

Production Practices Affecting Yield and Sugar Content of Sugar Beets Grown in Ontario, Canada—1961 and 1962¹

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This study is a cooperative project involving personnel of the Farmers and Manufacturers Beet Sugar Association, Saginaw, Michigan, Michigan State University, East Lansing, Michigan, Canada and Dominion Sugar Company, I.t.d., Chatham, Ontario, and the Western Ontario Agricultural School, Ridgetown, Ontario.

The objective is to investigate the production practices currently in use by Ontario sugar beet growers and correlate these practices with the resultant yield of roots, gross pounds of sugar per acre and the percent sugar. Data on percent sugar were available because the Canada and Dominion Sugar Company sample each load of beets delivered by the farmers for sugar content.

Data were collected from approximately 1700 farmers representing some 20,000 acres of beets. The data were coded and punched on IBM cards and then analyzed through the facilities of the Michigan State University and under direction of personnel of the Soil Science Department.

Various comparisons are possible with these data and particular import can be placed on the percent sugar and gross pounds of sugar per acre as affected by the various production practices.

Procedure

Standard IBM cards were used and the following items coded on the cards:

1. District. Three districts.
2. Year. 1961 to 1963.
3. Fieldman. Nine in total.
4. Soil texture. Clay and clay loams, sand and sandy loams, combinations.
5. Tile drained. Yes, no, partly.
6. Pounds seed per acre. (monogerm:: 0-0.5, 0.6-0.9, 1.0-1.4, 1.5-1.9, 2.0-2.4, 2.5-2.9, 3.0-3.4, 3.5-3.9, over 3.9.
7. Pounds seed per acre (processed). Same breakdown as monogerm.

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8. Pounds seed per acre (whole). 0-0.9, 1.0-1.9, 2.0-2.9, 3.0-3.9, 4.0-4.9, 5.0-5.9, 6.0-6.9, 7.0-7.9, over 7.9.
9. Pounds seed per acre. Combination (whole-processed-monogerm). 0-0.5, 0.6-0.9, 1.0-1.4, 1.5-1.9, 2.0-2.4, 2.5-2.9, 3.0-3.4, 3.5-3.9, 4.0-4.5, over 4.5.
10. Previous crop (1st year). Corn, vegetables, beans, wheat, spring grain, clover, alfalfa, sweet clover, grass sod, tobacco, beets, potatoes, others.
11. Legumes preceding years. 1st year, 2nd year, 3rd year, none.
12. Manure application (tons per acre). 1-4, 5-9, 10-14, 15-19, over 19, none.
13. Manure and year of application. 1963, 1962, 1961, 1960, 1959, 1958, 1957, none.
14. Plowing practice. Fall, spring, none.
15. Depth of plowing (inches). Less than 3.9, 4.0-5.9, 6.0-7.9, 8.0-9.9, 10.0-11.9, over 12.0, not plowed.
16. Soil test. Yes, no.
17. Soil test recommendation followed. Yes, no, partly.
18. Times worked between plowing and planting. 1, 2, 3, 4, 5, 6, 7, 8, 9, over 9.
19. Fertilizer application method. Plow down, broadcast, drill, combination.
20. Pounds fertilizer with drill (pounds per acre). None, 1-99, 100-199, 200-299, 300-399, 400-499, 500-599, 600-699, 700 and over.
21. Total pounds fertilizer used (pounds per acre). None, 1-199, 200-399, 400-599, 600-799, 800-999, 1000-1199, 1200-1399, 1400 and over.
22. Fertilizer ratio used with drill. O-x-x, 1-1-1, 1-2-3, 1-3-1, 1-4-2, 1-4-4, 1-6-5, 1-6-3, others.
23. Nitrogen material used. Ammonium nitrate, urea, anhydrous ammonia, nitrate-urea, aqua ammonia, cyanamid, others, none, combination.
24. Nitrogen application method. Pre-plant, side-dress, combination, none.
25. Time of side-dressing nitrogen. Before June 1, June 1-14, June 15-30, July 1-14, July 15-31, August 1-14, August 15 and later, no side-dressing.
26. Total pounds per acre nitrogen used. 0-19, 20-39, 40-49, 50-59, 60-69, 70-79, 80-89, 90-99, 100-119, 120 or more.
27. Total pounds per acre phosphate (P_2O_5) used. 0-49, 50-74, 75-99, 100-124, 125-149, 150-174, 175-199, 200-224, 225-249, 250 or more.
28. Total pounds per acre potash (K_2O) used. 0-24, 25-49, 50-74, 75-99, 100-124, 125-149, 150-174, 175-199, 200-224, 225 or more.
29. Date of planting, actual planting date or average planting date, e.g. Mar. 1-31, Apr. 1-30, May 1-31, June 1-30.
30. Row width (inches). Less than 22, 22, 24, 26, 28, 30, 32, 34, 36, 38 and over.
31. Date of harvest. Before Oct. 1, Oct. 1-7, Oct. 8-14, Oct. 15-21, Oct. 22-28, Oct. 29-Nov. 4, Nov. 5-11, Nov. 12-18, after Nov. 18.
32. Minor elements. No minor elements, boron, manganese, sodium, magnesium, zinc, others, combination.
33. Acres harvested.
34. Total tons beet.
35. Percent sugar.
36. Total tons sugar.
37. County. Eight counties.
38. Townships. Eighty townships.
39. Tons per acre beets.
40. Date planted. Before Mar. 21, Mar. 21-30, Apr. 1-10, Apr. 11-20, Apr. 21-30, May 1-10, May 11-20, May 21-30, May 31-June 9, after June 9.

This coding required 60 spaces on the standard IBM card. Prior to the card coding the data were recorded on standard tabulation sheets, then submitted to the Statistical Laboratory where the card punching and the analyses were made.

Following is a list of comparisons made:

1. Coarse-textured versus fine-textured soils.
2. Tile drainage.
3. The effect of previous crops on yields.
4. The effect of legumes in preceding years.
5. Manure application—amount.
6. Manure, year of application.

7. Fall plowing versus spring plowing.
8. Depth of plowing.
9. Soil test taken.
10. Number of times field was worked prior to planting.
11. Method of fertilizer application.
12. Pounds of fertilizer applied with the drill.
13. Total pounds of fertilizer applied.
14. Fertilizer ratio used with the drill.
15. Nitrogen material used.
16. Method of applying additional nitrogen.
17. Time of side-dressing additional nitrogen.
18. Total pounds of nitrogen applied.
19. Amounts of phosphate applied.
20. Amounts of potash applied.
21. Date of planting.
22. Row width.
23. Date of harvest.
24. Relationship of planting date and harvest date.
25. Relationship of nitrogen materials and time of side-dressing of nitrogen.
26. Relationship of tile drainage and total pounds of fertilizer used.
27. Relationship of plowing practice and number of times field worked.
28. Relationship of plowing practice and depth of plowing.
29. Relationship of plowing practice and date of planting.

Results and Discussion

Data for 1961 and 1962 are presented together with the weighted averages for the two years. Unless otherwise stated, the discussion accompanying each table pertains to the weighted averages. Approximately 80 percent of the acreage of beets is grown on fine-textured soils. Therefore, possibly more confidence can be placed on results from these soils. However, where results from coarse-textured soils are presented sufficient acreage exists so that reasonable confidence is assured.

In Ontario, fall plowing is the accepted practice on the fine-textured soils. Results from this survey (Table 1) tend to substantiate this. However, such a practice is not the case with coarse-textured soils where spring plowing is the recommended practice. The results, however, indicate a similar trend as on the fine-textured soil, that fall plowing is superior to spring plowing insofar as the yield of beets and gross sugar are concerned.

The comparison of the depth of plowing in Table 2 indicates that on both the coarse- and the fine-textured soils there is a tendency for the yield of beets and gross sugar to increase as depth of plowing increases to 8 inches in depth. On the fine-textured soil this influence continues to the 8 to 10 inch depth. The depth of plowing did not affect the percent sugar of roots produced on the coarse-textured soils but on the fine-textured soils there was a trend for the percent sugar to decrease with increasing depths of plowing.

Table 1.—Beet yields and percent sugar as affected by time of plowing, 1961 and 1962.

Plowing practice	1961				1962				Weighted average			
	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Acres	Beets T/A	Sugar %	Gross sugar Lbs A	Total acres	Beets T/A	Sugar %	Gross sugar Lbs/A
Fine-textured soils												
Fall	5881	17.1	14.88	5097	7507	18.2	15.88	5771	13,388	17.7	15.44	5475
Spring	182	15.1	14.98	4519	272	17.2	15.69	5405	454	16.4	15.41	5050
No	305	16.3	15.31	4989	83	16.1	16.34	5265	388	16.3	15.53	5048
Coarse-textured soils												
Fall	1148	17.5	14.36	5040	1584	18.3	15.39	5637	2732	18.0	14.96	5386
Spring	531	17.1	14.45	4937	701	15.8	15.48	4893	1232	16.1	15.04	4969
No	16	12.9	15.51	4012	18	16.8	15.54	5233	34	15.0	15.53	4658

Table 2.—Beet yields and percent sugar as affected by depth of plowing, 1961 and 1962.

Depth of plowing inches	1961				1962				Weighted average			
	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Total acres	Beets T/A	Sugar %	Gross sugar Lbs/A
Fine-textured soils												
8.0	2365	16.4	14.99	4912	2840	17.1	16.07	5596	5205	16.8	15.58	5285
8.0-9.9	3251	17.4	14.79	5147	4575	18.7	15.79	5889	7826	18.2	15.37	5581
10.0-11.9	447	18.3	15.05	5522	346	17.7	15.62	5516	793	18.0	15.30	5519
Coarse-textured soils												
8.0	777	17.2	14.26	4909	883	15.7	15.70	4935	1660	16.4	15.03	4923
8.0-9.9	709	17.6	14.44	5082	1388	18.8	15.24	5716	2097	18.4	14.97	5502
10.0-11.9	156	17.5	14.87	5211	14	15.0	16.00	4800	170	17.3	14.96	5177

The beneficial effect of minimum tillage is demonstrated in Table 3. The times worked refer to the number of times a field was tilled after plowing and prior to planting. Minimum tillage is defined as the least amount of tillage required to produce a satisfactory seedbed. Yields are maintained at a high level where fields are worked only 2 or 3 times prior to planting. The highest yield of beets and gross sugar per acre occurred on fields that were worked twice. An additional advantage of minimum tillage is the reduction in expense involved in seedbed preparation.

With few exceptions, beet planting in Ontario occurs during the months of April and May. For this survey, ten day planting intervals were recorded (Table 4). Beets planted on coarse-textured soils during the month of April produced a higher yield of roots and gross sugar than where beets were planted at a later date. The April 11th-20th period had the highest percent sugar content.

On fine-textured soils, the effect of date of planting, Table 4 shows a somewhat different trend than that for the coarse-textured soils. The average yields of beets and gross sugar decreased from the earliest planting date to the latest planting date. A marked decline in yield occurred at the end of April, similar to the coarse-textured soils. The percent sugar increased up to the end of April and then decreased sharply after this date. This undoubtedly accounts for the lower yield of gross sugar which occurred at this date. In Ontario, the results of this survey tend to substantiate the recommended practice of planting beets at an early date.

In the Eastern United States and Ontario, there have been considerable data obtained during the past years on the influence of row width on the yield of beets. In Ontario, the recommendation is to plant beets in a 24-inch row width. Table 5 illustrates for fine-textured soils a rather marked advantage of narrow row width plantings, i.e. insofar as the yield of beets and gross sugar is concerned. Beyond the 26-inch row width, there is a rather definite reduction occurring in the yield of beets and gross sugar. For the coarse-textured soils the same general trend occurs, but there seems to be possibly even a more distinct reduction in yield beyond the 26-inch row width. The influence on the yield of gross sugar arises from beet tonnage differences rather than from an influence on the percent sugar.

On fine-textured soils (Table 6), the greatest response to method of fertilizer application occurred where a combination of drill and broadcast methods were used. The drill method of fertilizer application refers to fertilizer that was applied at planting time, in a band to one side and below the seed or directly

Table 3.—Beet yields and percent sugar as affected by the number of times a field was worked prior to planting, 1961 and 1962. (Fine textured soils)

Times worked	1961				1962				Weighted average			
	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Total acres	Beets T/A	Sugar %	Gross sugar Lbs/A
2	154	19.4	14.43	5605	89	19.2	16.16	6202	243	19.3	15.06	5824
3	386	16.6	14.60	4845	732	18.7	16.04	5996	1100	18.0	15.56	5611
4	1498	16.7	15.02	5007	1472	17.4	16.07	5595	2970	17.1	15.54	5298
5	1534	16.8	14.79	4976	1734	18.0	15.80	5696	3268	17.4	15.33	5358
6	1929	17.5	15.01	5243	2255	18.3	15.83	5780	3584	18.0	15.53	5581
7	864	17.2	14.90	5121	1106	18.6	15.78	5854	1970	18.0	15.39	5533
8	366	16.3	14.66	4791	265	17.4	15.71	5458	631	16.8	15.10	5071

Table 4.—Beet yields and percent sugar as affected by date of planting, 1961 and 1962.

Date of planting	1961				1962				Weighted average			
	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Total acres	Beets T/A	Sugar %	Gross sugar Lbs/A
Coarse-textured soils												
Apr. 1-10	133	20.2	13.77	5569	52	19.8	16.64	6584	185	20.1	14.58	5854
April 11-20	56	20.4	14.15	5796	702	18.8	15.67	5903	758	18.9	15.56	5895
April 21-30	56	18.9	15.12	5707	791	19.6	15.03	5905	847	19.6	15.04	5892
May 1-10	361	17.9	14.15	5062	320	13.3	15.59	4146	681	15.7	14.83	4632
May 11-20	758	16.6	14.68	4885	110	15.8	15.76	4965	868	16.5	11.82	4895
May 21-30	174	16.7	14.17	4724	68	12.4	15.86	3938	242	15.5	14.64	4503
After May 30	157	16.3	14.38	4675	260	14.5	15.33	4443	417	15.2	14.97	4530
Fine-textured soils												
Apr. 1-10	641	20.0	14.65	5871	666	19.5	15.65	6092	1307	19.8	15.16	5984
Apr. 11-20	218	19.7	13.73	5416	3343	18.6	15.82	5872	3561	18.9	15.69	5844
Apr. 21-30	151	19.1	14.77	5633	2289	18.0	15.99	5765	2440	18.1	15.91	5757
May 1-10	1068	17.5	14.94	5216	769	16.1	16.06	5173	1837	16.9	15.41	5198
May 11-20	2801	16.4	14.90	4892	344	15.9	15.86	5041	3145	16.4	15.00	4908
May 21-30	1076	15.3	15.32	4676	62	13.4	16.27	4367	1138	15.2	15.37	4659

Table 5.—Beet yields and percent sugar as affected by row width, 1961 and 1962.

Row width inches	1961				1962				Weighted average			
	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Total acres	Beets T/A	Sugar %	Gross sugar Lbs/A
Fine-textured soils												
24	4512	17.1	14.82	5055	5374	18.1	15.89	5765	9886	17.6	15.40	5441
26	731	18.9	14.89	5625	1168	19.2	15.66	6018	1899	19.1	15.36	5867
28	951	15.6	15.38	4793	1204	17.1	16.06	5503	2155	16.4	15.76	5190
30	129	16.1	14.39	4627	86	16.4	16.23	5316	215	16.2	15.13	4903
Coarse-textured soils												
24	1111	17.7	14.35	5073	1280	18.9	15.32	5806	2391	18.3	14.87	5465
26	230	17.8	14.14	5028	300	18.7	15.20	5691	530	18.3	14.74	5403
28	349	16.1	14.77	4748	712	14.5	15.74	4564	1061	15.0	15.42	4625

Table 6.—Beet yields and percent sugar as affected by fertilizer application method, 1961 and 1962.

Fertilizer application method	1961				1962				Weighted average			
	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Total acres	Beets T/A	Sugar %	Gross sugar Lbs/A
Fine-textured soils												
Broadcast	923	17.4	14.97	5213	1144	17.8	15.68	5571	2067	17.6	15.36	5411
Drill	2486	15.7	14.99	4711	2234	17.7	16.08	5695	4720	16.7	15.50	5177
Combination	2920	18.0	14.82	5335	4451	18.4	15.84	5824	7371	18.2	15.44	5630
Coarse-textured soils												
Broadcast	187	16.7	14.77	4944	407	18.3	15.67	5747	594	18.0	15.39	5494
Drill	338	15.7	14.59	4595	356	16.1	15.89	5129	694	15.8	15.26	4869
Combination	1163	17.9	14.30	5123	1540	17.6	15.25	5382	2703	17.7	14.84	5271

below the seed. The broadcast method seemed to have an advantage over the drill method insofar as the yield of beets and gross sugar are concerned. However, the percent sugar was not influenced by the method of fertilizer application. On coarse-textured soils the greatest yield response occurred when the fertilizer was broadcast. Broadcasting the fertilizer showed a pronounced increase in the yield of beets and gross sugar over the drill method and a lesser response over the combination method. On the coarse-textured soils the percent sugar appeared to be influenced by the method of fertilizer application, with the broadcast method showing the highest percent sugar.

The effect of total pounds of potash per acre applied on fine-textured soils on yields of roots and gross sugar is indicated in Table 7. Varying the rates of potash had virtually no influence on the percent sugar. However, the yield of beets and gross sugar increased as the amount of potash increased over the entire range of potash application. In Ontario, it is generally accepted that most of the fine-textured soils in the beet area are fairly well supplied with potassium; therefore, little response to potash fertilization is anticipated.

With the coarse-textured soils, Table 7, as with the fine-textured soils, there seems to be approximately the same general trend occurring with the exception being that possibly minor fluctuations exist in the percent sugar.

An interesting comparison was obtained on the fine-textured soils concerning the method of applying the nitrogen fertilizer. There seemed to be little, if any, influence on the percent sugar due to the various methods of applying the nitrogen.

However, such was not the case when the yield of beets and gross sugar are considered. The pre-plant method of applying nitrogen (Table 8) had a distinct advantage over the side-dress method or a combination of methods. The side-dress method had a considerable advantage over the "combination" method. On the coarse-textured soils there appeared to be a rather definite influence of the method of fertilizer application on the percent sugar. The same general trend occurred on the coarse-textured soil as with the fine-textured soil but was less well defined.

The effect of time of side-dressing nitrogen is shown in Table 9. Present recommendations in Ontario are that nitrogen should be side-dressed as early as possible but no later than mid-July due to the possibility of a reduction in sugar percent that may result. The results of this survey illustrate on fine-textured soil that there seems to be no effect on the percent sugar due to any of the application times recorded. However, the yield of

Table 7.—Beet yields and percent sugar as affected by total pounds K₂O/acre, 1961 and 1962.

Total K ₂ O Lbs/A	1961				1962				Weighted average			
	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Total acres	Beets T/A	Sugar %	Gross sugar Lbs/A
Fine-textured soils												
0 - 24	545	15.5	14.84	4615	486	18.6	16.32	6075	1031	17.0	15.54	5303
25 - 49	1657	15.7	15.11	4740	1571	17.0	16.00	5431	3228	16.3	15.54	5076
50 - 74	1432	16.8	14.96	5022	1900	18.1	15.91	5758	3332	17.5	15.50	5442
75 - 99	1238	18.0	14.85	5343	1375	18.1	15.77	5912	2613	18.1	15.33	5642
100 - 124	955	18.3	14.82	5433	1769	17.8	15.81	5632	2724	18.0	15.46	5562
125 - 149	221	17.6	14.99	5279	357	19.9	15.62	6227	578	19.0	15.38	5865
150 - 174	147	17.6	15.11	5312	162	20.0	15.76	6291	309	18.9	15.45	5825
175 or more	173	21.2	13.81	5815	242	19.4	15.73	6080	415	20.2	14.93	5970
Coarse-textured soils												
0 - 24	73	14.9	14.39	4290	30	18.0	15.80	5700	103	15.8	14.80	4701
25 - 49	357	16.2	14.71	4768	247	18.5	13.60	5025	604	17.1	14.26	4873
50 - 74	583	17.0	14.63	4983	299	16.9	15.82	5347	882	17.0	15.03	5106
75 - 99	139	17.9	14.60	5230	409	17.6	16.01	5641	548	17.7	15.72	5537
100 - 124	315	18.6	13.76	5114	567	17.2	15.58	5360	882	17.7	14.93	5272
125 - 149	136	20.0	14.45	5785	395	16.5	15.37	5086	531	17.4	15.13	5265
150 - 174	31	18.1	13.79	5000	188	18.3	15.65	5728	219	18.3	15.39	5625
175 or more	61	16.3	13.64	4453	95	19.8	15.33	6048	156	18.4	14.67	5424

Table 8.—Beet yields and percent sugar as affected by nitrogen application method, 1961 and 1962.

Nitrogen application method	1961				1962				Weighted average			
	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Total acres	Beets T/A	Sugar %	Gross sugar Lbs/A
Fine-textured soils												
Pre-plant	980	19.1	14.77	5638	1168	19.3	15.7	6045	2148	19.2	15.28	5859
Side-dress	3820	16.8	14.97	5041	5199	18.4	15.9	5863	9019	17.7	15.51	5515
Combination	85	17.0	15.26	5178	8	16.1	16.1	5200	93	16.9	15.33	5180
Coarse-textured soils												
Pre-plant	365	18.4	14.35	5285	589	18.5	14.7	5451	954	18.5	14.57	5387
Side-dress	902	17.4	14.28	4970	1333	17.5	15.6	5480	2235	17.5	15.07	5274
Combination	62	16.0	14.64	4683	365	16.0	15.8	5045	427	16.0	15.63	4992

Table 9.—Beet yields and percent sugar as affected by time of side-dressing of nitrogen, 1961 and 1962.

Time of side-dressing	1961				1962				Weighted average			
	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Total acres	Beets T/A	Sugar %	Gross sugar Lbs/A
Fine-textured soils												
Prior to June 1st	11	19.1	14.90	5690	304	17.7	15.58	5515	315	17.8	15.56	5556
June 1 - 14	735	18.4	14.81	5462	2101	18.9	16.03	6072	2836	18.8	15.71	5914
June 15 - 30	2315	16.8	14.91	5005	2745	18.1	15.88	5758	5060	17.5	15.44	5413
July 1 - 14	802	15.6	15.34	4773	106	16.4	15.86	5190	908	15.7	15.40	4822
After July 14	18	14.8	15.75	4666	-----	-----	-----	-----	18	14.8	15.75	4666
Coarse-textured soils												
Prior to June 1st	43	19.9	13.36	5306	152	19.9	15.37	6107	195	19.9	14.93	5930
June 1 - 14	272	19.1	13.99	5337	395	18.6	15.87	5897	667	18.8	15.10	5669
June 15 - 30	588	16.5	14.51	4802	745	16.2	15.55	5027	1333	16.3	15.09	4928
July 1 - 14	51	14.7	14.37	4239	10	16.3	16.38	5340	61	15.0	14.70	4419

Table 10.—Beet yields and percent sugar as affected by total pounds of nitrogen per acre, 1961 and 1962. (Fine-textured soils)

Total N Lbs/A	1961				1962				Weighted average			
	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Total acres	Beets T, A	Sugar %	Gross sugar Lbs/A
20 or less	346	14.0	15.31	4276	307	14.9	16.00	4770	653	14.4	15.63	4508
20 - 39	820	15.5	15.01	4665	1026	15.9	16.01	5086	1846	15.7	15.74	4899
40 - 49	687	15.9	15.21	4841	554	17.4	16.14	5603	1241	16.6	15.63	5181
50 - 59	1230	17.2	15.06	5177	865	17.7	16.07	5676	2095	17.4	15.48	5383
60 - 69	668	17.1	14.91	5107	853	18.7	16.03	6006	1521	18.0	15.54	5611
70 - 79	814	17.6	15.08	5299	1286	18.8	15.85	5975	2100	18.3	15.55	5713
80 - 89	768	18.5	14.41	5317	809	18.2	15.67	5695	1577	18.4	15.06	5511
90 - 99	357	17.4	14.67	5111	670	20.6	15.69	6449	1027	19.1	15.34	5984
100 - 119	365	18.0	14.72	5292	812	19.1	15.77	6014	1177	18.7	15.44	5790
120 or more	313	19.4	14.14	5602	680	18.3	15.70	5756	993	18.6	15.30	5707

Table II.—Beet yields and percent sugar as affected by the total pound of fertilizer used on tile-drained land, 1961 and 1962.

Total fertilizer used Lbs.	1961				1962				Weighted average			
	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Acres	Beets T/A	Sugar %	Gross sugar Lbs/A	Total acres	Beets T/A	Sugar %	Gross sugar Lbs/A
Fine-textured soils												
200 - 399	635	14.4	15.11	4337	531	16.9	16.20	5482	1166	15.5	15.60	4858
400 - 599	2227	16.7	14.98	4992	2251	16.9	16.00	5410	4478	16.8	15.49	5202
600 - 799	1963	17.7	14.87	5264	3343	18.6	15.78	5864	5306	18.3	15.44	5642
800 - 999	685	18.9	14.83	5616	1275	20.1	15.78	6343	1960	19.7	15.45	6089
1000 - 1199	188	19.3	14.67	5670	134	18.2	16.34	5940	322	18.8	15.36	5782
Coarse-textured soils												
200 - 399	129	16.5	14.90	4916	47	13.9	16.05	4446	176	15.8	15.21	4790
400 - 599	341	16.3	14.52	4739	578	16.9	15.87	5358	919	16.7	15.37	5128
600 - 799	481	18.3	14.54	5326	977	17.8	15.56	5538	1458	18.0	15.22	5468
800 - 999	405	19.4	13.67	5295	505	18.1	14.62	5306	910	18.7	14.20	5301
1000 - 1199	39	17.6	13.80	4856	105	18.0	15.27	5489	144	17.9	14.87	5316

beets and gross sugar was affected by the time of application of the nitrogen. When nitrogen was applied later than June 15, there was a marked reduction in the yield of beets and gross sugar. In the case of the coarse-textured soils, a lower percent sugar in beet roots was produced than on the fine-textured soils but there was no apparent effect on the percent sugar due to time of application of nitrogen. Here, as with the fine-textured soils, there was a sharp decline in yield of beets and gross sugar when nitrogen was applied later than mid-June.

An interesting comparison was obtained with the total pounds of nitrogen per acre (Table 10). According to these data there was a definite trend of increased tonnage of beets and gross sugar up to the level where 70-80 pounds of nitrogen were applied per acre. Beyond this point levelling off of yields occurred. The data indicate that the maximum point of beet and sugar yield occurs somewhere in the range of a nitrogen application between 70-100 pounds per acre. There was a slight reduction in the percent sugar up to the level where 70-80 pounds of nitrogen were applied per acre. Beyond this level of nitrogen the reduction in percent sugar was definitely lower.

Table 11 illustrates the effect of total pounds of fertilizer on tilled, fine-textured soil. The effect on the percent sugar due to the pounds of fertilizer applied appears insignificant.

The yield of beets and gross sugar increased as the pounds of fertilizer used increased up to the 800-1000 pounds per acre level. The rate of fertilizer application (Table 11) influenced the percent sugar on tile-drained, coarse-textured soils. A reduction in percent sucrose occurred beyond the 600-800 pound per acre level. The yield of beets and gross sugar follows a similar trend as for the fine-textured soils with maximums apparently at the 600-800 pound per acre level.

Summary

Several sugar beet production practices for 1961 and 1962 have been correlated with the yield of roots and gross sugar per acre and percent sucrose. The yield data on the coarse-textured soils are very similar to the yields obtained on the fine-textured soils. In general, the production practices on both soils had marked effects on the yield of roots and gross sugar with a somewhat lesser effect on the percent sucrose.

In interpreting results from a survey such as this, there are many confounding factors to be considered. However, these data provide some useful information and trends. Caution should be used in assessing the various factors where the acreage is small.