

## Red River Valley Site-Specific Nitrogen Management in 1996

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Recent development in new technologies have given growers the potential to increase accuracy of nitrogen management and sugarbeet profitability. About 25 percent of all sugarbeet acreage in Minnesota and North Dakota was grid sampled and variable rate fertilized in 1996. Past experiences have indicated about 70 percent of the fields grid sampled are likely to give profitable responses to variable rate fertilization.

### Objective(s):

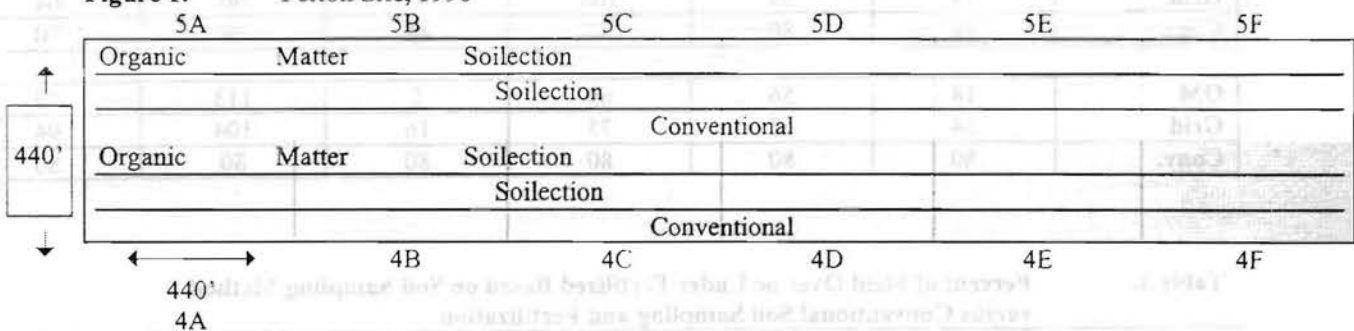
The purpose of these studies was to compare yield, quality and profitability of sugarbeet production using site-specific versus conventional soil sampling and fertilizer application techniques. An additional objective was to determine if nitrogen recommendations could be further refined by increasing or decreasing nitrogen application rates based on individual grid organic matter levels.

### Procedures:

The study was established in a grower fields at Felton, Minnesota. The field was grid sampled on about a 4.4 acre grid size to determine nitrogen status and organic matter content at Felton. Headlands were not included in the studies. The conventional sampling consisted of about 30 probes in a random pattern across the field. Twelve 4.4 acre grids were sampled at each location. Six or eight soil samples per grid were taken. Soil samples were taken from 0-6", 6-24", and 24-42" depths at Felton. Soil analysis was performed by Minnesota Valley Testing Labs.

The 12 grids across the field were grid sampled then split into thirds (a) one-third grided and variable rate fertilization; (b) one-third grided and variable rate fertilized with organic matter adjustment; and (c) one-third conventionally fertilized.

**Figure 1. Felton Site, 1996**



The Felton site was fertilized to a level of 120 lb/A available nitrate-nitrogen with adjustments made when 2-4' nitrogen is more or less than the "normal" 30 lb/A level. The study was designed only to look at variable rate nitrogen application. The field at Felton had very uniform plant populations of about 160 beets/100' of 22" wide rows.

North Dakota State University/University of Minnesota scientists took six ten foot long hand dug samples per grid for yield, quality, and plant population data. A total of 216 samples were taken at Felton. Harvest was completed by North Dakota State University/University of Minnesota scientists at Felton on September 30 and grower harvest completed on October 14. Quality analysis on all samples was done at the American Crystal Sugar Co. lab at East Grand Forks, Minnesota. All grower loads were delivered to the same outlying piling ground at Felton to reduce chances for errors.

## **Results and Discussion**

Grid sampling gave a far more accurate estimation of total nitrogen in the 0-42" soil profile at Felton than conventional sampling, **Table 1**. The field conventional soil test level was 62 lb/A, 0-48".

**Table 1. Total Soil NO<sub>3</sub>-N and OM by Grid, Felton, MN., 1996**

<b>OM</b>	%	5.0	4.8	3.6	3.5	4.2	5.4
<b>0-2'</b>	lbs/A	110	94	32	40	51	67
<b>2-4'</b>	lbs/A	25	14	5.0	11	4.0	16
<b>TOTAL</b>		135	108	37	51	55	83
<b>OM</b>	%	5.2	4.3	4.2	4.2	3.7	4.5
<b>0-2'</b>	lbs/A	76	70	56	109	35	39
<b>2-4'</b>	lbs/A	17	11	16	16	6.0	14
<b>TOTAL</b>		93	81	72	125	41	53

**Conventional field soil test = 62 lb/A, 0-4' nitrogen**

Nitrogen recommendations by grid for Felton are shown in **Table 2**. Wide variations in amounts of fertilizer nitrogen applied per grid occurred based on soil sampling method. Nitrogen applied based on organic matter adjustment ranged from 0 to 120 lbs/A. Nitrogen applied range from 14 to 108 lbs/A based on normal grid sampling while the conventional nitrogen application was 80 lbs/A. Percent of the fields over or under fertilized based on soil sampling method are shown in **Table 3**.

**Table 2. Nitrogen Recommendation (lbs/A) by Grid, Felton, MN., 1996**

<b>OM</b>	0	15	120	110	84	22
<b>Grid</b>	14	39	108	95	90	64
<b>Conv.</b>	80	80	80	80	80	80
<b>OM</b>	18	56	69	5	113	79
<b>Grid</b>	54	65	75	16	104	94
<b>Conv.</b>	80	80	80	80	80	80

**Table 3. Percent of Field Over or Under Fertilized Based on Soil Sampling Method versus Conventional Soil Sampling and Fertilization.**

Location	-----Sampling Method-----				
	GRID		GRID + OM		
	Over	Under	Over	Under	No Difference
<b>Felton</b>	58	42	58	33	9

**Table 4. Effect of Soil Sampling Method on Sugarbeet Yield & Quality, NDSU/U of MN., Felton, MN., 1996**

	Sugar (%)	Yield (T/A)	Rec Sugar (lbs/A)	Gross Return (\$/A)
Conv. 1 & 2	18.0	19.3	6417	955
Soilection 1 & 2	18.1	19.9	6628	991 (+36)
Org. Mtr. 1 & 2	17.9	20.1	6643	986 (+31)

The effects of grid sampling and variable rate spreading on sugarbeet yield and quality compared to the conventional method for Felton from the University data is shown in Table 4. The soilection grid sampling increased gross return by \$36.00 per acre over conventional soil sampling. The organic matter fertilization adjustment increased gross return per acre by \$31.00. A baseline organic matter content of four percent was used for this field and soil type. Nitrogen fertilization was increased by 3.0 lb/A for each 0.1 percent decrease in organic matter below 4.0 percent. Conversely nitrogen fertilization was decreased 3 lb/A for each 0.1 percent increase in organic matter above the four percent baseline.

The cooperating grower at Felton harvested each of the six treatment strips (12 grids) as an individual grower contract. The grower harvest resulted in \$54.00/A more gross return from variable rate fertilization adjusted by organic matter content, Table 5. Standard variable rate fertilization by Soilection increased gross return by only \$13.00/A compared to conventional methods.

**Table 5. Sugarbeet Yield & Quality as Determined by Grower Harvest at Felton, MN., 1996.**

	Sugar (%)	SLM (%)	Yield (T/A)	Rec. Sugar (lbs/A)	Gross Return*
Soilection	18.61	1.28	20.0	6932	1045 (+13)
Org. Matter	18.60	1.33	20.9	7219	1086 (+54)
Conv.	18.45	1.31	20.1	6890	1032

\* Basis - 1996 American Crystal Sugar Co. estimated 1996 payment formula

**I. Conclusion/Felton, 1996**

1. The average amount overfertilized by conventional methods versus grid sampling and variable rate fertilization at Felton was 33 lb/A (with a range of 5 to 66).
2. The average amount underfertilized by the conventional methods versus grid sampling and variable rate fertilization at Felton was 18 lbs/A (with a range of 10 to 24).
3. The average amount overfertilized by conventional methods versus grid sampling and variable rate fertilization plus OM adjustment was 47 lbs/A (with a range of 1 to 80).
4. The average amount underfertilized by conventional methods versus grid sampling and variable rate fertilization plus OM (organic matter) adjustment was 27 lb/A (with a range of 4 to 40).
5. With grid sampling and OM adjustment produced more recoverable sugar per acre than conventional methods in 9 of 12 grids (with a range of 61 to 1021 lbs. and a mean of 344 lbs).
6. With grid sampling and OM adjustment produced less recoverable sugar per acre in 3 of 12 grids than conventional methods (with a range of 101 to 213 lbs. and a mean of 167 lbs.).

7. Grid sampling and variable rate fertilization produced more recoverable sugar per acre than conventional methods in 8 of 12 grids (with a range of 149 to 834 lbs. and a mean of 401 lbs.).
8. Grid sampling produced less recoverable sugar per acre than conventional methods in 4 of 12 grids (with a range of 37 to 506 lbs. and a mean of 170 lbs.).
9. Grid sampling and organic matter adjustment produced more recoverable sugar per acre than grid sampling only and variable rate fertilization in 8 of 12 grids (with a range of 24 to 727 lbs. and a mean of 297 lbs.).
10. Grid sampling and organic matter adjustment produced less recoverable sugar per acre than grid sampling only and variable rate fertilization only in 4 of 12 grids (with a range of 31 to 728 lbs. and a mean of 418 lbs.).

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