring 1983 season were grown in replicated trials. Entries were evaluated for marketable yield of main heads, head weight and diameter, proportion of marketable heads, days to harvest and cumulative percent of marketable yield by harvest date. In the winter-spring trial, the cultivars were also evaluated for downy mildew (**Peronospora parasitica **Pers. ex Fr.) damage. The highest yielding entry in both trials was 'Green Top' with 438 23-lb. cartons/acre of marketable heads in the fall-winter and 344 cartons/acre in the winter-spring season. 'Dandy Early,' 'Early Emerald' and 'Prominence' also had high yields in 1982. 'Green Duke,' Experimental Hybrid 45, 'Citation,' 'Prominence,' Experimental Hybrid 45-B, 'Excalibur,' 'Dandy Early,' and 'Premium Crop' had good yields in 1983. All high yielding entries had a light green bud color, small buds with bud clusters all over the head, giving them a knobby appearance. Heads were compact, deep, dome-shaped with wide angle branching. 'Green Top' had the highest head weight and the greatest proportion of marketable heads in both tests. The cultivars required 46 days from transplanting to first cut in the fall-winter and 52 days in the winter-spring sasons. For uniformity of producing mature heads, 'Cleopatra' was best in 1982 and 'Green Comet Hybrid' in 1983. The cultivars 'Shogun' and 'Green Beret' had the highest tolerance to downy mildew.**

Broccoli, a nutritious green vegetable, has grown in popularity within recent years and its consumption in Florida has increased from 5.76 million pounds in 1970 to 28.29 million pounds in 1980. As a consequence of the increase in consumer demand for broccoli, Florida growers may increase production of this crop in coming years. In crop production, the selection of best cultivar for the local conditions is 1 of the most important decisions. New broccoli cultivars are being released by seed companies and need to be evaluated in Florida with currently planted cultivars. For these reasons, replicated variety trials were conducted at the Agricultural Research and Education Center (AREC) in Bradenton to evaluate the production potential of a number of broccoli cultivars. The results of this work are reported here.

Materials and Methods

The trials were conducted in the 1982 fall-winter (October-December) and in the 1983 winter-spring (January-March) seasons. The soil, a Myakka *fine sand (Aeric* haplaquod), was prepared similarly to that used in tomato culture (2). Seven raised beds, 30 inches wide and 9 inches high, were formed on 4.5 ft centers between irrigation furrows 40.5 ft apart. Soil tests prior to land preparation indicated low levels of available plant nutrients. Starter fertilizer (bed mix) was of 649 lb. 0-20-0 (with 80 lb./ton F503 oxide micronutrients), 271 lb. of 18-0-25-2 ($N-P_2O_5-K_2O-MgO$), 774 lb. of lime (90% $CaCO_3$), and 19.4 lb. of Borax (14.5% H_3BO_3) per acre. Banded fertilizer of 18-0-25-2 at 1074 lb./acre was applied in the bed center in a narrow furrow 1½ to 2 inches deep. The total amount of nutrients in lb./acre were: 242 N, 129 P_2O_5, 336 K_2O, 390 CaO, 27 MgO and 2.81 H_3BO_3. Soil was fumigated with 66% methyl bromide + 33% chloropicrin (Dowfume® MC-33) at 348.5 lb./acre. The beds were covered with a white polyethylene mulch in the fall and black polyethylene mulch in the spring.

Seeds of 35 entries in the fall and 34 entries in the winter trials (Table 1) were sown on September 6 and December 1, respectively, for the 2 seasons, in container trays with 1 sq inch cells (TODD® Planter Flat No. 100A). The cells were filled with a 1:1 (v/v) mix of vermiculite and peat amended with superphosphate (20% P_2O_5) and KNO_3. The superphosphate contained 80 lb./ton of micronutrients (F503 oxide). Seedlings were set in the field on October 14 in 1982 and on January 4 in 1983 in 20 ft long plots, arranged in a randomized complete block with 3 replicates. Plants were set in double rows per bed, 12 inches between and 15 inches within-row spacing (32 plants per plot). Recommended pesticides were applied twice a week for disease and insect control. Despite application of fungicides, downy mildew developed in the winter-spring planting and Horsfall-Barratt ratings (3) for downy mildew were made on the plants. At harvest, the central heads greater than 2.5 inches in diameter were cut to a total length of 7 inches. Stems were closely trimmed of leaves and the weight and diameter of marketable heads were measured (4).

Results and Discussion

Fall-winter 1982. Weather and yield data for the season are summarized in Tables 2 and 3, respectively. The weather was warm and dry, with only 2.88 inches of rain recorded during the 11-wk-long growing season. 'Green Top' had the highest marketable yield with 438 23-lb. crates/acre; however, 3 other cultivars, 'Dandy Early,' 'Early Emerald,' and 'Prominence' had similar yields. The yield of 'Green Top' was equal to the reported average United States yield for broccoli (5). The largest average head, 5.24 inches, was recorded for 'Early Emerald' (Table 3). Nine other entries, 'Cleopatra,' 'Green Comet,' 'Bravo,' 'Green Top,' 'Green Duke,' 'Express Corona,' Experimental Hybrid 45-B, 'Green

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