Proc. Fla. State Hort. Soc. 98:240-244. 1985.

RESPONSE OF TOMATO BREEDING LINE 7060 AND 'HORIZON' TO NITROGEN AND POTASSIUM RATES

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Additional index words. Lycopersicon esculentum, full-bed mulch, early yield, fruit size.

Abstract. **Responses of tomato (*Lycopersicon esculentum* Mill.) breeding line 7060 and 'Horizon' were evaluated in replicated trials to 3 N (1x, 1.5x, and 2x) and 3 K rates (1x, 2x, and 4x) in Fall 1983 and Spring 1984. The 1x rate of N was 225 and the 1x rate of K was 187 lb./7500 linear bed feet (lbf). Seven beds, 30 inches wide and 9 inches high, were formed on 4.5-ft centers between irrigation furrows 40.5 ft apart. The P rate in all treatments was 66 lb./7500 lbf. Cultural system was the full-bed mulch method with seepage irrigation. In Fall 1983, yields of line 7060 were similar with the 3 N rates but increased with increasing K rates. In spring, increasing N rates reduced marketable yield and increased number of cull fruit. Early yield increased with increasing K rates but total yield was not affected by K rates. 'Horizon' yields in the fall were not affected by N rates. Yields of 5x6 and combined 5x6 and 6x6 size tomato yields were similar at the 3 K rates, but yields of 6x7 and 7x7 fruit increased with increasing K rates. In the spring, increased N rates reduced marketable yields and increased the number of cull fruits. Increased K rates reduced early yields of 5x6 fruit. For the season, marketable yields were similar at the 3 K rates. For maximum yield, low N (1x) and low to medium (1x or 2x) K rates are recommended for 'Horizon.'**

In tomato production, the quantity and ratio of N and K fertilizers applied for the crop are important in determining yields and fruit quality. In Florida, several workers have reported either no increase or a decline in tomato yields above 250 lb. N and 281 lb. K/acre (1,2,3,5,13). Response of average fruit weight to N and K rates was similar, either no increase, or a reduction, in average fruit weight with high N and K rates (2,3). High fertilizer rates increase residual salt concentrations in soil and gradually build up salt concentrations in repeatedly cropped lands (4,10). Tomato cultivars vary in efficiency of N and K utilization. For example, O'Sullivan et al. (11) investigated the efficiency of N utilization of 146 tomato strains and concluded that variation in N-efficiency, as measured by dry matter production, depended on dominance and on additive x additive gene effects. Makmur et al. (9) tested the K utilization efficiency of 156 tomato lines and found that under K-stress (5 mg K per plant), efficient lines produced 79% more dry matter than did inefficient lines. At adequate K-levels (200 mg K per plant), dry matter yields of both efficient and inefficient lines were similar.

Potassium deficiency in tomatoes caused ripening disorders, graywall and blotchy ripening. Hayslip and Iley (7) emphasized the importance of proper N/K ratios in preventing ripening disorders. Low N/K ratios in the fertilizer resulted in fewer discolored fruit than high N/K ratios. Picha and Hall (14) found differences in tomato cultivars for susceptibility to graywall. In sand culture experiments. 'Flora-Dade' was resistant to graywall at –K, 1/10 K or 1 K nutrient regimes, while 'Healani' and 'Homestead 24' had graywall at low K and no graywall at high K concentrations. Lingle and Lorenz (8) in field experiments found K-deficient tomato cultivars showing K deficiency symptoms, regardless of the amount of K applied to the soil, whereas K-efficient cultivars had no apparent K-deficiency symptoms even at low K-rates.

The objective of this study was to evaluate the yield potential of 2 advanced tomato breeding lines at various N and K rates.

Materials and Methods

Experiments were conducted during fall-winter (Sept.-Dec.) of 1983 and spring (March-May) of 1984. Soil was an EauGallie fine sand with the spodic horizon at 34 inches. In both seasons, seeds of line 7060 developed at the GCREC, Bradenton, an F_8 selection of (626 × 74VF18) with a very large fruit and 'Horizon', developed at the GCREC, Bradenton, (tested as line 7067), and F_{11} selection of (71057 × 626) were sown in wooden flats containing a processed product of spent coal. Seedlings were transplanted 14 days later into 1.5-inch planter flats (Todd model #150), containing peat and vermiculite (1:1, v:v) amended with dolomite (16.9 lb.), superphosphate (5.6 lb.) and Micromax (1.1 lb.) per cubic yard of medium. Transplants were set in field on 9 Sept. in 1983 and on 1 Mar. in 1984. Experimental design was a 3x3 factorial of N and K rates arranged in a randomized complete block and replicated 3 times. Nitrogen was applied at rates equivalent to 225, 338, and 450 lb./7500 linear bed feet (lbf) and K at 187, 374, and 747 lb./7500 lbf. Phosphorus in all treatments was 66 P lb./9500 lbf. Micronutrients (F503 oxide) were applied at 35 lb./7500 lbf. Nutrients were derived from NH_4NO_3, KNO_3, KCl (52.4% K) and superphosphate (20% P_2O_5). Cultural method was the full-bed mulch system with seepage irrigation. Seven beds, 30 inches wide and 9 inches high, were formed on 4.5-ft centers between irrigation furrows 40.5 ft apart. Superphosphate with the micronutrients and KCl was applied as bed mix in the full width of the bed. Ammonium nitrate and KNO_3 were banded in 2 inches deep furrows on each side of the bed, 12 inches from the bed center, then covered with soil. Plot size was 20 ft and plants were set 2 ft apart in the row. During the season, plants were sprayed with approved fungicides and insecticides. At harvest, fruit was graded into marketable and cull, then marketable fruits were separated into 4 sizes, 5x6, 6x6, 6x7, and 7x7. Number and weight were taken of each grade and size.

Results

Fall 1983. Freezing temperatures after the first harvest killed the plants and all fruit in the second harvest had to

Florida Agricultural Experiment Stations Journal Series No. 6977.

Table 1. Main effect of cultivars, nitrogen and potassium rates on early tomato yields. Fall 1983.

Treatment	Marketable fruit size 5x6	6x6	6x7	7x7	Total	Combined 5x6 & 6x6
Cultivar	25-lb. ctn/7500 lbf[x]					
7060	861	113	17	1	991	974
Horizon	463	270	87	10	830	733
Significance[z]	*	**	**	**	*	*
N-rate (lb./7500 lbf)						
225	695	190	39	6	930	885
338	690	204	51	6	951	894
450	607	186	73	11	877	793
Significance[z]	NS	NS	L*	NS	NS	NS
K-rate (lb./7500 lbf)						
187	606	183	45	4	838	789
374	653	188	45	8	894	841
747	733	210	73	11	1027	943
Significance[z]	NS	NS	NS	L*	L*	NS
Sign. inter.[y]						
Cv. × K	NS	NS	NS	*	NS	NS

[z]Difference is significant at the 5% (*) and 1% (**) level, or nonsignificant (NS). Significant rate effects are linear (L).
[y]Interactions are significant at the 5% (*) and 1% (**) level or nonsignificant (NS).
[x]lbf = linear bed feet.

be harvested at once. Therefore, for the second harvest and total harvest, only marketable grade yields are presented. In the first harvest, line 7060 had a higher yield of 5x6, combined 5x6 and 6x6 and total marketable fruit than 'Horizon' (Tables 1 and 2). Average weight per fruit of marketable grade for 7060 was also higher, 7.67 oz, than for 'Horizon', 5.88 oz. Nitrogen rates averaged over the 2 cultivars and 3 K rates affected yield of 6x7 fruit only, which increased linearly with increasing N rates (Tables 1 and 2). Potassium rates averaged over the 3 N rates and 2 cultivars increased linearly 7x7 and marketable fruit weights (Table 1). Number of fruit for 6x7, 7x7, combined 5x6 and 6x6 and marketable grades also increased linearly with increasing K rates (Table 2). Interactions of cultivars and K rates affected the number of 6x7, 7x7 and cull grades (Table 3) and the weight of 7x7 fruit. 'Horizon' produced a higher number of 6x7, 7x7 and cull fruits than 7060 (Table 3). Highest 6x7 and 7x7 yields for 'Horizon' was similar with all 3 K rates. The weight of 7x7 fruits of 7060 was equivalent to 1 ctn/7500 lbf at all 3 K rates, while 'Horizon' yielded 8, 29, and 51 ctn/7500 lbf of 7x7 fruit at the 1x, 2x, and 3x K rates respectively, ($LSD_{0.05}$ = 29). Cultivar response to N rates was not different, although line 7060 yields tended to decline with increasing N rates (data not presented here). Response of cultivars to K rates was quite different. Line 7060 yields for 5x6, combined 5x6 and 6x6 and marketable grades increased linearly with increasing K rates. 'Horizon' yields for the same grades were similar at all 3 K rates (Table 4). Regression equations for the line 7060 yield response (per 7500 lbf) were:

5x6 fruit, ctn = 30.65 + 4.26 (K rate) × 55.
5x6 and 6x6 fruit, ctn = 30.65 + 4.24 (K rate) × 55.
Marketable fruit, ctn = 31.38 + 4.33 (K rate) × 55.

In the second harvest, marketable yields of 'Horizon' were higher, (P = 0.01) than line 7060 yields. 'Horizon' yielded 1010 and line 7060 yielded 672 25-lb. ctn/7500 lbf. Nitrogen rates had no significant effect on fruit yields. Number of marketable fruit were affected by the interaction of cultivars and K rates (Table 3). Highest number of marketable fruit, 109.38 thousand, was recorded for 'Horizon' at the 2x K rate. Line 7060 yields were lower at all 3 K rates than 'Horizon' yields. For the season, 'Horizon' had a higher (P 0.01) marketable yield, 1840 25-lb. ctn/7500 lbf than line 7060, with 1663 25-lb. ctn. Weight per marketable fruit was higher (P = 0.01) for line 7060, 6.17 oz, than for 'Horizon', 4.74 oz. Nitrogen rates had no significant effect on yields, but cultivar response to K rates was significant (Table 4). The estimated regression for line 7060 marketable yield is:

Marketable fruits ctn/7500 lbf = 62.36 + 4.21 (K rate) × 55.

Spring 1984. In the first harvest, 'Horizon' yields were higher for all fruit sizes and grades than 7060 yields (Table 5). The number of cull fruit increased linearly with an increase in N rates according to the regression equation:

Cull no./7500 lbf (x1000) = 1.129 + 6.527 (N rate) x 0.625.

Cull fruit yields were 3.85 thousand with the 1x N, 4.62 thousand with the 1.5x and and 12.01 thousand with the

Table 2. Main effect of cultivars, nitrogen and potassium rates on early tomato yields. Fall 1983.

Treatment	Marketable fruit size 5x6	6x6	6x7	7x7	Total	Combined Cull	5x6 & 6x6
Cultivar				No./7500 lbf (× 1000)			
7060	41.39	8.59	1.64	0.14	51.69	13.38	49.91
Horizon	25.88	20.30	8.52	1.78	56.48	26.46	46.18
Significance[z]	**	**	**	**	NS	**	NS
N-rate (lb./7500 lbf							
225	34.79	14.48	3.82	1.08	54.17	21.00	49.27
338	35.14	15.04	4.90	1.08	56.16	20.97	60.18
450	30.97	13.72	7.19	1.56	53.44	17.78	44.69
Significance[z]	NS	NS	L*	NS	NS	NS	NS
K-rate (lb./7500 lbf)							
187	30.83	13.75	4.41	0.80	49.76	22.95	44.55
374	32.92	14.03	4.41	1.28	52.64	18.82	46.95
747	37.15	15.49	7.08	1.63	61.35	17.99	52.64
Significance[z]	NS	NS	L*	L*	L*	NS	L*
Sign. Inter.[y]							
Cv. × K	NS	NS	*	*	NS	*	NS

[z]Difference is significant at the 5% (*) and 1% (**) level, or nonsignificant (NS). Significant rate effects are linear (L).
[y]Interactions are significant at the 5% (*) and 1% (**) level or nonsignificant (NS).
[x]lbf = linear bed feet.

Table 3. Interaction of cultivars and potassium rates on early yield of 6x7, 7x7 and cull fruits in the 1st pick and on marketable fruit in the 2nd pick. Fall 1983.

K rate (lb./7500 lbf)	Pick 1						Pick 2	
	6x7		7x7		Cull		Marketable	
	7060	Horizon	7060	Horizon	7060	Horizon	7060	Horizon
	No./7500 lbf (× 1000)							
207	1.18	6.39	0.13	1.00	18.83	25.86	45.00	98.75
310	1.74	5.83	0.14	3.65	8.33	28.05	65.00	109.38
414	1.46	11.46	0.13	6.43	11.04	23.63	68.13	88.75
$LSD_{0.05}$	6.03		1.48		10.43		6.03	

2x N rate. Potassium rate had no significant effect on yield but the interaction of cultivar and K rate affected 5x6 fruit yield (Table 6). Yield of 5x6 fruit of line 7060 increased with increasing K rates, while 'Horizon' yields of 5x6 fruit decreased with increasing K rates. Highest yield of 5x6 fruit was recorded for 'Horizon' with the 1x K rate. Yield of cull fruit (per 7500 lbf) of both cultivars increased linearly with increasing N rates (Table 7). The equation for line 7060 cull fruit yield is:

Cull fruit no. (x1000) = 5.851 + 7.388 (N rate) × 0.625, and for 'Horizon' cull fruit yield is:

Cull fruit no (x1000) = 1.592 + 5.666 (N rate) × 0.625.

The number of cull fruit (per 7500 lbf) also increased linearly with increasing N rates with each of the 3 K rates (Table 8). For 1x K rate over N rates:

Table 4. Interaction of line 7060 and 'Horizon' tomatoes to K rates. Early yield. Fall 1983.

Cultivar	K rate (lb./acre) 187	374	747	Significance[z]
	25-lb. ctn/7500 lbf			
	Early yield			
5x6 fruits				
7060	780	807	993 L*	
Horizon	428	494	467	NS
5x6 + 6x6 fruits				
7060	893	922	1105	L*
Horizon	679	750	769	ND
Marketable fruits				
7060	906	943	1123	L*
Horizon	758	844	944	NS
	Seasonal yield			
Marketable fruits				
7060	1450	1592	1794	L*
Horizon	1755	1987	1955	NS

[z]Significance is linear at the 5% level (*) or nonsignificant (NS).

Cull no (x1000) = 0.888 + 5.0 (N rate) × 0.625.

For 2x K rate over N rates:

Cull no. (x1000) = 1.0 + 4.416 (N rate) × 0.625.

For 4x K rate over N rates:

Cull no. (x1000) = –7.5 + 10.166 (N rate) × 0.625.

For the spring season yields were affected by cultivars (averaged over the 3N and 3K rates) (Table 9). Line 7060 had a higher 5x6, combined 5x6 and 6x6 yield than 'Horizon.' The low yields of 6x7 and 7x7 fruits of line 7060 were the outstanding characteristics of this selection. N rates affected weight of 5x6, combined 5x6 and 6x6 marketable fruits (Table 9). The weight of 5x6 fruits decreased from 778 of 393 25-lb ctn per acre with increasing N rates. The estimated equation for the 5x6 fruit is:

5x6 fruit, ctn/7500 lbf = 15.995 – 2.918 (N rate) × 55.

Marketable yields also decreased from 1727 to 1179 ctn/7500 lbf according to the equation:

Marketable fruit, ctn/7500 lbf = 34.035 – 4.188 (N rate) × 55.

Potassium rates had no significant effect on total yields for the spring. Interactions of experimental factors on yield were also nonsignificant. A further analysis of the response of line 7060 and 'Horizon' to N rates for the spring season is presented on Table 10. For both 7060 and 'Horizon' carton per 7500 lbf yields of 5x6 and combined 5x6 + 6x6 fruits decreased with increasing N rates. Yield of 6x6 and marketable fruits for 'Horizon' decreased with increasing N rates, while 7x7 yields of line 7060 increased with increasing N rates. The estimated equations for 'Horizon' yields (per 7500 lbv) are:

5x6 fruit, ctn = 10.352 – 2.286 (N rate) × 55

6x6 fruit, ctn = 15.535 – 2.355 (N rate) × 55

Marketable total, ctn = 40.523 – 5.321 (N rate) × 55

Line 7060 and 'Horizon' had a decreasing number of 5x6, 6x6, combined 5x6 + 6x6 and total marketable fruits with increasing N rates in the spring (Table 10). Number of 6x7 fruits for 'Horizon' also decreased with increasing

Table 5. Main effect of cultivars on early tomato yields. Spring 1984.

Cultivar	Marketable fruit size 5x6	6x6	6x7	7x7	Total	Combined 5x6	6x6	Cull
				25-lb. ctn/7500 lbf				
7060	29	9	3	1	42	38	–	
Horizon	56	63	21	7	147	119	–	
Significance[z]	**	**	**	**	**	**	–	
				No./7500 lbf (× 1000)				
7060	4.48	0.74	0.37	0.16	2.75	5.58	2.22	
Horizon	3.03	4.95	2.50	1.18	11.66	8.08	7.98	
Significance[z]	**	**	**	**	**	**	**	

[z]Mean difference is significant at the 1% level (**).

Table 6. Interaction of cultivars and potassium rates on early yield of 5x6 fruits. Spring 1984.

K rate (lb./7500 lbf)	Cultivar			
	7060	Horizon	7060	Horizon
	25-lb. ctn/7500 lbf		No./7500 lbf (× 100)	
187	15	73	0.83	3.81
374	33	54	1.80	3.05
747	39	40	2.14	2.22
$LSD_{0.05}$	18.0		2.53	

Table 7. Effect of nitrogen rates on number of cull fruits. 1st pick. Spring 1984.

Cultivar	N rate (lb./7500 lbf)			Significance[z]
	225	338	450	
	No./7500 lbf (× 1000)			
7060	2.64	2.22	11.86	L*
Horizon	5.06	7.00	12.13	L*

[z]Significance is linear at the 5% level (*).

Table 8. Effect of nitrogen and potassium rates on the number of cull fruits. 1st pick. Spring 1985.

K rate (lb./7500 lbf)	N rate (lb./7500 lbf)			Significance[z]
	225	338	450	
	No./7500 lbf (× 1000)			
187	2.70	5.41	8.94	L*
374	5.51	3.74	11.02	L*
747	3.33	4.68	16.02	L*

[z]Significance is linear at the 5% level (*).

N rates. The number of 7x7 fruits for line 7060 and cull fruits for both tomato lines increased with increasing N rates.

The equations for cull fruit yields (per 7500 lbf) are:

Line 7060, cull fruit, no. (x1000) = 13.925 + 15.277 (N rate) × 0.625.

'Horizon' cull fruit, no. (x1000) = 37.333 + 17.166 (N rate) × 0.625.

Discussion

The genetic makeup of a cultivar determines its yield potential and its yield response to nutrient rates in the soil

Table 9. Main effect of cultivars and nitrogen rates on seasonal tomato yields. Spring 1984.

Treatment	Marketable fruit size					Combined
	5x6	6x6	7x7	7x7	Total	5x6 + 6x6
Cultivar	25-lb. ctn/7500 lbf					
7060	854	253	133	12	1252	1107
Horizon	318	596	589	140	1643	914
Significance[z]	**	**	**	**	*	**
N-rate (lb./7500 lbf)						
225	778	499	381	69	1727	1277
338	587	423	355	73	1438	1010
450	393	352	346	88	1179	745
Significance[z]	L*	NS	NS	NS	L*	L*

[z]Mean difference is significant at the 5% (*) and 1% (**) level, or nonsignificant (NS). Significance rate effects are linear (L).

(12). In the present trials, line 7060 had a much larger proportion of 5x6 fruit than 'Horizon' in both season. For maximum yields, line 7060 had a greater demand for soil K than 'Horizon.' Apparently, the very large average fruit size (7.67 oz) of this breeding line requires large amounts of soil K or this line is inefficient in K absorption or utilization. Graywall has sometimes been a problem with 7060 during the breeding program. This ripening disorder might also have been caused by the inefficient K uptake of this line. 'Horizon' yields in the 5x6 and combined 5x6 + 6x6 sizes in the fall season were similar at the 3 K rates (Table 4). In the spring, early yields of 5x6 fruits decreased with increasing K rates (Table 2). Total marketable yields of 'Horizon' in both seasons increased with increasing K rates, because the 6x7 and 7x7 size fruit yields increased with increasing K rates (Tables 3 and 4). High K rates for increased yield and better fruit quality have been recorded for greenhouse tomatoes (6) and for processing tomatoes (16). For example, in greenhouse tomatoes ('J168') increasing the K rates from 348 to 1392 lb./7500 lbf reduced the proportion of unevenly ripened fruit from 18.1 to 1.4%, irregularly shaped fruit from 17.0 to 9.0%, and hollow fruit from 56.0 to 10.0%. In processing tomatoes, increased K rates doubled the proportion of No. 1 tomatoes from 41 to 80%. The influence of K on tomato color is well documented. Trudel and Ozbun (15) found increasing amounts of carotenoids (except B-carotene) with increasing K concentrations in fruits. Lycopene in particular increased and blotchy ripening and white tissues decreased with increased K levels.

Table 10. Effect of nitrogen rates on total yield of tomatoes. Spring 1984.

N-rate (lb./7500 lbf)	Fruit size and grade													
	5x6		6x6		6x7		7x7		total		Marketable 5x6 & 6x6		Combined Cull	
	7060	Horizon	7060	Horizon	7060	Horizon	7060	Horizon	7060	Horizon	7060	Horizon	7060	Horizon
							25-lb. ctn/7500 lbf							
225	1124	433	280	717	128	634	10	128	1524	1912	1405	1105	–	
338	836	339	229	617	113	598	5	140	1183	1694	1063	956	–	
450	604	182	249	455	158	535	21	152	1032	1324	853	537	–	
Significance[z]	L*	L*	NS	L*	NS	NS	L*	L*	NS	L*	L*	L*	–	
							No./7500 lbf (× 1000)							
225	51.31	23.64	21.56	54.84	12.83	63.72	1.39	16.57	87.09	158.77	72.87	78.48	20.52	33.56
338	39.66	18.03	18.23	47.36	11.72	59.97	0.83	17.82	70.44	143.18	57.89	65.39	25.51	45.62
450	29.19	9.92	18.58	33.90	15.39	53.46	2.98	18.30	66.14	115.58	47.77	43.82	39.38	54.98
Significance[z]	L8	L*	NS	L*	NS	L*	L*	NS	NS	L*	L*	L*	L*	L*

[z]Significance is linear (L) at the 5% level (*) or nonsignificant.

Increasing N rates had little effect on tomato yields in the fall. In the spring, increasing N rates increased number of cull fruits in the first pick (Table 7) and in the total harvest for both lines (Table 10). Number of cull fruits increased with increased N rates regardless of K rates or cultivars (Table 8). High N rates reduced fruit weight and number of 5x6, combined 5x6 + 6x6 and marketable yields. The yield reduction with increasing N rates was especially important in the large fruit sizes. For example, increasing the N rate for 'Horizon' from 225 to 450 lb./7500 lbf (from 3 lb. to 6 lb./100 lbf) reduced the seasonal yields of 5x6 and combined 5x6 + 6x6 fruits by 50% (Table 10). The present studies, therefore, provide further confirmation of earlier reports on the adverse effect of high N rates on tomato yield and quality in Florida.

In summary, large differences were found in the yield response of line 7060 and 'Horizon' to K rates in fall and spring. Line 7060 had a greater demand for K than 'Horizon.' Nitrogen rates reduced the marketable yields and increased the cull grade fruits of both tomato lines. Therefore, to maximize yield and quality, 'Horizon' should be grown with low, 225 lb./7500 lbf N and low to medium, 187 to 374 lb. K rates.

Literature Cited

1. Csizinszky, A. A. 1980. Response of tomatoes to fertilizer rates and within-row plant spacing in two and four row production systems. Proc. Fla. State Hort. Soc. 92:241-243.
2. Csizinszky, A. A. and D. J. Schuster. 1982. Yield response of staked, fresh-market tomatoes to reduced use of fertilizer and insecticides. J. Amer. Soc. Hort. Sci. 107:638-652.
3. Everett, P. H. 1976. Effect of nitrogen and potassium rates on fruit yield and size of mulch-grown tomatoes. Proc. Fla. State Hort. Soc. 89:159-162.
4. Geraldson, C. M. 1976. Salt accumulation and tomato production. Univ. Fla. IFAS, AREC-Bradenton Res. Rept. GC1976-11.
5. Geraldson, C. M. 1979. Relevance of water and fertilizer to production efficiency of tomatoes and pepper. Proc. Fla. State Hort. Soc. 92:74-76.
6. Geraldson, C. M. 1985. Potassium nutrition of vegetable crops. p. 915-927. In: R. D. Munson (ed.), Potassium in Agriculture. Amer. Soc. Agr., Madison, WI.
7. Hayslip, N. C. and J. R. Iley. 1967. Influence of potassium fertilizer on severity of tomato graywall. Proc. Fla. State Hort. Soc. 80:182-186.
8. Lingle, J. C. and O. A. Lorenz. 1969. Potassium nutrition of tomatoes. J. Amer. Soc. Hort. Sci. 94:679-683.
9. Makmur, Amris, G. C. Gerloff, and W. H. Gableman. 1978. Physiology and inheritance of efficiency in potassium utilization in tomatoes grown under potassium stress. J. Amer. Soc. Hort. Sci. 103:545-549.
10. Marlowe, G. A., Jr. and C. M. Geraldson. 1976. Results of a soluble salt survey of commercial tomato fields in southwest Florida. Proc. Fla. State Hort. Soc. 89:132-135.
11. O'Sullivan, J., W. H. Goldman, and G. C. Gerloff. 1974. Variations in efficiency of nitrogen utilization in tomatoes (*Lycopersicon esculentum* Mill.) grown under nitrogen stress. J. Amer. Soc. Hort. Sci. 99:543-547.
12. Parks, W. L. 1985. Interaction of potassium with crop varieties or hybrids. p. 535-558. In: R. D. Munson (ed.). Potassium in Agriculture. Amer. Soc. Agr., Madison, WI.
13. Peraud, N., S. J. Locascio, and C. M. Geraldson. 1976. Effect of rate and placement of nitrogen and potassium on yield of mulched tomato using different irrigation methods. Proc. Fla. State Hort. Soc. 89:135-138.
14. Picha, D. H. and C. B. Hall. 1981. Influences of potassium, cultivar, and season on tomato graywall and blotchy ripening. J. Amer. Soc. Hort. Sci. 106:704-708.
15. Trudel, M. J. and J. L. Ozbun. 1971. Influence of potassium on carotenoid content of tomato fruit. J. Amer. Soc. Hort. Sci. 96:763-765.
16. Usherwood, N. R. 1985. The role of potassium in crop quality. p. 489-513. In: R. D. Munson (ed.). Potassium in Agriculture. Amer. Soc. Agr., Madison, WI.

Proc. Fla. State Hort. Soc. 98:244-247. 1985.

THE EFFECT OF BACTERICIDES, TANK MIXING TIME AND SPRAY SCHEDULE ON BACTERIAL LEAF SPOT OF TOMATO

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Additional index words. Lycopersicon esculentum, Xanthomonas campestris pv. *vesicatoria.*

Abstract. **Bactericides were compared for control of bacterial spot of tomato (*Lycopersicon esculentum* Mill.), caused by *Xanthomonas campestris* pv. *vesicatoria* (Doidge) Dye in the field from 1981 through 1984. Various Cu formulations were compared for efficacy. The commercial Cu containing compounds did not differ significantly in control of bacterial spot. Addition of mancozeb to the Cu bactericides increased their efficacy. Cu hydroxide and mancozeb tank-mixed and held for 4 hours did not give any better control of bacterial spot than the Cu-mancozeb combination that was mixed and applied immediately.**

Bacterial spot of tomato incited by *Xanthomonas campestris* pv. *vesicatoria* (referred to as XCV) is one of the most destructive diseases of tomato (*Lycopersicon esculentum*) in Florida. Control of this disease with bactericides in Florida during periods of high disease pressure often is ineffective. Streptomycin has been quite effective for control of bacterial spot during periods of low disease pressure. However, XCV developed resistance to streptomycin in Florida, and thus reduced the effectiveness as the season progressed (6). Cu compounds have also been used extensively in Florida. Stall (5) demonstrated that a number of Cu compounds were equally effective for controlling bacterial leaf spot of tomato. Conover and Gerhold (2) reported that Cu sprays, when applied without maneb or mancozeb, were ineffective for controlling XCV. Marco and Stall (4) demonstrated that many of the XCV strains were actually tolerant to Cu, but when the Cu was mixed with maneb, the Cu tolerant strains became sensitive.

Florida Agricultural Experiment Stations Journal Series No. 6967.
The authors appreciate the technical assistance of Russell Owens, Brent Wightman, Charlotte Bell, and LaVerne Barnhill.