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Response of Mulched Tomato to Meister Controlled-Release Fertilizers 98-08

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Materials and Methods

Research with tomato response to Meister controlled-release fertilizer was carried out at the University of Florida's Horticultural Research Unit in Gainesville, Florida during the spring season of 1997. The objectives were to field test polymer-coated Meister fertilizer, to determine if rates of fertilizer for tomato could be reduced through use of controlled-release fertilizer, and to determine best placement for the fertilizer.

The soil used for the research was an Arrendondo fine sand that tested medium-low in K, high in P, Mg, Ca, and micronutrients, and with a pH of 6.2. The soil was plowed and disked in preparation for fertilization and bedding for the tomato trial. Beds were formed on 4-ft centers with a combination rototiller and bed press. Final beds were 6 inches in height and 24 inches across the top.

Fertilizer treatments were formulated by weighing out the appropriate amount of fertilizer to be manually applied to the soil. Fertilizer treatments were either Meister (19-5-14; $N\text{-}P^2O^5\text{-}K^2O$) or a mixture of ammonium nitrate and potassium chloride (soluble). Three rates of fertilizer, based on N rate were used, 75, 125, and 175 (recommended rate) lbs/acre. Two placement options, broadcast-incorporated in the bed and banded in a wide band on the surface of the bed and rototilled into the soil. For the band treatment, the fertilizer was spread in a 4-inch wide band on the surface in the middle of the bed and rolled (pressed) into the surface of the soil so the granules would not be moved by the mulch laying machine. Since tomatoes were grown in single-row fashion on the bed, then transplants were placed to the side of the band of fertilizer and not in the center.

Two additional fertilizer treatments, zero N and zero K, were formulated from potassium chloride and ammonium nitrate only, respectively. The fertilizer for these treatments was broadcast and incorporated.
Following fertilization, the beds were covered with black polyethylene mulch (Sonoco, Mt. Olive, NC) 0.75 mil. thick. During the mulching operation, drip irrigation tubing (Chapin Watermatics, Watertown, NY) with 12-inch emitters, 0.5 gal/100 ft/min and 10 mil. thick walls, was placed on the center surface of the bed.
Experimental plots were 20 ft in length. On 22 March 'Agriset 761' (Agrisales, Inc., Ft. Myers, FL) tomato plants were transplanted through the mulch.

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Tomatoes were irrigated by drip irrigation to maintain soil moisture tension at -10 cb on a tensiometer with the ceramic tip placed 6 inches deep in the soil in the root zone. Diseases and insects were controlled by timely applications of labeled pesticides. Tomatoes were free of diseases and insect problems throughout the season.

Tomato fruits were harvested when they reached the mature-green maturity stage. Harvest dates were 10, 17, and 24 June 1997. Fruits were graded on Kerian roller sizer into extra large, large, and medium sizes, counted and weighed. All data were analyzed by analysis of variance.

Results

Main effect for fertilizer, placement, and N rate are presented in Table 1. However, some factors interacted in their effects on certain fruit yield variables for some harvests. These interaction effects are presented in Table 2, Table 3, Table 4 and Table 5.

First (early) harvest. Yields of all grades of tomato and marketable fruit totals were similar across N rates (Table 1). Production of marketable fruits with any N rate was twice that with zero N or zero K. Most of the marketable fruits were in the extra large grade category.

Fertilizer material and placement interacted in their effects on yields of all fruit grade categories and total marketable fruits of first harvest (Table 1). With soluble fertilizer, yield of extra large fruits was greater with broadcast placement whereas with Meister, yield was better with band placement (Table 2). This type of response was repeated for large, medium, cull, and total marketable grade categories (Table 2). The exceptions were large and cull fruits with Meister where placement was not significant. These results might indicate the possibility of soluble salt injury with band placement of soluble fertilizer. Some soluble salt injury was observed on plants with banded soluble fertilizer. In most cases, yields with Meister fertilizer were greater than yields with soluble fertilizer.

Second harvest. There were no significant interactions for second-harvest yield variables. Fruit production was nearly two-fold greater in each size category with Meister fertilizer compared to soluble fertilizer (Table 1). Placement had no effect on fruit production in the second harvest. Fertilization rate affected extra large fruit yield but not yields for any other size category. Yield of extra large fruits were increased with fertilization rate. Fruit yields with the lowest rate of Meister fertilizer were twice those of plants with zero N or zero K.

Third harvest. Main effects of placement were not significant for any fruit grade category and placement did not interact with fertilizer or N rate (Table 1). Yield of medium fruits was greater with Meister compared with soluble fertilizer and cull yields were not affected by fertilizer (Table 1). Yields of medium and cull fruits were not affected by N rate.

Extra large, large, and marketable fruit yields were affected by the interaction of fertilizer and N rate (Table 1). With soluble fertilizer, N rate had no effect on yields of extra large, large, and total marketable fruits (Table 3). With Meister, yields for all three grade categories were increased by fertilization over the range of 75 to 175 lbs N/acre. Best yields came with the highest rate of Meister fertilizer, but yields with the lowest rate of Meister were as great as with the highest rate of soluble fertilizer (Table 3), showing the benefit of controlled-release fertilizer for sustained nutrient availability.

Seasonal harvest. Yields of medium and cull fruits were not effected by interaction of factors (Table 1). Medium fruit yield was greater with Meister compared to soluble fertilizer while cull yield was not affected by fertilizer material. Neither placement nor fertilizer rate affected yield of medium or cull tomato fruits.

Fertilizer material and placement interacted in their effects on extra large fruit yield (Table 1). With soluble fertilizer, yield of extra large fruits was greater with broadcast fertilizer but with Meister, yields were comparable across placement options (Table 4). Extra large fruit yield was increased with fertilizer rate up to 175 lbs N/acre (Table 1).

Fertilizer material and placement, and fertilizer material and N rate interacted in their effects on yield of large fruits (Table 1). With soluble fertilizer yield of large fruits was better with broadcast placement whereas banding of Meister led to greater large-fruit yields than broadcasting (Table 4). Yields of large fruit were reduced as fertilizer rate increased with soluble fertilizer, but with Meister, large-fruit yields increased as fertilizer rate increased (Table 5).

Total marketable fruit yields were affected by the interaction of factors in the same fashion as large fruit yields. With soluble fertilizer, broadcasting led to greater yields than banding, whereas with Meister the opposite was true (Table 4). Yields with Meister fertilizer were 40 to 50% greater than with soluble fertilizer. With soluble fertilizer, total marketable yields decreased as fertilizer rate increased. With Meister, the opposite was true. The best yields were with the highest rate of Meister (Table 5).

Summary

1. Yields of tomato throughout the season were better with Meister fertilizer compared with soluble fertilizer.

2. Band placement of Meister usually resulted in greater yields than broadcast placement.

3. Yields were best with the highest rate of Meister fertilizer.
4. Yields with the lowest rate of Meister were often greater than yields with the highest rate of soluble fertilizer.

Table 1. Response of tomato to rate and placement of Meister controlled-release fertilizer and soluble fertilizer, Gainesville, FL. Spring 1997.

Fertilizer[z]	Placement[y]	N rate lbs/acre[x]	Yield 25-lb ctn/acre				
			Ex Lg	Lg	Med	Cull	Mkt
------------------------- **First Harvest** -------------------------							
Soluble			405	174	38	25	617
Meister			614	341	59	25	1014
Significance[w]			**[v]	**[v]	NS[v]	NS[v]	**[v]
	Band		466	247	50	22	764
	Broadcast		553	268	47	28	868
	Significance		*[v]	NS[v]	NS[v]	NS[v]	NS[v]
		75	484	269	58	25	812
		125	483	217	37	23	737
		175	560	286	51	27	898
		Significance	NS	NS	NS	NS	NS
Zero N			237	156	43	24	436
Zero K			294	136	28	24	457
------------------------- **Second Harvest** -------------------------							
Soluble			235	363	141	4	740
Meister			564	659	253	10	1477
Significance[w]			**	**	**	**	**
	Band		379	518	194	6	1091
	Broadcast		421	503	200	9	1125
	Significance		NS	NS	NS	NS	NS
		75	350	460	185	7	996
		125	334	535	225	8	1095
		175	514	537	180	7	1233
		Significance	*	NS	NS	NS	NS
Zero N			75	211	253	13	541
Zero K			154	241	87	3	482
------------------------- **Third Harvest** -------------------------							

Soluble			50	195	257	33	502
Meister			154	340	342	35	835
Significance[w]			**[v]	**[v]	**	NS	**[v]
	Band		105	283	295	35	683
	Broadcast		99	251	304	34	654
	Significance		NS	NS	NS	NS	NS
		75	89	233	270	32	643
		125	81	241	320	41	772
		175	137	327	308	30	592
		Significance	NS[v]	NS[v]	NS	NS	NS[v]
Zero N			6	49	206	45	261
Zero K			27	147	251	53	425
- Season Harvest -							
Soluble			690	731	436	62	1859
Meister			1333	1340	653	71	3326
Significance[w]			**[v]	**[v]	**	NS	**[v]
	Band		951	1048	539	62	2538
	Broadcast		1072	1022	551	70	2647
	Significance		NS[v]	NS[v]	NS	NS	NS[v]
		75	1000	979	507	64	2486
		125	900	1046	603	65	2550
		175	1134	1081	525	70	2742
		Significance	*	NS[v]	NS	NS	NS[v]
Zero N			319	417	502	82	1239
Zero K			474	524	367	80	1365

[z] Soluble fertilizer was a mixture of ammonium nitrate and potassium chloride.
[y] Placement was band in a wide band on surface of bed in middle. Tomatoes planted in single row to side of band.
[x] Fertilizer rates calculated on basis of 6-foot bed centers.
[w] Treatment effects were significant at 1% (**) or 5% (*) probability level or not significant (NS).
[v] Interaction was significant.

Table 2. Interaction of fertilizer material and placement for tomato yield, first harvest.

Fertilizer[z]	Placement	Yield (25lb ctn/acre)				
		Ex Lg	Lg	Med	Cull	Mkt
Soluble	Band	280	130	26	16	436
	Broadcast	530	217	51	34	799
	Signifance[y]	*	*	*	*	*
Meister	Band	653	364	74	28	1091
	Broadcast	575	318	43	23	937
	Signifance[y]	*	NS	*	NS	*

[z] Soluble fertilizer was mixture of ammonium nitrate and potassium chloride. Meister was 19-5-14.
[y] Significance was yes (*) or no (NS) at 5% probability.

Table 3. Interaction of fertilizer material and N rate for several variables from tomato, third harvest.

Fertilizer[z]	N rate lbs/acre[y]	Yield (25-lb ctn/acre)		
		Ex Lg	Lg	Mkt
Soluble	75	55	206	5058
	125	55	202	548
	175	41	177	454
	LSD (.05)	NS	NS	NS
Meister	75	124	260	679
	125	107	281	737
	175	232	477	1089
	LSD (.05)	34	92	176

[z] Soluble fertilizer mixture of ammonium nitrate and potassium chloride. Meister was 19-5-14.
[y] N rate calculated on basis of 6-ft bed centers.

Table 4. Interaction of fertilizer material and placement for tomato yield variable for season harvest totals.

Fertilizer[z]	Placement[y]	Yield (25-lb ctn/acre)		
		Ex Lg	Lg	Mkt
Soluble	Band	550	668	1631
	Broadcast	831	794	2087
	Significance[y]	*	*	*
Meister	Band	1352	1428	3446
	Broadcast	1314	1251	3207
	Significance[y]	NS	*	*

[z] Soluble fertilizer was mixture of ammonium nitrate and potassium chloride. Meister was 19-5-14.
[y] Significance was yes (*) or no (NS) at 5% probability.

Table 5. Interaction of fertilizer material and N rate on tomato variable for seasonal harvest.

Fertilizer[z]	N rate lbs/acre[y]	Yield (25-lb ctn/acre)	
		Lg	Mkt
Soluble	75	783	1963
	125	755	1878
	175	656	1735
	LSD (.05)	115	NS
Meister	75	1174	3009
	125	1338	3221
	175	1506	3748
	LSD (.05)	115	259

[z] Soluble fertilizer mixture of ammonium nitrate and potassium chloride. Meister was 19-5-14.
[y] N rate calculated on basis of 6-ft bed centers.