Effect of Barnyard Manure and Inorganic Nitrogen Fertilizer on Sugarbeet Production

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Commercial inorganic nitrogen (N) fertilizers applied in proper amounts have been effective in producing maximum sucrose yields. However, as supplies of inorganic N become limited and more expensive, barnyard manure may become an economical and desirable source of N for sugarbeets.

Manure has been shown to have both direct and indirect value to the grower. The direct benefits are that both N and P are supplied by applications of manure. Indirect benefits result from the addition of organic matter to the soil. Organic matter supplied with manure can improve the physical condition of the soil and stimulate microbial activity.

The N in manure is mostly combined in organic compounds. These compounds are decomposed slowly in the soil to provide forms of N readily absorbed by the plant. There has been some concern that large amounts of N would be released from manure late in the season when excessive amounts of N are detrimental to sucrose accumulation.

A study was undertaken in the 1975-76 season to determine the value of using barnyard manure, applied just prior to planting, as a source of N for sugarbeet production. Two experiments were conducted simultaneously: one comparing manure rates and manure plus N fertilizer and the other comparing N fertilizer rates only. The experiments were positioned together in the field so that soil and environmental conditions would be similar and comparisons could be made between treatments of the two experiments.

Procedure

Beets were planted on 30-inch, single-row beds on September 25, 1975. The plot area for both experiments received a uniform application of 200 lbs per acre of 0-45-0 fertilizer preplant. In the manure experiment, application rates of 10, 20 and 30 tons per acre were compared. Each manure plot was split with one-half receiving no inorganic N and the other half 75 lbs of fertilizer N per acre on October 22, 1975. Manure contained 79% dry matter and 1.76% N and 1.77% P, both on a dry weight basis. Thus, 28 lbs of both N and P were applied with each ton of moist manure.

In the N fertilizer experiment, application rates of 0, 75, 150 and 225 lbs per acre of N were compared. Plots received 0, 75 or 150 lbs of N per acre on October 22, 1975. The 225 lb per acre N treatment received an additional 75 lbs of N per acre in January of 1976. Soil samples collected before planting and analyzed for N indicated that the top four and six feet of soil contained approximately 140 and 180 lbs

of residual N per acre, respectively. Plots of both experiments were harvested on June 23, 1976, using Amstar Spreckel's plot harvester.

Results

There were no significant differences among manure application rates in root yield, sugar yield or sucrose content (see manure rate averages in Table 1).

The addition of 75 lbs of N per acre to manure plots did not significantly affect root or sugar yields. The lack of response to N fertilizer applied with manure might be expected, since large amounts of N were already present in the soil as residual N. Manure alone did not decrease sucrose content; however, when N fertilizer was used with the highest rate of manure, sucrose content was significantly reduced.

Comparisons of treatments between the manure and N fertilizer experiments showed that a 10 ton per acre application of manure tended to result in higher root and sugar yields than where no manure or N fertilizer were used. Beets receiving 75 lbs of N per acre yielded the same as those receiving 10 tons of manure per acre or 10 tons of manure per acre plus 75 lbs per acre of fertilizer N.

In these experiments, in which large amounts of residual N were present in the soil, applications of 10 tons of manure per acre or 75 to 150 lbs of fertilizer N per acre were adequate for producing maximum yields. High rates of manure did not greatly reduce sucrose content as might have been expected, except where N fertilizer was used with manure. Beets in all treatments, including manure treatments, were deficient in nitrogen by harvest (Table 2).

In the 1977-78 season, sugarbeets will be grown in the same plots as in the 1975-76 experiments to determine the effect of residual manure on sugarbeet production.

Table 1. Effect of manure and N fertilizer application rates on root yield, sugar yield and sucrose content of sugarbeets.

Manure (Tons/A)	N Fertilizer (Lbs/A)	Root Yield (Tons/A)	Sugar Yield (Lbs/A)	Sucrose Content (%)
		Manure Experiment		
10	0	32.0	10,180	15.84
10	75	33.4	10,490	15.69
Avg. for manure rate		32.7	10,340	15.77
20	0	32.6	10,200	15.34
20	75	36.5	10,950	14.98
Avg. for manure rate		34.9	10,570	15.16
30	0	34.7	10,610	15.43 a[1/]
30	75	36.4	10,570	14.51 b
Avg. for manure rate		35.6	10,590	14.97
		N Fertilizer Experiment		
0	0	28.8 a[1/]	9,350 a	16.22 a
0	75	33.1 b	10,430 ab	15.71 b
0	150	38.4 c	11,730 b	15.28 c
0	225	37.7 c	11,530 b	15.25 c

[1/] Means for N fertilizer rates at the 30 ton per acre manure rate were significantly different at the 5% level. There were no significant differences among means for manure rates or between means for N fertilizer rates at a manure rate except where noted above.

[2/] Means in columns in the N fertilizer experiment followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

Table 2. Effect of manure and N fertilizer application rates on petiole NO_3-N content.

Manure (Tons/A)	N Fertilizer (Lbs/A)	Date Sampled 1/26/76	4/7/76 (ppm NO_3-N)	6/11/76
		Manure Experiment		
10	0	3580	990	400
10	75	2680	1100	380
20	0	2910	820	400
20	75	2830	1370	400
30	0	2970	1510	430
30	75	3050	1580	450
		N Fertilizer Experiment		
0	0	2620	780	390
0	75	1950	1210	390
0	150	3270	1670	350
0	225	3950	1680	370