Tomato Fertilizer Trials

close placement of fertilizers under direct-seeded tomatoes in comparative tests with sidedressing of the same materials

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Slow growth of field seeded tomatoes and purple coloring of the leaves shortly after emergence may indicate a phosphorus deficiency.

Of 48 fertilizer trials on canning tomatoes—almost entirely with transplants and before 1956—in the major producing counties, 24 trials showed responses to nitrogen; four responded to phosphorus but none of the tests showed any benefit from potassium.

To determine the influence of close placement of nitrogen and phosphorus on the yield of field seeded canning tomatoes a trial plot was established near Tracy in 1956. Close placement—2″ below the seed—was compared to larger amounts of the same fertilizers placed 6″ below and 6″ to the side of the seed, applied at time of planting. Treatments receiving a small amount of phosphate close to the seed gave early—first-pick—yields significantly higher than with other treatments, and total yields were significantly higher than the check. Early and total yields were not increased over the check by a larger amount of phosphate placed at greater distances from the seed. Apparently, the influence of phosphate was early in the growth cycle, and effective placement was essential for yield response. At harvest it was estimated that as much as three tons per acre were lost from overripe fruit in the close-placement plots. Total yields were not much stimulated, indicating that the main influence of the treatments might be earlier maturity of the fruit.

Plant tissue samples—taken from all plots on July 7 and August 24—were analyzed for total nitrogen, phosphorus, and potassium. The data obtained from the analyses correlated poorly with the treatments, especially in phosphorus. In some instances, plots that received phosphorus placed under the seed produced plants with lower phosphorus concentrations than those of the plants in the check plot. Plant growth, stimulated by the effect of the close-placed phosphorus, had probably diluted any higher phosphorus concentration that may have existed earlier. Larger amounts of phosphorus placed further from the plants increased phosphorus concentration on the first sampling date, but this was not reflected in plant growth. A similar condition existed in nitrogen concentrations on the sampling dates. Potassium concentrations were not affected by treatment, nor was there any evidence that this element had any effect on fruit quality.

Similar trials were conducted in several locations in 1957. To measure growth, the fresh weights of plants were determined at thinning time and growth increases were just as marked as in previous trials. In all trials, plant weights at thinning time were 3–4 times as great with fertilizer placed under the seed as with no preplant fertilizer.

Several variations in placement and amounts of under-seed fertilization were compared. Phosphorus seemed to be the most important nutrient considered in close placement trials. The addition of nitrogen to the fertilizer increased seedling growth only slightly in the Tracy test. Addition of potassium likewise had little effect—except in a test near Stockton, in a soil where soil tests had indicated that potassium supply might be somewhat limited.

Plant growth was not detectably dif-

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Petiole Analysis—Tomato Fertilizer Test, Tracy, 1956

Treatment				Percent dry weight of petioles					
Pounds/acre				Nitrogen		Phosphorus		Potassium	
N[1]	P_2O_5[2]	K_2O[3]	Placement	7/7	8/24	7/7	8/24	7/7	8/24
0	0	0	.....	2.96	1.35	0.24	0.21	5.75	5.65
60	0	0	6″ to side and 6″ below seed	2.97	1.37	0.23	0.22	5.57	6.09
120	0	0	"	3.10	1.46	0.27	0.21	5.54	6.09
120	120	0	"	3.09	1.41	0.35	0.24	5.14	5.96
120	120	120	"	3.19	1.31	0.36	0.22	5.86	5.66
0	25	0	2″ below seed	2.91	1.24	0.31	0.18	5.85	4.72
20	25	0	"	2.53	1.28	0.26	0.18	6.08	4.28
20	25	0+	"	2.71	1.25	0.25	0.18	5.46	4.91
120	0	0	Sidedressed						
	LSD[4] 5%			0.09	0.29	0.04	0.03	0.55	0.86

[1] Nitrogen. [2] Phosphorus pentoxide. [3] Potassium oxide. [4] Least significant difference.

Growth of tomato plants as influenced by close placement of fertilizer at seeding time.

Tomato Fertilizer Test, Tracy, 1956

Treatment				Plant wgt. thinning time Grams	Yield Tons/acre	
Pounds/acre						
N[1]	P_2O_5[2]	K_2O[3]	Placement[4]		1st	Total
0	0	0	...	1.46	6.3	14.7
60	0	0	6″ below	1.42	7.4	17.1
120	0	0	6″ below	1.83	8.5	19.4
120	120	0	+ 6″ to side	2.13	8.1	18.2
120	120	120	+ 6″ to side	2.16	7.7	18.2
0	25	0	2″ below	7.92	10.0	19.0
20	25	0	2″ below	8.64	10.7	19.0
20	25 plus	0	2″ below 6″ side	11.70	11.4	20.2
120	0	0	2″ below 6″ side	11.70	11.4	20.2
LSD[5] 5%					1.7	2.4

[1] Nitrogen. [2] Phosphorus pentoxide. [3] Potassium oxide. [4] Refers to location of fertilizer band in reference to location of seed. [5] Least significant difference.

TOMATO

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ferent when fertilizers were placed 4" under the seed instead of 2". Doubling the rate of application—to 40 pounds of nitrogen and 50 pounds of phosphorus pentoxide per acre—definitely increased the growth of the plants, but the effect generally disappeared shortly after thinning.

Accurate fruit yield records were difficult to obtain in 1957. Extremely hot weather in June and July delayed fruit set, which may have reduced the earlier maturity observed in previous years.

Plant Weights at Thinning Time, 1957

Treatment				Ave. plant wgt. Grams		
Pounds/acre			Placement below seed	Davis	Tracy	Stockton
N[1]	P_2O_5[2]	K_2O[3]				
0	0	0	...	2.08	0.65	0.91
0	25	0	2"		2.42	
20	25	0	2"	7.78	2.72	3.00
20	25	25	2"		2.90	3.58
20	25	0	4"	7.96	2.71	3.09
40	50	0	2"	8.81	2.89	3.53
LSD[4] 5%				1.04	0.53	0.43

[1] Nitrogen. [2] Phosphorus pentoxide. [3] Potassium oxide. [4] Least significant difference.

Furthermore unseasonable rains cut short the harvest season, and in most plots several tons of tomatoes per acre were left in the field. Yield records of one plot were not taken, because of nematode infestation. The yield results in which some confidence may be placed are shown in the larger table on this page. Generally, close placement of fertilizer under the seed—either phosphorus or phosphorus plus nitrogen—produced greater early yields of fruit, but total yields were not greatly affected.

In one trial in San Joaquin County—on Staten Island—liquid 8-24-0 was used instead of the dry fertilizer used in the under-seed fertilizer treatment. Results from this test were quite comparable to the others in the effect of fertilizer on both plant growth and early yield.

Certain inherent dangers exist with these fertilizer practices. Close placement may, under certain conditions, allow soluble salts to migrate into the seed band and interfere with germination. However, proper irrigation and fertilizer band placement should avoid damage by soluble salts. Anhydrous or aqua ammonia should not be used in this manner because each one is very toxic—when placed too close to plants—and can inhibit germination.

The main effect of close placement of fertilizer may be an indirect one. The fertilizer stimulates growth to such an extent that fertilized plants are much larger when environmental conditions permit fruit set to begin. This provides a greater number of flowers that set at one time, which results in greater early yields.

Some indirect benefits are also apparent. Close placement stimulates a more vigorous root system, which allows the plant to explore the soil mass for other needed nutrients. Faster growth of the seedling considerably simplifies the weed control problem, since closer cultivation can be practiced at an earlier date. It also provides a shorter period of susceptibility to such seedling insect pests as flea beetles.

The results of the placement trials—coupled with previous fertilizer trials—can be translated into generalized fertilizer treatments for this crop. Treatments of 10–20 pounds per acre of nitrogen and 25 pounds of phosphate—phosphorus pentoxide—placed 2"–4" directly beneath the seed should be applied at planting time. About 60 pounds of nitrogen in the ammoniacal form, should be applied as a sidedressing shortly after thinning. The small amount of nitrogen applied at planting is probably not sufficient for maximum yields, and larger amounts might lead to germination troubles or be leached from the soil before the plants can use it.

Similar trials—continued in 1958—are designed to study the effect of these fertilizer practices on direct-seeded tomatoes growing on a wider range of soil types and climatic conditions.

Tomato Fertilizer Yields, 1957 Tests

Treatment				Yields, tons/acre				
Pound/acre				Woodland		Stockton		Tracy
N[1]	P_2O_5[2]	K_2O[3]	Placement	1st harvest	Total harvest	1st harvest	Total harvest	1st harvest
0	0	0	Sidedress	3.3	14.2	8.5	21.3	9.7
60	0	0	"	3.3	15.7			
120	0	0	"	2.6	14.4	7.9	20.6	
120	120	0	"	3.9	16.8			
120	120	120	"	5.3	18.3			
0	25	0	2" Under seed					9.0
20	25	0	"	4.3	19.7	11.8	22.1	
20	25	25	"					10.9
40	50	0	"					10.0
20	25	0+	"	7.0	19.8	9.3	21.2	
60	0	0	Sidedress					
LSD[4] 5%				3.06	2.60	2.40	N.S.	N.S.

[1] Nitrogen. [2] Phosphorus pentoxide. [3] Potassium oxide. [4] Least significant difference.

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RED MITE

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vealed no significant differences—as a result of mite infestation—when untreated, mite-damaged trees were compared with trees treated with oil sprays and acaricides. Neither was there any significant effect of mite damage on the production of trees receiving no pest control measures as compared with treated trees. In a few cases mite infested trees yielded less fruit at one pick than the best of the pest control treatments, but the differences were not statistically significant.

The Orange County trees were young and vigorous with a relatively light crop in proportion to total leaf area. There were several periods during the experiments when the leaves of a single growth flush were noticeably injured by mites; but other growth flushes in the same year were not as severely injured. The vigor of the trees, the relatively small ratio of fruit to foliage, and the breaks in the continuity of mite damage, may have been factors in the lack of larger differences in crop.

Certain special conditions of the experimental plots may have helped protect the untreated trees from the full effects of mite infestation. The plots were small—four trees in a square—and the treatments consisted of an application timing series. Such conditions would be favorable to populations of mite predators, while the over-all population of citrus red mites in the plot would be knocked down by the spray treatments.

In similar experiments with navel orange trees at Corona, the check trees were severely infested with citrus red mite during the fall of 1957 and there was a heavy leaf drop. Although at the time of harvest the total number of fruit was not reduced, the buttons were discolored and the fruit was soft, resulting in lowering of the grade to culls.

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