THE EFFECT OF ADDITIONAL NITROGEN ON YIELD AND SUGAR CONTENT OF SUGAR BEETS IN ONTARIO

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The object of the experiment was to examine the effect of additional nitrogen on the yield and sugar content of sugar beets. The experiment was established with the cooperation of the Soils Department of the Ontario Agricultural College, Guelph. It was conducted on the Canada & Dominion Sugar Company, Ltd., Experimental Farm, Wallaceburg, for the past three years.

The location each year was a well-tiled, Brookston silt loam field which was fall plowed. The preceding crop in 1960 was tomatoes, 1961 alfalfa, and in 1962, oats. The land the first year was prepared in the normal fashion of double disking, harrowing, etc., whereas, in the second and third year's work, the field was disked one way with a harrowing following; a minimum tillage practice which is beginning in Ontario.

Fertilizer each year was applied as a band application about 3 inches below the seed according to a soil test recommendation. (1960 - 300 lbs. 4-24-20; 1961 - 500 lbs. 5-20-20; and in 1962 - 600 lbs. of 5-20-20.) It was applied with a John Deere 74 precision drill.

The plots ran the length of the field. The treatments were randomized and the results represented three replicates of each of four rates of nitrogen. The nitrogen was applied as 32% urea liquid in the center of the row (24" rows) three to four inches deep on June 30th in 1960, June 7th in 1961, and July 2nd, 1962. The rates used each year ranged from 0, 40, 80, 120 and 160 pounds of actual nitrogen per acre.

In 1960 and 1962, visual observations indicated a very distinct difference in color and size of foliage throughout the season which was later reflected in similar differences in tonnage and sugar content. The deeper the green color of the foliage, the higher the tonnage. In 1961, these visual differences were not very distinct. This change in 1961 could probably be attributed to the preceding alfalfa crop along with an extremely adequate supply of moisture in 1961, which continued throughout the growing season, resulting in a record tonnage up to that date.

In 1960, the weather was quite dry in August and September, thus, possibly curtailing the release of nitrogen which showed up in differences in yield, sugar content and color of leaves.

The results are reported for the hand harvested plots which consisted of two sections of 1/200th of an acre each from each plot out of which two samples of five beets each were used for sugar analysis.

1/ Canada & Dominion Sugar Co. Ltd., and Ontario Agricultural College, respectively.

The results were as follows:

NITROGEN PLOTS 1960

(Average of 3 Replicates)

RATE OF NITROGEN (lbs. actual N per acre)	PLANT POPULATION	TONS/ ACRE	% SUGAR	SUGAR PER ACRE GROSS LBS.	% OF CHECK
0	23,167	17.7	17.8	6301	100.00
80	22,767	21.0	17.6	7392	117.31
120	22,000	21.3	16.9	7199	114.25
160	22,600	21.3	16.0	6816	108.17

NITROGEN PLOTS 1961

(Average of 3 Replicates)

RATE OF NITROGEN (lbs. actual N per acre)	PLANT POPULATION	TONS/ ACRE	% SUGAR	SUGAR PER ACRE GROSS LBS.	% OF CHECK
0	18,867	22.4	15.6	6989	100.00
80	18,733	21.1	14.5	6119	87.55
120	20,133	23.0	14.3	6578	94.12
160	17,333	21.8	14.1	6148	87.97

NITROGEN PLOTS 1962

(Average of 3 Replicates)

RATE OF NITROGEN (lbs. actual N per acre)	PLANT POPULATION	TONS/ ACRE	% SUGAR	SUGAR PER ACRE GROSS LBS.	% OF CHECK
0	16,600	22.0	16.1	7084	100.00
40	17,400	22.5	15.9	7155	101.00
80	16,800	24.4	15.3	7466	105.39
120	17,200	25.8	15.8	8153	115.09
160	18,200	27.1	14.8	8022	113.24

C. Gross Sugar

The economics of the nitrogen applications in 1960 favored a rate of not over 120 pounds per acre, whereas, in 1961 with a good crop of alfalfa plowed down the previous year, and a good growing season, the check plot was sufficiently competitive to give the highest net returns per acre. In 1962, the gross sugar per acre increased linearly with the increasing nitrogen rate and gave the highest net returns per acre at the 120 pound rate.

EFFECT OF NITROGEN ON NET VALUE PER ACRE BY YEARS

1960

RATE OF NITROGEN PER ACRE	GROSS LBS. OF SUGAR PER ACRE	GROSS VALUE PER ACRE	GROSS VALUE INCREASE	NITROGEN COST	NET VALUE INCREASE
0	4941	206.77	-	-	-
80	6218	260.20	53.43	10.12	43.31
120	6351	265.62	58.85	15.18	43.67
160	6193	258.84	52.07	20.24	31.83
1961					
0	6621	265.06	-	-	-
80	6167	241.00	24.06	10.12	34.18
120	6401	251.32	13.74	15.18	28.92
160	5841	230.40	34.66	20.24	54.90
1962					
0	7084	287.76	-	-	-
40	7155	290.70	2.94	5.12	-2.18
80	7466	303.54	15.78	10.24	5.54
120	8153	331.27	43.51	15.36	28.15
160	8022	326.28	38.52	20.48	18.04

Conclusions

In conclusion the following points should be noted:

A. Yield

In 1960 and 1962, the yield increased linearly, particularly in 1962, thus, indicating a more pronounced effect of the increased rates of nitrogen. In 1961, with continuous growing weather and the lack of a frost, coupled with the fact that the sugar beets followed alfalfa, which would probably leave more residual nitrogen than tomatoes, there seemed to be a sufficient supply of nitrogen which caused the beets to continue actively growing throughout the season.

B. Sugar

The sugar in each of the three years decreased linearly with increasing rates of nitrogen. In 1962, the percent sugar was significantly lower at the 160 pound rate than any other.