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Evaluation of Monopotassium Phosphate-Based Starter Fertilizer Solution Effects on Vegetable Production in Florida 96-06

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Abstract

Studies were conducted at Gainesville, FL in 1995 to evaluate the response of mulched tomato and pepper and of unmulched snapbean and carrot to starter fertilizers based on monopotassium phosphate. Results with mulched tomato and pepper showed positive responses to ammoniated monopotassium phosphate applied as a starter solution to transplants at 10 lbs of P_2O_5 per acre. Early and total fruit yields of tomato were enhanced with starter solutions. Results with tomato were more dramatic than for pepper. Starter solutions had little effect on beans or carrots.

Materials and Methods

Experiments to evaluate the effects of starter fertilizers formulated from monopotassium phosphate on four vegetable crops were conducted in Gainesville, Florida during the spring season of 1995. The crops used in the studies were tomato, pepper, carrot, and snapbean providing differing production systems, polyethylene mulch, and transplants for tomato and pepper and direct-seeding for carrot and snapbean.

The experiments were conducted at the Horticultural Research Unit on Arrendondo fine sand. The soil had a pH (water) of 6.4 and tested very high in P (>120 ppm Mechlich-1 extractable P), typical of commercial vegetable production soils in Florida.

Two plantings of each crop were used to evaluate response to starter fertilizer under crops established at slightly earlier than typical and slightly later than typical planting windows. Both white and black mulches were used in each experiment to provide for variable soil temperatures to strengthen the opportunity for evaluation of any starter fertilizer effect.

Tomato and pepper. Beds for tomato and pepper were prepared on four-foot centers. A false-bed was prepared into which was banded ammonium nitrate at 100 lbs/acre to provide 33 lbs N/acre. The soil in the false bed and ammonium nitrate were then thoroughly mixed by rototilling. The beds were then fumigated with methyl bromide at 300 lbs/acre broadcast rate, pressed, and covered with polyethylene mulch, either white-on-black (white side up) or black, depending on specific mulch treatment. Drip

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irrigation tubing, Netafim Typhoon (0.34 gal per hour emitters at 10 psi on 12-inch spacing), was placed three inches off center and one inch deep.

Tomato (cv. Agriset) and pepper (cv. Camelot) transplants were obtained from a commercial transplant production company and were five weeks old at transplanting. For the first planting date, tomato and pepper plants were transplanted on 28 Feb. The second planting was made on 24 March. Tomato plants were planted in two rows on each bed with 12 inches between rows and 12 inches between plants. Plots contained 17 tomato plants and 40 pepper plants.

Fertilizer treatments were two rates of monopotassium phosphate (MKP and two rates of ammoniated monopotassium phosphate (AMKP). The two rates were 10 and 20 lbs/acre calculated as P_2O_5. MKP solutions were formulated from MKP salt 0-52-34, and AMKP solutions were formulated from ammoniated MKP (4-26-17) liquids. Treatments also included triple superphosphate at 20 lbs P_2O_5 per acre and a check with no fertilizer starter. Starter fertilizers were applied as a solution in 250 ml final solution per plant at transplanting by pouring solution in the plant hole. The TSP starter fertilizer was broadcast in the bed before mulching and rototilled along with the ammonium nitrate.

Irrigation was done with drip irrigation to maintain a tensiometer at -8 to -12 cb at the six-inch soil depth. On average, this resulted in 600 gal/acre/day early in the season to 7000 gal/acre/day when plants neared harvest. On a weekly basis, N and K were applied through the irrigation system starting at the second week after planting. Mixtures of ammonium nitrate and potassium nitrate were used. Total injected N was 145 lbs N/acre and 225 lbs K_2O/acre. On five occasions (week 3, 5, 7, 9, and 11), magnesium sulfate was injected at 5 lbs Mg/acre.

One tomato and two pepper plants were cut at the soil line at three weeks after planting, dried, and weighed. Tomato plants had early flower buds visible put pepper plants had no buds visible.

Tomato plants were staked and tied. Tomato and peppers were sprayed with fungicides and insecticides as needed to control diseases and insects. Crops were disease and insect free all season. No other crop chemicals, pesticides, or nutrients were applied foliarly.

Tomato and pepper fruits were harvested several times for each crop, and graded according to standards used by the Florida tomato and pepper industries. Tomatoes were harvested from the first planting four times on 12 and 25 May, and 2 and 9 June, and from the second planting three times on 7, 13, and 21 June. Peppers form the first

planting were harvested on 22 May, and 1 and 19 June, and from the second planting on 1 and 16 June.

Data were analyzed by analysis of variance. Fertilizer treatment means were compared using the least significant difference when F-test was significant (P of larger F <0.05).

Snapbean and carrot. Soil was prepared by plowing and disking; beds were raised and pressed on four-foot centers. For both crops, 30 lbs N from ammonium nitrate were incorporated in the bed at bed formation. Snapbean (cv. Magnum) and carrot (cv. Choctaw) were seeded in two rows on each bed with 12 inches between rows. The first planting of snapbean and carrot was made on 6 March and the second on 16 March.

Fertilizer treatments were the same as used for tomato and pepper. MKP and AMKP solutions and TSP fertilizer were banded at two inches below and one inch to side of the carrot or bean seeds. Irrigation was from overhead sprinklers applied as needed to maintain tensiometers at -8 to -12 cb at eh six-inch soil depth. Diseases and insects were controlled on carrots with timely pesticide applications. No pesticides were used on snapbeans. Nitrogen and K fertilizers were sidedressed for carrots three times with 40 lbs N and 50 lbs K_2O per acre in each application. Fertilizers were banded in the soil between the two carrot rows on the bed. Applications were made when carrots were 2, 4, and 6 inches tall. For snapbeans, two applications of N and 30 lbs N/acre each with 50 lbs K2O/acre were made at first trifoliate leaf and early flower bud. Snapbean and carrot sidedressings were supplied from potassium chloride and ammonium nitrate.

Bean plants were collected for dry weight measurements once at early bud stage. No plant samples were collected for the second bean or either carrot planting. The second carrot planting was lost due to wind damage at seedling emergence. Snapbeans were harvested on 4 May (first planting) and 18 May (second planting). Carrots were harvested on 19 June.

Results and Discussion

Tomato – planting date. Planting date, mulch, and starter fertilizer significantly affected tomato yield (Tables 1 – 3). Results from treatments in planting one are presented in entirety in Table 1 and those from planting two in Table 2. There were very few significant interactions among planting date, mulch, or starter fertilizer treatments. Therefore the main effects for these three factors are presented in Table 3. Yield of all fruit grades form the first harvest were better for the second planting compared to the first planting. Cooler temperatures during early fruit set could have reduced yields from the first harvest from planting one compare to two. Total fruit production was however better from the early planting due to more extra large (most valuable) fruits. Production of smaller-size fruits was greater from the second planting. These data

show that it is important not to delay tomato planting past optimum (first two weeks of March for northern Florida) in order to obtain high yields of extra large fruit.

Tomato – mulch. Early yields were better with black mulch (Table 3) due to increased amount of extra large fruits. Soil temperature averaged two degrees higher under black mulch than under white mulch for the first six weeks of the season (77°F for black mulch vs. 75°F for white). Total season marketable yields were better, however, from white mulch due to greater amounts of extra large and large fruits. Planting date and mulch interacted for effects on early total marketable yields. For experiment one, total marketable early yield was 325 ctn/acre with black mulch and 272 ctn/acre with white mulch. For experiment two, the difference was greater with 603 ctn/acre with black mulch and 438 ctn/acre with white mulch. Mulch and planting date also interacted for effects on average fruit weight from the early harvest. Average fruit size for planting one with black mulch was 0.66 lb/fruit and 0.70 with white mulch. For planting two, average fruit size was 0.71 lb/fruit with black mulch and 0.68 lb fruit with white mulch. Average fruit size for all situations, however, was excellent for Florida conditions.

Tomato – starter fertilizer. Yields of extra large and total marketable early tomato fruits were affected by starter fertilizer treatment (Table 3). Best yields were with AMKP at either 10 or 20 lbs P_2O_5/acre and with TSP at 20 lbs P_2O_5/acre. The average yield of extra large fruits with AMKP and TSP was 36% greater than the average of MKP and the check. For total marketable early yield, the former three treatments resulted in 33% more yield than the MKP and check average. Increased early yields and especially increased extra large fruits are important to Florida tomato producers leading to increased profits. The ammoniated form of MKP appears to have merit for improved tomato profits.

Total season yields of extra large fruits and total marketable yields (sum of medium, large, and extra large) were affected by the interaction of mulch and starter fertilizer treatment (Table 4). For extra large fruits, there were no differences among starter fertilizers with black mulch. With white mulch, yields of extra large fruits tended to be better with AMKP-10 or MKP-20. For total marketable yields on black mulch, production was better with AMKP-20 or TSP and on white mulch, yields tended to be better with MKP-20 or AMKP-10. Although there were negligible effects of starter fertilizer when observing the main effects (Table 3), some specific treatment combinations appeared to have a significant effect on yields (Table 4). Starter fertilizers appeared to have a positive effect on total season yields although the effects were not as clear as with early fruit production.

Starter fertilizers had significant effects on early plant growth (Table 5). MKP, especially the higher rate of MKP starter solution was especially effective in improving early plant growth. Growth with AMKP was not enhanced over other starter fertilizer

treatments, therefore some factors other then early plant growth must explain why AMKP resulted in improved early fruit yield.

Pepper – planting date. Results of pepper experiments are presented in Tables 6 through 9. There were few interactions among the experimental factors. Early and total season pepper yields were greater in planting one compared to planting two (Table 8). This result is opposite of tomato for early yields response, but similar to tomato for total season yield. Fruit set under cooler temperatures associated with the early planting was not reduced for pepper compared to tomato.

Pepper – mulch. Responses of pepper yields to mulch were similar to those from tomato. Early yields were improved with black mulch and total season yields were sometimes better with white mulch. Caution should be taken not to place too much weight on the main effects because yields of early and total season extra large fruits were affected by the interaction of planting date and mulch. Total marketable early yield was also affected by the interaction of planting date and mulch. In experiment one, early extra large fruit yield was 711 ctn/acre with black mulch and was 534 ctn/acre with white mulch. In experiment two, early extra large was 463 ctn/acre with black mulch and 403 ctn/acre with white mulch. Total marketable early yields in experiment one with black mulch was 1120 ctn/acre and with white mulch was 855 ctn/acre. In experiment two, total early marketable yield with black mulch was 716/ctn/acre and with white mulch was 591 ctn/acre.

Total season extra large fruit yield in experiment one was 952 ctn/acre with black mulch and 857 ctn/acre with white mulch. In experiment two, seasonal extra large fruit yield was 765 ctn/acre with black mulch and 816 ctn/acre with white mulch.

These interaction results showed that the improving effect of black mulch on early extra large and early total marketable yields was greater for experiment one compared to experiment two. The benefit of black mulch for experiment one carried to total season yields. For experiment two, total season marketable yields were slightly better with white mulch compared to black mulch. Therefore, pepper yields responded to the warmer soil temperatures by two degrees under black mulch compared to white mulch.

Pepper – starter fertilizer. Pepper early or total marketable season yields were not greatly affected by starter fertilizer (Table 8). Yields of early extra large and total season extra large fruits, the most valuable fruits were affected by starter fertilizer (Table 8). Yields tended to be better with MKP-20, AMKP-10, and TSP. The differences were slight but pointed to improved yields and pepper profits where starter fertilizer is used compared to no starter fertilizer.

Planting date and starter fertilizer interacted with starter fertilizer for effects on total marketable yield of early fruits (Table 9). In the first planting under cooler temperatures, yields were best with MKP-20 or with either AMKP treatment. In the second planting, yields were best with TSP and the low rate of AMKP. Perhaps the high rate (20 lbs P_2O_5/acre) from AMKP was excessive for pepper growing under higher temperatures. These results indicate the possible need for variable rates of starter fertilizer depending on growing season conditions.

These interpretations are supported by data on plant growth in Table 10 and 11. Early plant growth was better with black mulch compared to white. Plant growth tended to be better with MKP solutions or with the low rate of AMKP.

Snapbean and carrot. Planting date and starter fertilizer had no effect on plant growth or yield of snapbean or carrot (Tables 12 and 13). These direct-seeded crops were difficult to successfully establish due to rain and wind during March. The second carrot experiment was lost to wind and blown sand damage. Yields with the early snapbean planting were relative low due to reduced plant stand.

Summary Results with transplanted, mulched tomato and pepper provided some positive indication for starter fertilizer solutions as follows:

1. MKP and AMKP starter solutions usually resulted in greater early yields and sometimes in improved total yields.
2. AMKP might be a better choice compared to MKP for tomato than for pepper.
3. MKP and a low rate of AMKP gave good results with pepper.
4. There are indications that selection of starter solution and rate might be affected by crop and planting season.
5. Results of this study indicate that profitability of tomato and pepper production can be improved by the use of starter fertilizer solutions.

Table 1. Effects of mulch and starter fertilizer on yield and fruit grade of tomato in a first planting, Gainesville FL, spring 1995.

Mulch	Starter Ferilizer[z]	Yield (25-lb carton/acre)					Avg. Fruit Wt. (lb)
		Medium	Large	Ex. Large	Total Mkt.	Cull	
- First Harvest -							
Black	None	0	34	258	292	50	0.64
	MKP-10	0	28	260	286	25	0.62
	MKP-20	0	22	194	216	22	0.62
	AMKP-10	0	27	412	439	42	0.70
	AMKP-20	0	32	343	375	35	0.72
	TSP-20	0	29	312	340	37	0.68
White	None	0	20	189	209	14	0.66
	MKP-10	0	20	198	218	8	0.72
	MKP-20	0	29	235	264	28	0.66
	AMKP-10	0	25	223	248	46	0.66
	AMKP-20	0	29	310	339	33	0.74
	TSP-20	0	27	324	351	17	0.74
- Season (4 harvests) -							
Black	None	184	470	2970	3625	203	0.62
	MKP-10	177	449	2782	3408	121	0.61
	MKP-20	211	500	2835	3547	158	0.61
	AMKP-10	95	453	2782	3330	159	0.63
	AMKP-20	187	522	2957	3666	162	0.66
	TSP-20	192	550	3137	3879	179	0.60
White	None	154	785	2895	3833	204	0.63
	MKP-10	213	770	2864	3847	193	0.63
	MKP-20	193	642	3217	4052	168	0.64
	AMKP-10	134	655	3264	4052	165	0.62
	AMKP-20	160	748	2858	3766	213	0.62
	TSP-20	179	561	3002	3742	225	0.64

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

Table 2. Effects of mulch and starter fertilizer on yield and fruit grade of tomato in a second planting, Gainesville FL, spring 1995.

Mulch	Starter Ferilizer[z]	Yield (25-lb carton/acre)					Avg. Fruit Wt. (lb)
		Medium	Large	Ex. Large	Total Mkt.	Cull	
- First Harvest -							
Black	None	24	80	326	430	52	0.69
	MKP-10	43	78	406	527	34	0.68
	MKP-20	23	81	473	577	31	0.78
	AMKP-10	33	81	547	661	57	0.69
	AMKP-20	49	93	539	682	73	0.69
	TSP-20	46	72	624	742	59	0.72
White	None	36	50	297	383	55	0.69
	MKP-10	27	36	326	389	20	0.72
	MKP-20	36	60	324	420	23	0.67
	AMKP-10	51	55	370	476	26	0.67
	AMKP-20	45	112	280	437	59	0.60
	TSP-20	25	50	442	517	32	0.72
- Season (3 harvests) -							
Black	None	577	810	1742	3128	153	0.55
	MKP-10	663	822	1737	3223	140	0.54
	MKP-20	674	808	1692	3174	113	0.58
	AMKP-10	628	822	1806	3257	215	0.54
	AMKP-20	663	809	2060	3531	173	0.55
	TSP-20	724	778	1807	3309	166	0.53
White	None	609	751	2164	3524	201	0.57
	MKP-10	684	828	1923	3436	128	0.57
	MKP-20	651	1005	1948	3604	130	0.55
	AMKP-10	737	1069	1999	3805	283	0.54
	AMKP-20	742	945	1731	3418	223	0.52
	TSP-20	628	904	1836	3368	151	0.55

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

Table 3. Main effects of planting, mulch, and starter fertilizer on tomato yield and fruit grade, Gainesville FL, spring 1995.

Treatment	Yield (25-lb carton/acre)					Avg. Fruit Wt (lbs)
	Medium	Large	Ex Large	Total Mkt.	Cull	
- Early (first harvest) -						
Planting 1	0	27	271	298	30	0.68
Planting 2	36	71	413	520	44	0.69
Prob >F	0.001	0.0001	0.0001	0.0001	0.0014	0.3329
Black Mulch	18	55	392	464	43	0.69
White Mulch	18	43	293	354	30	0.69
Prob >F	0.9533	0.1212	0.0001	0.0001	0.0017	0.8968
No fertilizer	15	46	267	328	43	0.67
MKP-10	17	40	297	355	22	0.68
MKP-20	15	48	306	369	26	0.68
AMKP-10	21	47	388	456	43	0.68
AMKP-20	24	66	368	458	50	0.69
TSP-20	18	44	425	488	36	0.72
Prob >F	0.6506	0.4500	0.0001	0.0002	0.0007	0.6335
LSD (0.05)	N/A	N/A	65	57	14	N/A
- Season (all harvests) -						
Planting 1	173	592	2964	3729	177	0.63
Planting 2	665	863	1871	3398	173	0.55
Prob >F	0.001	0.0001	0.0001	0.0001	0.7519	0.0001
Black Mulch	415	650	2359	3423	159	0.59
White Mulch	424	805	2475	3704	190	0.59
Prob >F	0.6610	0.0001	0.0406	0.0001	0.0078	0.4913
No fertilizer	381	704	2442	3528	190	0.59
MKP-10	434	717	2326	3479	145	0.59
MKP-20	432	739	2423	3594	142	0.60
AMKP-10	398	750	2462	3611	198	0.59
AMKP-20	438	756	2401	3595	193	0.59
TSP-20	431	698	2446	3575	180	0.59
Prob >F	0.4886	0.8771	0.7674	0.7094	0.0124	0.8335
LSD (0.05)	N/A	N/A	N/A	N/A	39	N/A

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

Table 4. Treatment means for starter fertilizer and mulch for total season extra large and total marketable tomato yields.

Mulch	Starter Fertilizer[z]	Yield (25-lb ctn/acre)	
		Extra Large	Total Marketable
Black	None	2355	3376
	MKP-10	2260	3315
	MKP-20	2263	3360
	AMKP-10	2294	3293
	AMKP-20	2508	3600
	TSP-20	2472	3594
	LSD (0.05)	274	264
White	None	2529	3678
	MKP-10	2394	3642
	MKP-20	2582	3828
	AMKP-10	2631	3928
	AMKP-20	2294	3592
	TSP-20	2420	3555
	LSD (0.05)	274	264

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

Table 5. Effects of mulch and starter fertilizer on early tomato plant growth in two experiments, Gainesville FL, spring 1995.

Mulch	Starter Fertilizer[z]	Plant dry wt. (g/plant)	
		Experiment 1	Experiment 2
Black	None	1.2	3.3
	MKP-10	1.3	3.8
	MKP-20	1.7	4.7
	AMKP-10	1.1	3.1
	AMKP-20	1.1	3.3
	TSP-20	1.3	3.1
	LSD (0.05)	0.2	0.6
White	None	0.8	3.0
	MKP-10	1.5	3.7
	MKP-20	1.3	3.6
	AMKP-10	0.9	2.6
	AMKP-20	0.9	2.3
	TSP-20	1.6	3.2
	LSD (0.05)	0.2	0.6

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

Table 6. Effects of mulch and starter fertilizer on yield and fruit grade of pepper in a first planting, Gainesville FL, spring 1995.

Mulch	Starter Ferilizer[z]	Yield (25-lb carton/acre)					Avg. Fruit Wt. (lb)
		Medium	Large	Ex. Large	Total Mkt.	Cull	
- First Harvest -							
Black	None	3	445	702	1150	0	0.43
	MKP-10	7	379	670	1157	5	0.40
	MKP-20	4	463	757	1224	0	0.42
	AMKP-10	0	374	732	1106	0	0.43
	AMKP-20	3	440	721	1162	2	0.40
	TSP-20	0	329	684	1014	0	0.43
White	None	0	281	457	738	0	0.42
	MKP-10	0	329	502	831	0	0.42
	MKP-20	6	372	551	929	0	0.40
	AMKP-10	6	333	588	927	0	0.43
	AMKP-20	8	328	537	872	0	0.43
	TSP-20	3	261	567	831	2	0.44
- Season (4 harvests) -							
Black	None	59	900	872	1830	73	0.33
	MKP-10	56	904	969	1928	0	0.33
	MKP-20	40	982	965	1987	65	0.35
	AMKP-10	30	868	1055	1953	26	0.34
	AMKP-20	49	970	877	1897	95	0.35
	TSP-20	34	904	977	1915	95	0.35
White	None	95	1032	793	1920	122	0.35
	MKP-10	74	1077	842	1993	98	0.35
	MKP-20	132	977	827	1936	102	0.34
	AMKP-10	75	1047	934	2055	69	0.35
	AMKP-20	99	1059	825	1983	123	0.35
	TSP-20	60	1016	925	2002	116	0.36

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

Table 7. Effects of mulch and starter fertilizer on yield and fruit grade of pepper in a second planting, Gainesville FL, spring 1995.

Mulch	Starter Ferilizer[z]	Yield (25-lb carton/acre)					Avg. Fruit Wt. (lb)
		Medium	Large	Ex. Large	Total Mkt.	Cull	
- First Harvest -							
Black	None	0	248	501	749	22	0.42
	MKP-10	0	265	406	670	29	0.39
	MKP-20	0	251	388	639	20	0.41
	AMKP-10	0	276	496	772	20	0.42
	AMKP-20	0	262	456	718	31	0.43
	TSP-20	0	213	535	748	16	0.43
White	None	0	222	367	588	14	0.42
	MKP-10	0	155	398	553	3	0.44
	MKP-20	0	169	379	548	8	0.44
	AMKP-10	0	216	419	634	8	0.42
	AMKP-20	0	177	315	492	5	0.42
	TSP-20	0	189	544	733	12	0.45
- Season (4 harvests) -							
Black	None	88	588	794	1470	72	0.38
	MKP-10	101	733	647	1481	67	0.36
	MKP-20	105	721	735	1561	82	0.38
	AMKP-10	81	672	823	1578	57	0.39
	AMKP-20	105	675	726	1506	114	0.38
	TSP-20	92	635	865	1592	56	0.40
White	None	161	753	718	1631	85	0.37
	MKP-10	135	752	822	1710	110	0.40
	MKP-20	137	643	800	1581	131	0.40
	AMKP-10	145	774	805	1724	91	0.39
	AMKP-20	132	721	731	1584	139	0.38
	TSP-20	82	500	1018	1600	78	0.42

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

Table 8. Main effects of planting, mulch, and starter fertilizer on pepper yield and fruit grade, Gainesville FL, spring 1995.

Treatment	Yield (25-lb carton/acre)					Avg. Fruit Wt (lbs)
	Medium	Large	Ex Large	Total Mkt.	Cull	
- Early (first harvest) -						
Planting 1	3	361	623	987	1	0.42
Planting 2	0	220	434	654	16	0.43
Prob >F	0.0029	0.0001	0.0001	0.0001	0.0001	0.4294
Black Mulch	1	329	588	918	12	0.42
White Mulch	2	253	469	723	4	0.43
Prob >F	0.6604	0.0001	0.0001	0.0001	0.0001	0.1756
No fertilizer	1	299	507	806	9	0.42
MKP-10	2	281	494	778	9	0.41
MKP-20	3	314	519	836	7	0.42
AMKP-10	2	300	559	860	7	0.43
AMKP-20	3	301	507	811	10	0.42
TSP-20	1	248	582	831	7	0.44
Prob >F	0.8185	0.1319	0.0718	0.4662	0.9062	0.1640
LSD (0.05)	N/A	N/A	N/A	N/A	N/A	N/A
- Season (all harvests) -						
Planting 1	67	978	905	1950	132	0.34
Planting 2	114	681	791	1585	90	0.38
Prob >F	0.0001	0.0001	0.0006	0.0001	0.0001	0.0001
Black Mulch	70	796	859	1725	118	0.36
White Mulch	111	863	837	1810	105	0.37
Prob >F	0.0001	0.0041	0.4958	0.0099	0.0002	0.0226
No fertilizer	100	818	794	1713	88	0.36
MKP-10	91	866	820	1778	221	0.36
MKP-20	104	831	831	1767	95	0.36
AMKP-10	82	840	904	1828	61	0.36
AMKP-20	96	857	790	1743	118	0.36
TSP-20	67	764	947	1778	86	0.38
Prob >F	0.2006	0.1351	0.0309	0.4565	0.0094	0.0126
LSD (0.05)	N/A	N/A	112	N/A	32	0.03

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

Table 9. Treatment means for planting date and starter fertilizer for marketable pepper fruit yield for the early (first) harvest.

Planting Date	Starter Fertilizer[z]	Yield (25-lb ctn/acre) Early Marketable
First	None	944
	MKP-10	944
	MKP-20	1077
	AMKP-10	1017
	AMKP-20	1018
	TSP-20	923
	LSD (0.05)	118
Second	None	667
	MKP-10	612
	MKP-20	594
	AMKP-10	704
	AMKP-20	605
	TSP-20	740
	LSD (0.05)	118

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

Table 10. Effects of mulch and starter fertilizer on early pepper plant growth in two experiments, Gainesville FL, spring 1995.

Mulch	Starter Fertilizer[z]	Plant dry wt. (g/plant)	
		Experiment 1	Experiment 2
Black	None	0.4	1.1
	MKP-10	0.6	1.5
	MKP-20	0.4	1.5
	AMKP-10	0.5	1.4
	AMKP-20	0.4	1.5
	TSP-20	0.4	1.4
White	None	0.3	1.1
	MKP-10	0.3	1.6
	MKP-20	0.4	1.4
	AMKP-10	0.2	1.1
	AMKP-20	0.3	1.1
	TSP-20	0.3	1.1

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

Table 11. Main effects of mulch and fertilizer treatment on early pepper plant growth in two experiments, Gainesville FL, spring 1995.

Treatment	(Plant dry weight (g/plant)	
	Experiment 1	Experiment 2
Mulch		
Black	0.43	1.40
White	0.30	1.24
Prob. >F	0.0001	0.0325
Fertilizer[z]		
None	0.32	1.11
MKP-10	0.47	1.58
MKP-20	0.69	1.45
AMKP-10	0.35	1.24
AMKP-20	0.33	1.26
TSP	0.33	1.27
LSD (0.05)	0.07	0.18

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

Table 12. Response of carrot to selected starter fertilizer treatments, Gainesville FL, spring 1995.

Fertilizer Treatment	Yield (cwt/acre)[y]			Carrot length (cm)
	Jumbo	US No 1	Cull	
None	0	82	30	22.9
MKP-10	1	24	49	19.5
MKP-20	0	58	42	21.9
AMKP-10	0	37	39	21.8
AMKP-20	3	56	49	22.0
TSP-20	0	63	37	22.3
Prob. >F	0.14	0.22	0.08	0.13

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

[y] Carrots in US No 1 class had length greater than 13 cm and width between 1.9 and 3.5 cm. Jumbo carrots had diameter greater than 3.5 cm.

Table 13. Response of snapbean to selected starter fertilizer treatments, Gainesville FL, spring 1995.

Fertilizer Treatment[z]	Early Plant dry weight (g/pl)	Bean Yield (30-lb ctn/acre)			Plants with blooms (%)[y]	Plant vigor rating[x]
		Mkt	Small (pin)	Cull		
- Experiment 1 -						
None	6.3	225	10.9	6.5	20	3.6
MKP-10	6.2	215	13.8	8.7	24	3.0
MKP-20	5.5	224	13.1	7.9	18	3.6
AMKP-10	6.8	202	9.4	2.9	23	2.8
AMKP-20	5.8	246	11.6	7.3	25	3.4
TSP-20	5.6	208	13.8	4.4	19	2.8
Prob. >F	0.52	0.69	0.44	0.08	0.76	0.13
- Experiment 1 -						
None	-	300	7.3	39.9	-	-
MKP-10	-	257	6.9	26.9	-	-
MKP-20	-	282	10.9	37.8	-	-
AMKP-10	-	282	8.0	36.3	-	-
AMKP-20	-	274	8.7	49.4	-	-
TSP-20	-	277	10.2	33.4	-	-
Prob. >F	-	0.86	0.48	0.70	-	-

[z] Starter fertilizers were MKP (monopotassium phosphate), ammoniated MKP and TSP (triple superphosphate) at 10 or 20 lbs/acre as P_2O_5.

[y] Percentage of plants with open bloom; evaluation made at early bloom stage.

[x] Vigor rating: 1=poor vigor, smaller plants; 5=excellent vigor, large plants.