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Soil Fertility Experiments with Tomatoes — 1970

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A COOPERATIVE RESEARCH program between tomato growers in Geneva County, Alabama, and Auburn University Agricultural Experiment Station was begun in 1970.[2] Purpose of this continuing research is to better define the fertility requirements and to improve soil test calibration for tomatoes.

Four experimental test areas were located in tomato fields of cooperating growers: Billy Adkison, James Bedsole, H. D. Green, and Leon Keel. Each grower prepared the land, layed off rows, subsoiled, planted, cultivated, and sprayed for disease and insect control in the experimental test area just as he did in the remainder of his tomato field. The authors applied fertilizer and harvested tomatoes from the test area.

Each test area was marked off into 24 single-row plots 6 feet wide and 15 feet long. Each test included six treatments replicated four times. Rates of N were 0, 50, 100, and 160 pounds per acre from ammonium nitrate. Except for one P "check" plot that got no phosphorus and one K "check" treatment that got no potassium, all plots received 80 pounds P (180 pounds P_2O_5) and 150 pounds K (180 pounds K_2O). All plots had gypsum applied at 1,000 pounds per acre and the recommended rate of a nematicide was applied in the furrow during row preparation.

Approximately one-third of the nitrogen, all the phosphorus, one-half of the potassium, and all the gypsum were applied before planting. It was applied on a 3-foot strip centered on the row and incorporated with the soil using a rototiller. The remaining nitrogen and potassium were sidedressed at all test areas on April 17, 1970.

During the harvest period, ripe, pink, and mature green tomatoes were picked once each week for a total of 5 weeks. These were sorted into marketable and non-marketable fruit and weighed.

INDIVIDUAL EXPERIMENTS

Keel farm (Table 1). Tomatoes at this location were staked and supplemental irrigation was applied during dry periods. Plots that received no phosphorus fertilizer made the lowest yield—67 per cent of the top yields. On plots that got no potassium, the yield was 88 per cent of the highest yield. Soil-test P and K were both "low" at this location. Highest yields were on plots receiving 100 or 160 pounds of

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[2] Successful establishment of the research program was made possible through efforts of the Geneva County Extension Chairman.

TABLE 1. EFFECT OF FERTILIZER TREATMENT ON TOMATO YIELDS, LEON KEEL'S FARM, 1970[1]

No.	Treatment, lb./acre			Marketable fruit per acre[2]						Culls
	N	P	K	June 10	June 17	June 25	July 1	July 7	Total	
				Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Pct.*
1	0	80[3]	150[4]	2,860	2,420	2,100	4,660	6,430	18,460	11
2	50	80	150	4,090	2,930	2,470	5,010	4,950	19,440	8
3	100	80	150	3,550	3,470	2,710	6,060	7,830	23,620	5
4	160	80	150	3,170	2,440	2,440	5,230	11,490	24,740	10
5	160	0	150	2,690	2,450	2,080	4,480	4,940	16,630	8
6	160	80	0	3,520	2,800	3,000	5,700	6,870	21,890	10

[1] Soil test P = 48 (low); soil test K = 75 (low).
[2] Variety, Floradel.
[3] 80 pounds P = 180 pounds P_2O_5.
[4] 150 pounds K = 180 pounds K_2O.

TABLE 2. EFFECT OF FERTILIZER TREATMENTS ON TOMATO YIELDS, H. D. GREEN'S FARM, 1970[1]

No.	Treatment, lb./acre			Marketable fruit per acre[2]						Culls
	N	P	K	June 4	June 10	June 17	June 24	June 30	Total	
				Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Pct.*
1	0	80[3]	150[4]	590	1,190	2,940	2,830	6,900	14,450	14
2	50	80	150	940	1,430	3,790	2,070	10,590	18,820	12
3	100	80	150	500	1,270	3,860	1,970	9,150	16,750	9
4	160	80	150	490	1,760	3,510	1,770	10,900	18,430	12
5	160	0	150	990	900	4,320	2,410	8,480	17,100	11
6	160	80	0	900	1,170	2,820	2,290	9,200	16,370	11

[1] Soil test P = 145 (medium); soil test K = 80 (low).
[2] Varieties, Manapal and Floradel.
[3] 80 pounds P = 180 pounds P_2O_5.
[4] 150 pounds K = 180 pounds K_2O.

N per acre (treatments 3 and 4). The combined yields of the first four harvests from 50 and 100 pounds of N per acre were as high or higher than from the 160-pound N rate. Therefore, early production was delayed from use of a high rate of N. At the last harvest, the yield from 160 pounds N was considerably larger than that for any other N rate.

The relative amounts of culls were 5 per cent from 100 pounds N, 11 per cent from 0 N, and 8 or 10 per cent from the others.

Green farm (Table 2). Tomatoes at this location were staked but not irrigated. The yield from 50 pounds of N was as high as that from 160 pounds, but the 0 N treatment made the lowest yield. Without applied phosphorus, the yield was 93 per cent and without applied potassium it was 89 per cent. Soil test P was "medium" and K was "low." The percentage of culls ranged from a low of 9 from 100 pounds of N to a high of 14 from 0 N. The other fertilizer rates had either 11 or 12 per cent culls.

Adkison farm (Table 3). Tomatoes at this location were not staked or irrigated. Nitrogen had little or no effect on total yields, and there was little yield response to phosphorus or potassium. However, added phosphorus did improve early growth and early yield. Soil-test P was "low" and soil-test K was "medium."

The number of cull tomatoes was quite large because of excess rainfall following an extended drought during fruit production. Over half of the culls occurred at the peak harvest on June 11, the first harvest after the heavy rain. Most culls were the result of cracking. Total culls ranged from 25 to 33 per cent of the total crop. The 0 N rate had 25 per cent culls, the 0 potassium plots had 33 per cent, and the others were 28 or 32 per cent.

TABLE 3. EFFECT OF FERTILIZER TREATMENTS ON TOMATO YIELDS, BILL ADKISON'S FARM, 1970[1]

No.	Treatment, lb./acre			Marketable fruit per acre[2]						Culls
	N	P	K	May 28	June 4	June 11	June 17	June 24	Total	
				Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Pct.*
1	0	80[3]	150[4]	710	3,130	6,320	5,690	7,230	23,080	25
2	50	80	150	1,830	5,010	8,410	4,190	5,140	24,580	28
3	100	80	150	1,320	5,160	6,460	3,630	5,700	22,260	32
4	160	80	150	1,820	5,430	7,430	4,080	3,340	22,100	32
5	160	0	150	1,570	2,300	6,460	5,160	6,160	21,640	28
6	160	80	0	1,600	4,420	6,320	3,180	5,510	21,020	33

[1] Soil test P = 38 (low); soil test K = 236 (medium).
[2] Variety, Homestead 24.
[3] 80 pounds P = 180 pounds P_2O_5.
[4] 150 pounds K = 180 pounds K_2O.

TABLE 4. EFFECT OF FERTILIZER TREATMENTS ON TOMATO YIELDS, JAMES BEDSOLE'S FARM, 1970[1]

No.	Treatment, lb./acre			Marketable fruit per acre[2]						Culls
	N	P	K	June 4	June 10	June 16	June 25	June 30	Total	
				Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Pct.*
1	0	80[3]	150[4]	390	1,730	4,470	2,940	5,510	15,030	13
2	50	80	150	330	1,110	4,480	2,610	4,860	13,400	13
3	100	80	150	560	930	4,420	2,350	6,440	14,690	8
4	160	80	150	460	1,000	4,220	2,360	5,880	13,930	14
5	160	0	150	170	850	2,990	2,760	5,740	12,500	11
6	160	80	0	50	1,610	3,510	2,830	6,700	14,690	10

[1] Soil test P = 56 (medium); soil test K = 148 (medium).
[2] Variety, Manapal.
[3] 80 pounds P = 180 pounds P_2O_5.
[4] 150 pounds K = 180 pounds K_2O.

Bedsole farm (Table 4). Tomatoes at this location were staked but not irrigated. Rates of N had no effect on yield. Without phosphorus fertilizer the yield was 90 per cent, but omitting potassium fertilizer had no effect. Soil-test values for both P and K were "medium."

Cull tomatoes ranged from a low of 8 per cent for 100 pounds of N to a high of 14 per cent for 160 pounds of N. For the other treatments, culls ranged from 10 to 13 per cent.

SIZES OF TOMATOES

Tomatoes are marketed by sizes according to diameter measurements. Tomatoes in these experiments were sorted into three size categories: 5 × 6 and larger—minimum diameter of 2 11/16 inches; size 6 × 6—diameter ranging between 2 14/16 and 2 8/16 inches; and size 6 × 7 and smaller—ranging from 2 10/16 to 2 inches.

The different fertilizer treatments had an effect on the size of tomatoes produced at some locations, Tables 5-8. At the Keel farm, for example, the fewest large tomatoes were on plots receiving no phosphorus fertilizer. This treatment, together with plots receiving 0 N, also had the lowest yield of intermediate size tomatoes (6 × 6). As the N rate was raised from 50 to 160 pounds per acre the yield of small size fruit (6 × 7) increased. At the Green farm, the 0 N plots had the lowest yield of large tomatoes, whereas the 0 phosphorus plots and plots receiving 50 pounds of N had the highest yield of large size fruit. Fertilizer rates did not appear to affect fruit sizes at the Adkison and Bedsole farms.

TABLE 5. TOTAL YIELD OF TOMATOES BY SIZES, KEEL'S FARM, 1970

No.	Treatment, lb./acre			Marketable fruit per acre		
	N	P	K	Size 5 × 6 and larger	Size 6 × 6	Size 6 × 7 and smaller
				Lb.	*Lb.*	*Lb.*
1	0	80	150	5,640	5,020	7,800
2	50	80	150	6,630	5,990	6,820
3	100	80	150	6,920	7,420	9,280
4	160	80	150	6,150	6,440	12,160
5	160	0	150	3,120	4,880	8,630
6	160	80	0	5,360	8,340	8,190

TABLE 6. TOTAL YIELD OF TOMATOES BY SIZES, GREEN'S FARM, 1970

No.	Treatment, lb./acre			Marketable fruit per acre		
	N	P	K	Size 5 × 6 and larger	Size 6 × 6	Size 6 × 7 and smaller
				Lb.	*Lb.*	*Lb.*
1	0	80	150	1,760	4,910	7,790
2	50	80	150	3,850	6,640	8,320
3	100	80	150	3,120	6,240	7,380
4	160	80	150	3,060	6,990	8,370
5	160	0	150	3,860	6,320	6,920
6	160	80	0	2,440	6,100	7,830

TABLE 7. TOTAL YIELD OF TOMATOES BY SIZES, ADKISON'S FARM, 1970

No.	Treatment, lb./acre			Marketable fruit per acre		
	N	P	K	Size 5 × 7 and larger	Size 6 × 6	Size 6 × 7 and smaller
				Lb.	*Lb.*	*Lb.*
1	0	80	150	10,530	8,050	4,510
2	50	80	150	10,680	9,180	4,720
3	100	80	150	9,480	8,730	4,050
4	160	80	150	9,830	8,060	4,200
5	160	0	150	9,120	7,890	4,630
6	160	80	0	8,030	8,970	4,020

TABLE 8. TOTAL YIELD OF TOMATOES BY SIZES, BEDSOLE'S FARM, 1970

No.	Treatment, lb./acre			Marketable fruit per acre		
	N	P	K	Size 5 × 6 and larger	Size 6 × 6	Size 6 × 7 and smaller
				Lb.	*Lb.*	*Lb.*
1	0	80	150	3,280	5,920	5,830
2	50	80	150	3,180	5,450	4,770
3	100	80	150	3,010	5,600	6,070
4	160	80	150	2,520	5,320	6,090
5	160	0	150	1,950	5,030	5,520
6	160	80	0	2,440	5,970	6,280

SUMMARY

Test areas were located on farmers' fields that tested "low" or "medium" in phosphorus and potassium. An application of phosphorus fertilizer increased yield by as much as 33 per cent on a soil "low" in P and adding potassium raised the yield by as much as 12 per cent. That phosphorus or potassium fertilizer improved early growth and production of tomatoes was observed at three locations.

The effect of fertilizer nitrogen varied from one location to another. Overall, the response in 1970 indicated that 100 pounds of fertilizer N was adequate for optimum yields. The 100-pound N rate was the treatment having the lowest percentage of culls at three of the four locations.