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RESPONSE OF TOMATOES TO SEAWEED BASED NUTRIENT SPRAYS[1]

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Abstract. **Staked tomatoes** (Lycopersicon esculentum **Mill.) cvs. Hayslip and Sunny, were treated with seaweed based nutrient sprays code named B10, BM86, and MZ63 (Goemar International Corporation). Foliar sprays were applied at different rates and frequencies in 1983 spring and fall and in 1984 spring. Best results were obtained when the products were applied at 34 fl oz/acre in 50 to 100 gal/acre H_2O, depending on plant size, and sprayed 4 times during the season: 1 week after transplanting, then 3 more times at 2-week intervals beginning at first bloom. In fall 1983, 2 applications of MZ63, followed by 2 applications of BM86 sprays, increased ($P \leq 0.05$) early yield of 5 x 6 fruit by 2270 lb./acre (99%), and combined 5 x 6 and 6 x 6 yield by 2722 lb./acre (62%) over control. BM86 and MZ63 treatments alone also increased combined 5 x 6 and 6 x 6 early yields. Spray effects were equally great on the early yields of both cultivars, but total yields of 'Sunny' were higher with seaweed sprays than yields of 'Hayslip.' In a commercial field, in 1983 fall, MZ63 and BM86 sequential sprays on 'Sunny' tomatoes increased ($P \leq 0.01$) early yield of 5 x 6 fruit by 3870 lb./acre (38%), 6 x 6 yield by 3307 lb./acre (99%), and marketable yield by 12,380 lb./acre (74%) over control. In spring 1984 with 'Sunny', MZ63 sprays alone increased early and total yields. In the MZ63 treated plots for the season, 'Sunny' yielded 10,200 lb./acre (72%) more 5 x 6, 13,850 lb./acre (58%) more 6 x 6 and 13,150 lb./acre (44%) more marketable grade fruit than in control plots. With 'Hayslip,' MZ63 and BM86 sprays increased early yields, but total yields for the season were lower with seaweed sprays than with water control.**

In fresh market tomatoes, increased fruit size and large early yield usually results in a greater return and profit for the grower. Unfortunately, there are only a few cultural and nutritional methods by which tomato fruit size and proportion of the early yield can be increased (5, 8). Soil amendments, seed treatments and foliar sprays were also evaluated to increase tomato yields and fruit size (1). In a previous experiment (6), kinetin spray applied 1 week after transplanting increased the number of flower clusters with fruit set and, at a high P rate, also increased 5 x 6 and 6 x 6 fruit yield and total marketable yield. Seaweed based products have been used in the U.S. and elsewhere to increase crop yields or to extend shelf life of fruits. For example, in South Carolina seaweed sprays increased potato yields by 37% and corn yields by 56% (2). Three applications of seaweed preparations (1 gal seaweed extract in 100 gal water) extended shelf life of peaches from sprayed trees (10). In cucumbers a seaweed solution (Kelpak 66), applied as a root dip or as a weekly foliar spray, increased overall dry mass and root growth (9). In all cases the responses were thought due to plant hormones, auxins, gibberellins and cytokinins, present in the seaweed extract (2, 9). There is no published work in Florida on the effect of seaweed based sprays on staked, fresh market tomatoes. Studies were initiated therefore to investigate the effect of seaweed sprays on tomato yields.

Materials and Methods

Experiments were conducted in 1983 spring and fall and in 1984 spring at the Gulf Coast Research and Education Center-Bradenton, and at 2 commercial farms (Farm A and Farm B) in Hillsborough County in 1983 spring and 1983 fall. At all 3 locations soil was EauGallie (Aeric haploquod) fine sand. Seaweed preparations designated B10, BM86, and MZ63 (Table 1) were obtained from Goemar International Corp., Atlanta, GA.

Experiments at GCREC-Bradenton—1983 spring. Experimental design was a split-plot, arranged in a randomized complete block with 4 replications. Main plots, 40 ft long, were spray treatments and sub-plots, 20 ft long, were 2 tomato cultivars—'Sunny' and 'Hayslip'. Plots were established on 30-inch wide and 9-inch high beds, formed on 4.5 ft centers with irrigation furrows 40.5 ft apart (7 beds between irrigation furrows). Nutrients applied (in lb. per acre) were: 325 N, 70.8 P, 540 K, 22.3 Mg, 0.97 B, 0.97 Cu, 5.84 F, 2.43 Mn, 0.066 Mo and 2.27 Zn. Nutrients were derived from KNO_3, 18-0-20.75-1.21 (N-P-K-Mg) isobutylidene diurea (IBDU) and superphosphate (0-8.74-0) which also contained 80 lb./ton micronutrients (F503 oxide). Ten percent of the N and K fertilizers and all of the superphosphate with the micronutrients were broadcast full width of the bed, then incorporated 3-4 inches deep. Ninety percent of the N and K fertilizers were banded in 2 narrow, 1½ to 2-inch deep furrows on each half of the bed, 12 inches from the center. Soil was fumigated with 66% methyl bromide and 33% chloropicrin at 350 lb./acre. The beds were covered with a black polyethylene mulch. Five-week-old containerized tomato seedlings (Todd Planter flat No. 100A) were received from a commercial source and were set at 30-inch

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Table 1. Acidity and mineral concentration of seaweed based nutrient sprays.[z]

Product	pH	Seaweed paste	Minerals							
			N	Mg	S	B	Cu	Mn	Mo	Zn
		oz/gal								
B10	7.2	40	—[y]	—	—	2.14	—	—	—	—
BM86	6.2	21.4	5.34	3.86	3.20	2.64	—	—	0.013	—
MZ63	5.9	40	5.34	3.86	5.98	—	1.04	2.10	—	3.15

[z]Obtained from Goemar International Corp., Atlanta, GA.
[y]Not determined.

spacing in the row. Insecticides and fungicides were applied once per week. Seaweed based BM86 spray was applied 6 times during the season as follows: on the day of transplanting (March 9), then 5 more times in 14-day intervals. Rate of application was 34 fl oz per acre in 53 to 88 gal water, depending on plant size. The spray was applied by a hand sprayer with a fan nozzle at 45 lb./sq inch pressure. Control plots were sprayed with tap water. Fruits were picked on June 13 and 21, separated into marketable and cull, and then were graded into 4 sizes (5 x 6, 6 x 6, 6 x 7, and 7 x 7).

Farm A—1983 spring. 'Sunny' tomato seedlings were set at 28-inch in-row spacing in a 5-acre block on February 15. Beds, 36-inches wide and 11-inches high, were formed on 6-ft centers. Soil was not fumigated since the land had not been cropped previously. Irrigation was by the seepage system. Fertilizer sources and N and K rates were the same as at GCREC-Bradenton. Phosphorous was applied at 80.8 lb./acre P at the farm and 25% of the N and K was applied in the bed mix and 75% was banded. BM86 and MZ63 were applied as follows: BM86 on February 22, March 9, April 4, and April 26; MZ63 on March 15, May 10 and May 27. The MZ63 was applied at 13 fl oz and the BM86 was applied at 68 fl oz/100 gal water. Sprays were applied by a commercial boom type sprayer at 200 lb./sq inch pressure. The seaweed concentrate was mixed in with pesticides and applied during the regular pesticide spray program. Fruits were picked on May 20, June 2 and June 30 from 4 randomly selected 24 ft long plots (10 plants per plot). Control plots were selected from an adjacent 5-acre block. Fruits were graded as described above.

GCREC-Bradenton, 1983 fall and 1984 spring. Experimental design, cultivars and fertilizer rates were as described for GCREC-Bradenton for 1983 spring. Spray treatments were: water control, 'B10,' BM86, MZ63, MZ63 + 'B10,' and MZ63+ BM86. Sprays, 34 fl oz seaweed solutions in 53-88 gal water per acre, depending on plant size, were applied 4 times during the season: 1 week after transplanting (August 29, 1983 and February 24, 1984), then 3 more times at 2-week intervals beginning at first bloom. In the combination sprays, the MZ63 was applied in the first 2 treatments, then B10 or BM86 sprays were applied in the third and fourth treatments. Fruit was picked 4 times at weekly intervals, beginning on November 9 in 1983 and 3 times at weekly intervals, beginning on May 8 in 1984.

Farm B—1983 fall. 'Sunny' tomato seedlings were set at 36-inch in-row spacing in a 40-acre block on August 20. Plant bed arrangement, fertilizer rates and sources and irrigation was as described for Farm A. Seaweed spray combination MZ63 + BM86 was applied at 34 fl oz/acre in 53-100 gal H_2O with a commercial boom type sprayer on August 27 (MZ63), September 10 (MZ63), October 1 (BM 86) and October 13 (BM86). Fruits were picked from six 18-ft long plots on November 5 and 25, and December 12. Control plots were from an adjacent 40-acre nontreated block. Fruits were graded as described above.

Results and Discussion

GCREC-Bradenton—1983 spring. BM86 sprays, averaged over 2 cultivars and 4 replications, increased ($P \leq 0.05$) 5 x 6 yield by 3700 lb./acre, combined 5 x 6 and 6 x 6 yield by 4300 lb./acre and marketable yield by 4200 lb./acre over the control in the first pick (Table 2). The effect of BM86 treatment was greater on 'Hayslip' than on 'Sunny,' which had a 16% yield increase compared to control. In the second pick, yields were not significantly different with or without BM86 sprays. Yields in the total harvest (picks 1 and 2) were also not different with BM86 or with water sprays. Thus, BM86 sprays increased yields and fruit size only in the first pick. The effect of BM86 sprays was due to a large number of fruits harvested (Table 3) and to a slightly larger and heavier fruit size.

Farm A—1983 spring. MZ63 and BM86 sprays reduced ($P \leq 0.05$) the amount of cull fruits in the first and second picks and in the total harvest (Table 4). Although marketable fruit yields with the seaweed treatments exceeded marketable yields in control plots in each of the 3 picks, yield differences were significant only in the third pick.

GCREC-Bradenton—1983 fall. Averaged over 2 cultivars and 4 replications in the first pick, MZ63 and BM86 sequential treatment, increased ($P \leq 0.05$) 5 x 6 yield compared to control (Fig. 1). Tomato yields in plots treated with B10, BM86 or MZ63 had lower but statistically similar yields compared to the MZ63 and BM86 treatment. MZ63 and B10 sequential sprays did not increase 5 x 6 yields over control. The yield increase of 5 x 6 size fruit with MZ63 and BM86 sprays over control in the first pick was 99% or 2270 lb. The yield with the MZ63 and BM86 sprays in the first pick for 5 x 6 size fruit was greater than the combined yields in the first and second pick of 5 x 6 size fruit in the control plots (Fig. 2). However, in the second, third, and fourth picks and for the season, yield of 5 x 6 size fruit was not different with any of the seaweed

Table 2. Effect of BM86 spray on tomato yield (lb./acre), GCREC-Bradenton, spring 1983.

Treatment	Fruit yield (lb./acre)[z]							
	Grade				Total marketable	Cull	Total marketable + cull	Grade 5x6 + 6x6
	5x6	6x6	6x7	7x7				
	1st pick							
BM86	22,139	5,780	482	98	28,499	11,489	39,988	27,919
Control	18,402	5,165	660	71	24,298	8,884	33,182	23,567
$F_{0.05}$[y]	*	NS	NS	NS	*	NS	NS	*
	2nd pick							
BM86	7,939	12,613	3,711	1,151	25,414	21,908	47,322	20,522
Control	6,663	14,736	5,629	1,900	28,928	21,693	50,621	21,399
$F_{0.05}$[y]	NS	NS	NS	NS	NS	NS	NS	NS
	Total harvest							
BM86	30,078	18,393	4,193	1,249	53,913	33,397	87,310	48,471
CONTROL	25,065	19,901	6,289	1,971	53,226	30,577	83,803	44,966
$F_{0.05}$[y]	NS	NS	NS	NS	NS	NS	NS	NS

[z]Average over 2 cultivars and 4 replications.
[y]F value is significant (*) or non-significant (NS) at the 5% level.

Table 3. Effect of BM86 spray on tomato fruit number. GCREC-Bradenton. Spring 1983.

Treatment	Fruit yield (no./acre x 1000)[z] Grade 5x6	6x6	6x7	7x7	Total marketable	Cull	Cull + marketable	Grade 5x6 + 6x6
	1st pick							
BM86	42.00	16.19	2.13	0.63	60.95	24.63	85.58	58.19
Control	35.19	14.13	2.56	0.44	52.32	19.81	72.13	49.32
F value[y]	*	NS	NS	NS	NS	NS	NS	NS
	2nd pick							
BM86	15.88	34.94	14.63	6.50	71.95	85.19	157.14	50.82
Control	15.00	42.25	21.81	10.38	89.44	83.25	172.69	57.25
F value[y]	NS	NS	NS	NS	NS	109.81	NS	NS
	Total harvest							
BM86	57.88	51.13	16.76	7.13	132.90	109.81	242.72	
Control	50.19	56.38	24.37	10.82	141.76	103.06	245.19	109.01
F value[y]	NS	NS	NS	NS	NS	NS	NS	NS

[z]Average of 2 cultivars and 4 replications.
[y]F value is significant at the 5% (*) level or non significant (NS).

Table 4. Effect of MZ63 and BM86 sprays on 'Sunny' tomato yields, Farm A, spring 1983.

Treatment	Fruit yield (lb./acre)[z] Grade 5x6	6x6	6x7	7x7	Total marketable	Cull	Total marketable + cull	Grade 5x6 + 6x6
	1st pick							
MZ63 and BM86	12,008	4,731	1,891	316	18,945	7,493	26,439	16,739
Control	10,673	3,920	1,335	216	16,144	24,895	41,039	14,593
$F_{0.05}$[y]	NS	NS	NS	NS	NS	*	*	NS
	2nd pick							
MZ63 and BM86	9,330	6,251	3,118	617	19,370	18,752	38,122	15,581
Control	8,983	5,873	2,832	432	18,120	41,325	59,445	14,856
$F_{0.05}$[y]	NS	NS	NS	NS	NS	*	NS	NS
	3rd pick							
MZ63 and BM86	2,817	3,619	3,388	1,412	11,236	26,354	37,590	6,436
Control	756	1,520	2,099	1,250	5,625	29,109	34,734	2,276
$F_{0.05}$[y]		*	NS	NS	*	NS	NS	*
	Total harvest							
MZ63 and BM86	24,155	14,601	8,397	2,399	49,552	52,599	102,151	38,756
Control	20,412	11,313	6,266	1,898	39,889	95,329	135,218	31,725
$F_{0.05}$[y]	NS	NS	**	NS	NS	*	NS	NS

[z]Average of 4 replications.
[y]F value is significant (*) or non-significant (NS) at the 5% level.

sprays from control. Yield of combined 5 x 6 and 6 x 6 fruits in the first pick (Fig. 2) was also highest ($P \leq 0.05$) with MZ63 + BM86 treatment, followed by BM86 and MZ63 sprays. Plots treated with B10 and MZ63 + B10 had similar yields to control. Again, yield differences for 5 x 6 and 6 x 6 fruits were significant in the first pick only. Marketable yields with seaweed treatments were not different from control yields in any of the 4 picks (Fig. 3). When yields were tabulated separately for the 2 cultivars, data indicated a different response by 'Hayslip' and 'Sunny' to the spray treatments (Tables 5 & 6). 'Hayslip' 5 x 6 size yields in the first pick were increased by 3 of the seaweed based sprays, MZ63 + BM86 and MZ63 (Table 5). Yields of 5 x 6 and 6 x 6 and marketable fruits in the first pick were increased by all of the 5 seaweed sprays. For the total harvest, only MZ63 + BM86 spray increased 5 x 6 fruit yields. All other treatments had no effect or reduced yields for 'Hayslip'. In contrast, 'Sunny' yields in the first pick were increased by all 5 spray treatments (Table 6). Yield increase was greatest (95%) for the 5 x 6 size fruit with the MZ63 + BM86 spray. For the season's total, MZ63 + BM86 sprays increased 5 x 6, 5 x 6 + 6 x 6 and marketable yields and 'B10' spray increased 5 x 6 yields. None of the 5 seaweed sprays caused a reduction in marketable yields in 'Sunny' compared to control.

Farm B—1983 fall. MZ63 + BM86 sprays in the first pick increased ($P \leq 0.01$) 'Sunny' yields for all marketable grades. For example, combined 5 x 6 and 6 x 6 yield was 8680 lb./acre (58%) and marketable yield was 12,380 lb./acre (74%) higher in the seaweed treated land than in the control land (Table 7). Cull fruit yields in the seaweed treated and control lands were not different. In the second and third pick, yields in the control plots were higher than in the seaweed spray treated plots. The higher yields of 'Sunny' with the seaweed sprays in the first pick were due to a larger number of fruit and not to a larger weight per fruit (Table 8). Thus, MZ63 + BM86 sprays in the fall 1983 season had the same effect on 'Sunny' tomato yields in both small and large scale experiments, viz: increasing early yield, with the greatest increase in the volume of 5 x 6 and 6 x 6 grades.

GCREC-Bradenton—spring 1984. Tomato yields aver-

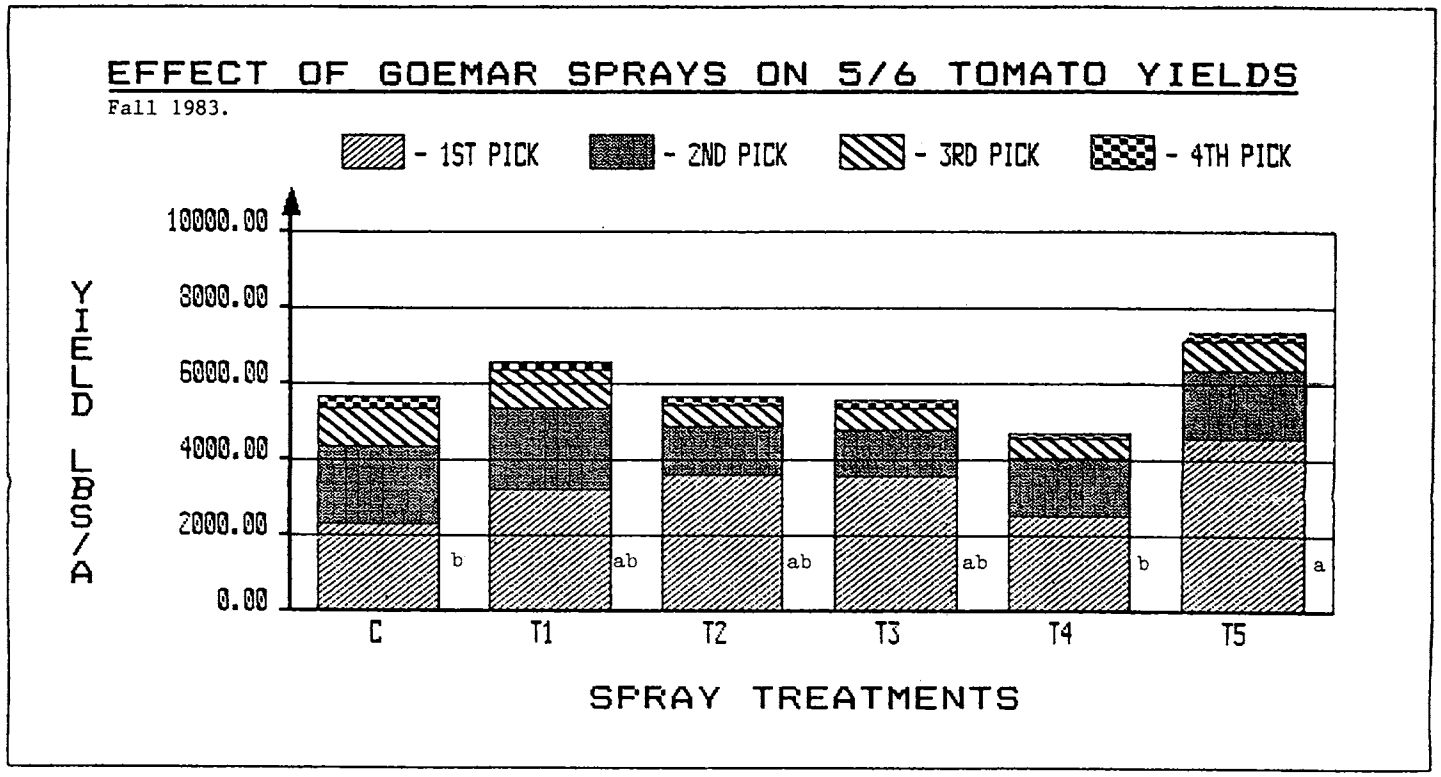

Fig. 1. Effect of seaweed-based sprays (Goemar International, Inc.) on 5x6 tomato yields. C = control; T_1 = B10; T_2 = BM86; T_3 = MZ63; T_4 = MZ63 + B10; T_5 = MZ63 + BM86. Average of 2 cultivars and 4 replications. Mean separation between columns for the 1st pick by Duncan's multiple range test at the 5% level.

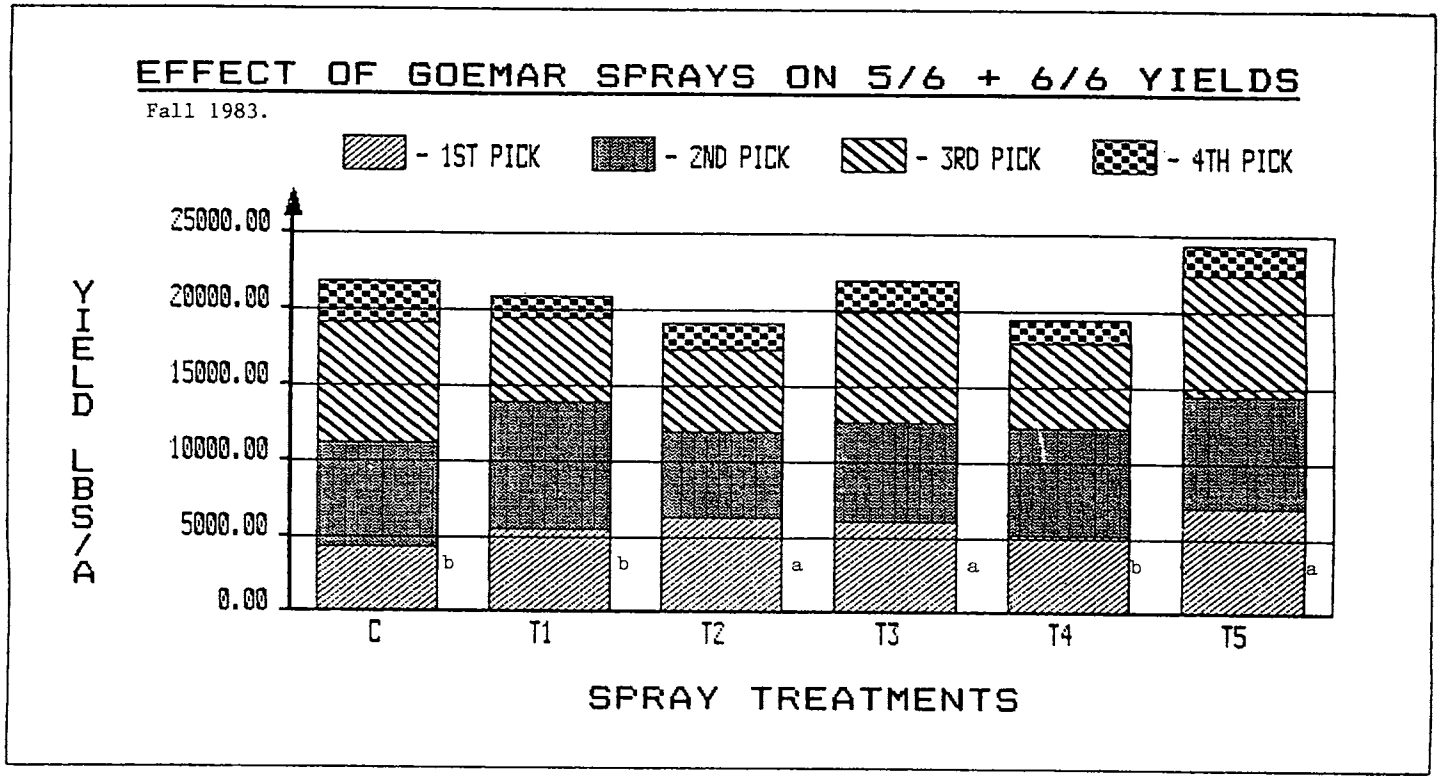

Fig. 2. Effect of seaweed-based sprays (Goemar International, Inc.) on 5x6 + 6x6 tomato yields. C = control; T_1 = B10; T_2 = BM86; T_3 = MZ63; T_4 = MZ63 + B10, T_5 = MZ63 + BM86. Average of 2 cultivars and 4 replications. Mean separation between columns for the 1st pick by Duncan's multiple range test, at the 5% level.

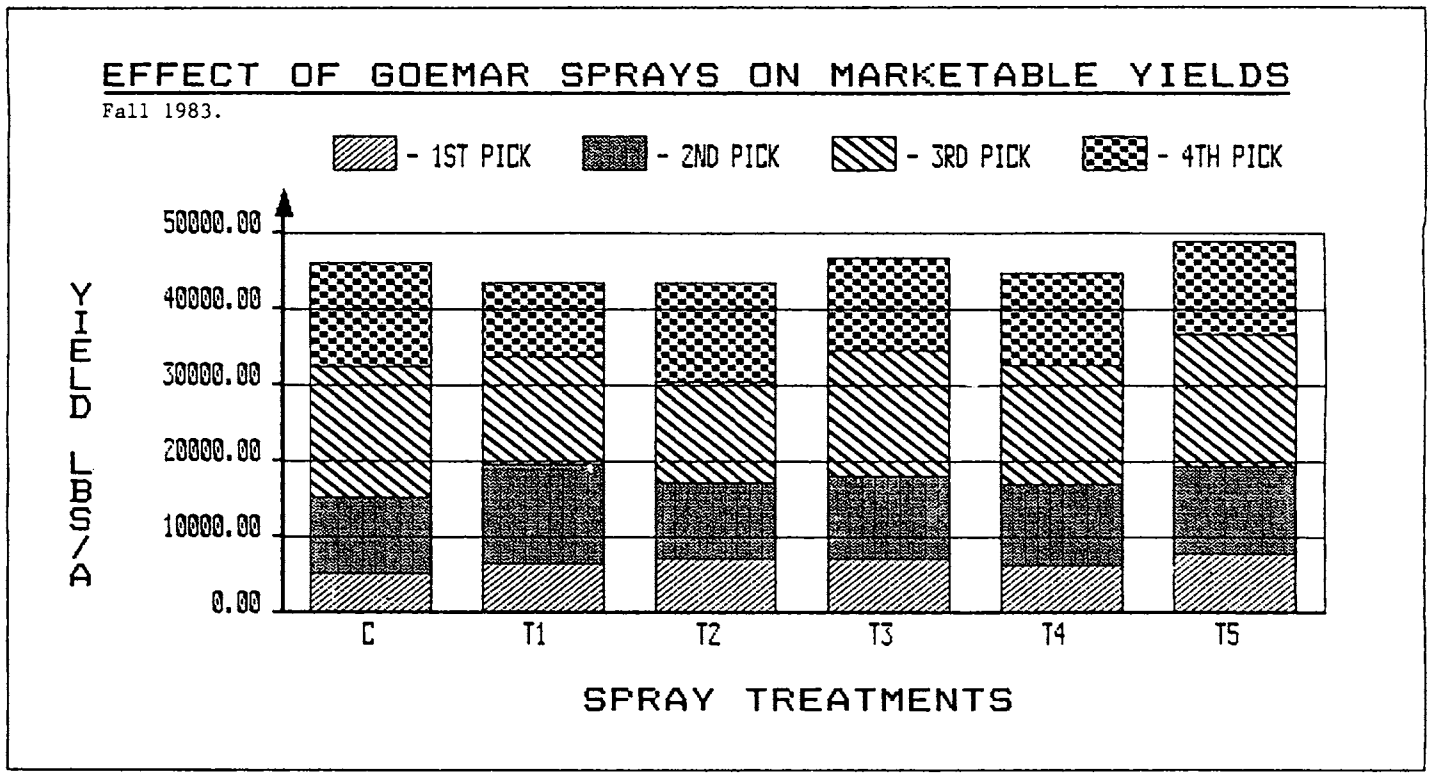

Fig. 3. Effect of seaweed-based sprays (Goemar International, Inc.) on marketable tomato yields. C = control; T_1 = B10; T_2 = BM86; T_3 = MZ63; T_4 = MZ63 + B10; T_5 = MZ63 + BM86. Average of 2 cultivars and 4 replications.

Table 5. Effect of seaweed based nutrient sprays on 'Hayslip' tomato yields (lb./acre)[z,y], GCREC-Bradenton, fall 1983.

Fruit size and grade	Spray treatment					
	Control	B10	BM86	MZ63	MZ63 and B10	MZ63 and BM86
First pick:						
5x6	2255	2189	3680	3605	2074	4571
	(100)	(97)	(163)	(160)	(92)	(203)
5x6 and 6x6	3273	3955	5311	5635	3955	6672
	(100)	(121)	(162)	(172)	(121)	(204)
Marketable	3716	4277	6178	6531	4478	7217
	(100)	(115)	(166)	(176)	(121)	(194)
Total harvest:						
5x6	6200	5295	6195	5805	4413	7160
	(100)	(85)	(100)	(94)	(71)	(116)
5x6 and 6x6	22403	19620	18960	21953	17648	23290
	(100)	(86)	(85)	(98)	(79)	(104)
Marketable	49614	40233	40243	43438	39594	45341
	(100)	(81)	(81)	(88)	(80)	(91)

[z]Average of 4 replications.
[y]Yield difference (%) compared to control in brackets (control = 100%).

aged over the 2 cultivars and 4 replications, were not different with seaweed sprays from control. MZ63 sprays increased 5 x 6 yields by 2500 lb./acre (16%) and combined 5 x 6 and 6 x 6 yields by 3610 lb./acre (13%) compared to control. B10 spray treatments reduced tomato yields. The effect of seaweed sprays on the 'Hayslip' and 'Sunny' tomatoes in spring 1984 were similar to that of fall 1983 at the GCREC-Bradenton trials: in the first pick, MZ63 + BM86 sprays increased 5 x 6, 5 x 6 and 6 x 6 and marketable yields of 'Hayslip' over control by 22%, 29% and 24%, respectively for the 3 grades. For the season's total, however, seaweed sprays had no effect on 'Hayslip' yields. 'Sunny' again had a greater response to seaweed sprays than 'Hayslip.' All sprays except the B10 spray increased 'Sunny' yields over control (Table 9). Yield increase in this season was especially great with the MZ63 spray; 10,200 lb./acre (72%) for 5 x 6, 13,850 lb./acre (58%) for 6 x 6 and 13,150 lb./acre (44%) more marketable fruit over control. The higher early yields and especially the higher yields in the 5 x 6 and 6 x 6 grades with seaweed sprays in the experiments reported here, may be due to hormonal actions in the seaweed sprays or to an unknown biochemical promoting increased endogenous hormonal activity in the plant as suggested by Nelson and Van Staden (9). Auxins, gibberellins and cytokinins are known to increase fruit size by increasing cell size, cell numbers or both (3, 4). All 3 plant hormones are present in seaweeds and affected potato, corn, pepper, banana and orange yields (2). The added mineral nutrients in the seaweed sprays (Table 1) in the experiments reported here, may not have had an important role in the increase in

Table 6. Effect of seaweed based nutrient sprays on 'Sunny' tomato yields (lb./acre)[z,y], GCREC-Bradenton, fall 1983.

Fruit size and grade	Spray treatment					
	Control	B10	BM86	MZ63	MZ63 and B10	MZ63 and BM86
First pick						
5x6	2335	4241	3528	3526	2921	4549
	(100)	(182)	(151)	(151)	(125)	(195)
5x6 and 6x6	5451	7068	7253	6480	6438	7494
	(100)	(140)	(133)	(119)	(118)	(137)
Marketable	6499	8369	8392	7781	7893	8575
	(100)	(129)	(129)	(120)	(121)	(132)
Total harvest:						
5x6	4483	7240	4680	4725	4283	6960
	(100)	(161)	(104)	(105)	(96)	(155)
5x6 and 6x6	20046	21158	18658	21098	20118	24253
	(100)	(106)	(93)	(105)	(100)	(121)
Marketable	41579	44628	44441	48171	47559	52168
	(100)	(107)	(107)	(116)	(114)	(126)

[z]Average of 4 replications.
[y]Yield difference (%) compared to control in brackets (control = 100%).

Table 7. Effect of MZ63 and BM86 sprays on 'Sunny' tomato yields, Farm B, fall 1983.

Treatment	Fruit yield (lb./acre)[z]							
	Grade				Total marketable	Cull	Marketable + Cull	Grade 5x6 + 6x6
	5x6	6x6	6x7	7x7				
1st pick								
MZ63 and BM86	13,888	9,679	4,906	548	29,021	2,606	31,527	23,567
Control	10,021	4,862	1,599	157	16,639	2,747	19,386	14,883
F value[y]	**	**	**	**	**	NS	**	**
2nd pick								
MZ63 and BM86	7,182	7,504	6,424	1,772	22,882	2,429	25,311	14,686
Control	10,984	8,712	5,921	826	26,443	1,321	27,764	19,696
F value[y]	*	NS	NS	**	NS	**	NS	*
3rd pick								
MZ63 and BM86	455	2,529	4,866	2,892	10,742	2,538	13,280	2,984
Control	1,208	3,254	5,063	2,397	11,922	1,591	13,513	4,462
F value[y]	**	*	NS	NS	NS	NS	NS	**
Total harvest								
MZ63 and BM86	21,525	19,712	16,196	5,212	62,645	7,573	70,218	41,237
Control	22,213	16,828	12,583	3,380	55,004	5,659	60,663	39,041
F value[y]	NS	NS	**	*	*	NS	*	NS

[z]Average of 6 replications.
[y]F value is significant at the 1% (**) and 5% (*) level of probability or non-significant (NS).

Table 8. Number of fruit per acre of 'Sunny' tomatoes treated with MZ63 and BM86 sprays. Farm B. Fall 1983.

Treatment	Fruit yields (no./acre x 1000)[z]							
	Grade				Total marketable	Cull	Marketable + Cull	Grade 5x6 + 6x6
	5x5	6x6	6x7	7x7				
1st pick								
MZ63 and BM86	42.74	40.90	26.70	3.79	113.32	11.46	124.78	82.83
Control	29.20	20.25	8.23	0.97	58.65	8.23	66.88	49.45
F value[y]	*	**	**	**	**	NS	**	**
2nd pick								
MZ63 and BM86	22.83	31.62	35.17	10.00	99.62	15.89	115.51	54.45
Control	33.80	36.06	31.30	5.56	106.72	7.10	113.82	69.86
F value[y]	*	NS	NS	**	NS	*	NS	NS
3rd pick								
MZ63 and BM86	1.53	11.46	26.78	19.93	59.70	20.49	80.19	12.99
Control	4.03	13.63	27.75	16.62	62.03	13.47	75.50	17.66
F value[y]	**	NS	NS	NS	NS	NS	NS	NS
Total harvest								
MZ63 and BM86	67.10	83.17	88.65	33.72	272.64	47.84	320.48	150.27
Control	67.03	69.94	67.28	23.15	227.10	28.80	256.20	136.97
F value[y]	NS	NS	*	*	NS	*	*	NS

[z]Average of 6 replications.
[y]F value is significant at 1% (**) and 5% (*) level or non-significant (NS).

Table 9. Effect of seaweed based nutrient sprays on 'Sunny' tomato yields (lb./acre)[z,y] GCREC-Bradenton, spring 1984.

Fruit size and grade	Spray treatment					
	Control	B10	BM86	MZ63	MZ63 and B10	MZ63 and BM86
First pick:						
5x6	1508	1210	2056	2456	1731	1756
	(100)	(80)	(136)	(163)	(115)	(116)
5x6 and 6x6	1819	1623	2596	3084	2233	2153
	(100)	(89)	(143)	(170)	(123)	(118)
Marketable	1847	1656	2646	3189	2261	2178
	(100)	(90)	(143)	(173)	(122)	(118)
Total harvest:						
5x6	14209	11477	21262	24438	19200	13418
	(100)	(81)	(150)	(172)	(135)	(94)
5x6 and 6x6	23762	19051	33560	37613	34085	26741
	(100)	(80)	(141)	(158)	(143)	(112)
Marketable	29688	24079	40410	42842	39882	32262
	(100)	(81)	(136)	(144)	(134)	(109)

[z]Average of 4 replications.
[y]Yield difference (%) compared to control in bracket (control = 100%).

early yield and fruit size. In previous studies at this center (7), minerals supplied by the BM86 spray alone, did not increase yield or fruit size of fall and spring tomatoes. Further studies will be needed to evaluate the effect of seaweed concentrations and timing of application with plant growth stages on tomato yields.

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SEVERITY OF BACTERIAL SPOT (XANTHOMONAS CAMPESTRIS PV. VESICATORIA (Doidge)Dye) ON LEAVES AND FRUIT OF FLORIDA GROWN TOMATO CULTIVARS[1]

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Abstract. **Florida grown tomato** (Lycopersicon esculentum **Mill.) cultivars, 'Sunny', 'Duke', 'FTE-12', 'Hayslip', 'Flora-Dade', 'Walter', and 'Independence', new IFAS cultivar releases 'Horizon' and 'Suncoast'; and heat-tolerant breeding line 7106 were compared to 'Campbell 28' ('C-28') for bacterial spot** (Xanthomonas campestris **pv.** vesicatoria **Doidge) Dye) (XCV) tolerance in the summer of 1983. Four blocks with 5 plant plots of each cultivar were inoculated by spraying a suspension of XCV containing 10^8 colony forming units (c.f.u.)/ml. Leaves were rated for disease incidence twice during the season, and the percentage fruit spot was determined afterwards. The Florida grown cultivars had significantly more foliar disease than 'C-28' for the combination rating derived from the 2 rating periods. All Florida grown cultivars had similar foliage infection for the first rating, but 'Flora-Dade' had greater disease incidence than the other cultivars for the second rating. For the combination rating, all Florida grown cultivars had similar disease ratings except for 'Flora-Dade' which had more disease than all cultivars except 'Suncoast', 'Duke', and 'Independence'. 'Flora-Dade' had significantly greater fruit spot (33.0%) than all other cultivars except Hayslip (23.8%) and Suncoast (8.9%). There were no significant differences in fruit spot between any other cultivars. There were significant correlations between fruit and foliar infection, but r^2 values were less than 0.35.**

Bacterial spot incited by *Xanthomonas campestris* pv. *vesicatoria* (Doidge) Dye (XCV) causes significant losses to Florida tomato growers every year (6, 8). None of the cultivars presently grown in Florida have appreciable tolerance to the disease, and control measures (1, 5) are often inadequate in preventing crop losses. Growers often feel

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