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Evaluation of Pursell Controlled-Release Polymer-Coated Urea for Tomato and Pepper 98-07

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Research was conducted in the spring season of 1998 at the University of Florida Horticultural Research Unit to evaluate tomato and pepper responses to 'Polyon' polymer-coated urea controlled-release fertilizer. The soil used for the study was an Arredondo fine sand that tested very high in P, low in K, high in Mg, and high in Cu, Mn, and Zn (Mehlich-1 extractant). The soil pH was 6.3 in a 1:2 (soil:water) mixture. The soil was plowed and disked in preparation for fertilization and bedding. 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. During bed marking, a portion of the fertilizer was incorporated in the bed (Table 1). Beds were fumigated with methyl bromide and drip irrigation tubing (Chapin Watermatics, Inc., Watertown, NY) with 12-inch emitters, 0.4 gal/100 ft/min flow rate, and 10-mil thick wall was placed on center surface of bed. Beds were covered with black polyethylene mulch (0.5 mil thick) (Sonoco, Mt. Olive, NC).

Fertilizer treatments consisted of two polymer-coated fertilizers, PCU-1 and PCU-2, in various combinations with soluble fertilizers applied with the PCUs at planting or applied through the season in the drip irrigation system (Table 1). The PCU-1 was 43% N and PCU-2 was a blend of two materials, a 44% N and a 42% N material in a 33%:67% blend, respectively. Treatment 1 was the "standard fertility program" consisting of 20% of N (ammonium nitrate) and 20% potassium (potassium chloride) applied before planting by incorporating in the bed. The remaining N and K_2O was injected through the season in weekly injections. All other fertilizer treatments included the application of 20% of the K_2O with the preplant incorporated fertilizer and the remaining K_2O injected (all from KCI). Treatments 2 through 11 consisted of varying percentages of the N being supplied from PCU or soluble sources (Table 1). Total N, P_2O_5, and K_2O rates were 260, zero, and 330 pounds per acre, respectively, for tomatoes grown on four-foot centers.

Pepper (Camelot X3R) transplants (Peto Seed Co., Saticoy, CA) and tomato (Agriset 761) transplants (Agrisales, Ft Myers, FL) were planted on 30 March 1998. Peppers were planted in double-rows on each bed with 12 inches between the rows on the bed and 12

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inches between plants in a row. Tomato plants were set in a single row on the bed with 18 inches between plants in the row.

Each pepper plot was 20 ft in length and each tomato plot was 25 ft in length. There were four replicates of each treatment. Irrigation was supplied by drip irrigation to maintain soil moisture potential 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 application of labeled pesticides.

Whole-leaf samples were collected from plants in each plot, at first harvest, for determination of mineral nutrient concentrations. Tomatoes were harvested three times on 12, 22, and 30 June, 1998 and peppers were harvested three times on 3, 15, and 23 June, 1998. Fruits were graded by size into extra large, large, medium sizes, and cull categories. All data were analyzed by analysis of variance.

During the season, measurements were made of soil temperatures (Table 2). The temperature was measured at 6 inches deep in the soil in the bed at early AM and PM.

Results

Fertilization treatment had no effect on tomato yields (Table 3) for any harvest, for total season yield, or fruit size except for yield of medium-size fruits for the season. Yields of medium fruits were highest with treatment 4, 60% CRN from PCU-1. Medium-size fruits are the smallest marketable class of fruits and generally command the lowest price. Yields were extremely good with 80% of marketable yields in the extra large and large categories. Treatment with more than 1000 cartons per acre of extra large fruits, the most valuable fruits, were PCU-2 (20% soluble and 60% CRN) with 20% SN injected; PCU-1 at 60% CRN and 40% injected; PCU-1 at 20% soluble and 80% CRN with none injected; PCU-2 at 20% soluble and 80% CRN with non injected; and PCU-2 at 100% CRN with none injected. Whole leaf N, P, and K concentrations were affected by fertilizer treatment. Leaf N and P concentrations were mostly within or above, sufficiency ranges (Table 4). Whole-leaf K concentrations were mostly slightly below the sufficiency range. Tomato yields were not related to leaf nutrient concentration.

Pepper yields were rarely affected by fertilizer treatment (Table 5). Total marketable yields at first harvest were better with treatments 5, 6, and 11. These were treatments with most of the N supplied by CRN with less injected. The greatest early yield was with PCU-2 with 20% soluble N and 60% CRN preplant with 20% N injected. Total season yields were above 1100 cartons/acre with all treatments except for treatment 12 (100% soluble N) which was 1020 cartons/acre.

Whole-leaf N concentrations were not affected by fertilizer treatment (Table 6). Whole-leaf P and K concentrations were affected by fertilizer treatment; however, all leaf-P and leaf-K concentrations were within or above the sufficiency ranges.

These results showed that 'Polyon' fertilizers can be used to produce pepper and tomato yields at least equal to the standard fertilizer program with 80% N injected. The PCU-2, a blend of coated ureas with different coating thicknesses was particularly effective.

Table 1. Fertilizer treatments used in tomato and pepper experiments with Pursell 'Polyon' fertilizers, Gainesville, FL, Spring 1998.

Treatment Number	Fertilizer Material [y]	Preplant Proportion [z]	Fertigation Proportion
All Treatments		20% K_2O	80% K_2O
1.	SFP	20% NS	80% SN
2.	PCU-1	20% SN 40% CRN	40% SN
3.	PCU-2	20% SN 40% CRN	40% SN
4.	PCU-1	20% SN 60% CRN	20% SN
5.	PCU-2	20% SN 60% CRN	20% SN
6.	PCU-1	60% CRN	40% SN
7.	PCU-2	60% CRN	40% SN
8.	PCU-1	20% SN 80% CRN	0% SN
9.	PCU-2	20% SN 80% CRN	0% SN
10.	PCU-1	100% CRN	0% SN
11.	PCU-2	100% CRN	0% SN
12.	Soluble	100% SN	0% SN

[z] Controlled-release (Polyon) fertilizer (CRN) or soluble fertilizer (ammonium nitrate).
[y] PCU-1 is 43% N and PCU-2 is mixture of 67% of a 42% N and 33% of 44% N materials.

Table 2. Soil temperature at AM and PM measured in soil of pepper beds.

Date	Temp (°C)		Date	Temp (°C	
	AM	PM		AM	PM
April 7		32	May 14	28	37
8	22	27	15	-	36
9	23	28	18	27	37
10	21	31	19	24	34
13	16	31	20	-	37
14	18	30	21	27	37
15	19	31	22	27	37
16	21	31	26	27	37
17	20	31	27	28	34
20	20	34	28	26	32
21	23	33	29	27	-
22	22	31	June 1	28	35
23	18	30	2	28	37
24	16	30	3	29	38
27	20	-	4	29	38
29	25	26	5	29	37
30	21	28	8	25	34
May 1	22	28	9	26	35
4	22	26	10	27	36
5	21	34	11	28	37
6	22	35	12	28	38
7	22	33	15	28	38
8	25	-	16	28	38
11	24	34	17	27	38
12	23	33	18	29	38
13	24	37	19	28	-

Table 3. Tomato yield response to fertilization with controlled-release (Pursell 'Polyon') fertilizer, Gainesville, FL, Spring 1998.

Treatment	Yield (25-lb cartons/acre)					
	Extra Large	Large	Medium	Mkt	Cull	Avg Fruit Wt (lb)
- First Harvest -						
1	270	140	50	460	4	0.45
2	270	230	86	590	2	0.42
3	310	300	90	700	10	0.43
4	240	290	100	630	5	0.41
5	350	250	60	670	2	0.44
6	300	220	50	570	2	0.44
7	360	280	60	700	5	0.44
8	370	190	50	610	3	0.46
9	380	230	80	700	2	0.45
10	270	170	60	500	3	0.45
11	330	260	70	650	3	0.43
12	350	240	80	660	9	0.43
Significance	NS	NS	NS	NS	NS	NS
Prob. >F	0.1571	0.1450	0.6710	0.2882	0.3787	0.3067
- Second Harvest -						
1	520	800	470	1790	50	0.42
2	470	740	450	1670	70	0.41
3	530	700	640	1870	40	0.40
4	530	700	640	1870	40	0.40
5	730	900	350	1980	30	0.44
6	700	580	190	1480	20	0.46
7	430	760	340	2410	30	0.41
8	770	820	380	1970	50	0.42
9	660	770	333	1760	30	0.42
10	570	680	310	1560	40	0.43
11	670	720	340	1720	40	0.42
12	540	730	480	1750	70	0.42
Significance	NS	NS	NS	NS	NS	NS
Prob. >F	0.7067	0.9013	0.2733	0.8288	0.1905	0.5809

- Third Harvest -						
1	140	350	370	860	70	0.37
2	90	350	310	760	30	0.35
3	90	440	290	830	15	0.36
4	70	230	300	600	40	0.34
5	60	300	300	660	20	0.36
6	190	430	340	960	30	0.37
7	110	270	210	590	10	0.36
8	80	230	205	510	30	0.35
9	90	300	290	680	45	0.35
11	40	240	230	510	40	0.35
12	7	200	180	380	20	0.35
Significance	NS	NS	NS	NS	NS	NS
Prob. >F	0.7047	0.7398	0.7662	0.4502	0.4629	4.4022

- Total Season -						
1	930	1295	880	3100	130	0.41
2	840	1320	850	3010	100	0.40
3	810	1455	680	2940	60	0.40
4	840	1220	1040	3095	90	0.38
5	1140	1455	710	3300	50	0.41
6	1190	1230	590	3000	50	0.42
7	900	1300	610	2810	50	0.41
8	1220	1235	640	3090	80	0.41
9	1130	1310	690	3130	80	0.41
10	990	1180	570	2750	80	0.42
11	1040	1220	630	2890	80	0.40
12	900	1170	730	2790	100	0.40
Significance	NS	NS	*	NS	NS	NS
Prob. >F	0.5906	0.3622	0.0134	0.7662	0.3441	0.6160

Table 4. Tomato leaf tissue nutrient concentration response to fertilization with controlled-release (Pursell 'Polyon') fertilizer, Gainesville, FL, Spring 1998.

Treatment	Whole-leaf nutrient concentration (%)[z]		
	N	P	K
1	2.8	0.20	1.6
2	2.8	0.20	1.0
3	2.9	0.20	1.3
4	2.8	0.20	1.6
5	2.5	0.13	1.7
6	2.4	0.18	1.5
7	2.5	0.18	1.6
8	2.4	0.20	1.0
9	2.4	0.18	1.1
10	2.6	0.20	1.2
11	2.7	0.20	1.0
12	2.6	0.20	0.8
Significance	*	*	**
Prob. >F	0.0181	0.0309	0.0025

[z] Sufficiency ranges are N (2.0-3.5), P (0.2-0.4), and K (2.0-4.0).

Table 5. Pepper yield response to fertilization with controlled-release (Pursell 'Polyon') fertilizer, Gainesville, FL, Spring 1998.

Treatment	Yield (28-lb cartons/acre)					
	Extra Large	Large	Medium	Mkt	Cull	Avg Fruit Wt (lb)
- First Harvest -						
1	160	40	10	210	30	0.38
2	150	45	3	200	40	0.37
3	100	40	9	150	40	0.34
4	140	60	6	210	15	0.36
5	190	95	10	300	20	0.35
6	170	80	21	270	8	0.34
7	130	60	16	200	30	0.34
8	160	30	11	200	20	0.38
9	100	40	9	150	20	0.34
10	150	80	9	235	10	0.35
11	170	100	11	290	15	0.34
12	80	60	4	145	25	0.33
Significance	NS	NS	NS	*	NS	NS
Prob. >F	0.1834	0.0888	0.5721	0.0342	0.5859	0.3261
- Second Harvest -						
1	280	310	30	615	18	0.29
2	200	360	60	620	35	0.28
3	280	340	70	690	35	0.29
4	270	370	30	660	35	0.29
5	200	325	30	550	10	0.30
6	220	290	30	550	7	0.31
7	170	300	25	490	16	0.31
8	230	260	40	580	22	0.30
9	280	260	40	580	22	0.30
10	260	320	30	605	13	0.29
11	230	260	40	530	0	0.31
12	185	250	150	580	17	0.36
Significance	NS	NS	NS	NS	NS	NS
Prob. >F	0.9323	0.4718	0.2985	0.9568	0.0583	0.7071

- Third Harvest -						
1	90	160	90	335	35	0.23
2	60	160	120	340	55	0.21
3	90	155	110	355	45	0.22
4	60	125	115	305	45	0.21
5	75	160	110	340	30	0.23
6	100	145	110	360	45	0.23
7	120	170	120	415	40	0.22
8	275	140	145	560	50	0.30
9	100	170	115	385	50	0.22
11	80	155	110	350	30	0.23
12	65	85	145	290	55	0.20
Significance	NS	NS	NS	NS	NS	NS
Prob. >F	0.6663	0.9387	0.8745	0.8894	0.3455	0.7219

- Total Season -						
1	525	510	130	1160	85	0.30
2	415	560	185	1160	130	0.29
3	470	530	190	1190	120	0.29
4	470	560	150	1180	98	0.29
5	455	580	155	1190	60	0.28
6	500	510	170	1180	60	0.28
7	420	525	165	1110	90	0.28
8	660	535	205	1400	100	0.32
9	475	470	165	1110	95	0.28
10	490	505	150	1150	80	0.28
11	485	515	165	1160	45	0.29
12	325	400	300	1020	100	0.29
Significance	NS	NS	NS	NS	NS	NS
Prob. >F	0.7214	0.4554	0.1771	0.8533	0.0691	0.8289

Table 6. Pepper leaf tissue nutrient concentration response to fertilization with controlled-release (Pursell 'Polyon') fertilizer, Gainesville, FL, Spring 1998.

Treatment	Whole-leaf nutrient concentration (%)[z]		
	N	P	K
1	4.6	0.23	4.8
2	5.1	0.28	3.7
3	4.5	0.25	3.8
4	5.3	0.25	4.8
5	4.2	0.25	4.8
6	5.0	0.28	4.3
7	3.4	0.33	4.6
8	4.5	0.30	3.8
9	5.3	0.30	4.5
10	5.5	0.30	3.7
11	5.8	0.30	3.6
12	4.9	0.30	3.7
Significance	NS	*	**
Prob. >F	0.3174	0.0488	0.0010

[z] Sufficiency ranges are N (2.0-3.0), P (0.20-0.40), and K (2.0-3.0).