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Nitrogen Use Management In Sugar Beet Culture As Related To Soil Type As Well As Timing Of Application

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Our Approach

- N use requirement = lbs. N needed per projected tons of beets which will be grown.

Three determinations

- 1) Can N use rate be refined down from 8 lbs. N per ton of beets produced ?
- 2) Can N use rate be refined basis of soil type ?
- 3) Does soil type significantly affect the proper timing of N application relevant to rate ?

What we thought we knew

- Carry over amounts of N need to be accounted for down to 3 foot soil depth at least, as well as all other potential N inputs, i.e. N mineralization.
- Soil type affects the amount of N which can be mineralized in season.
- Because of differences in mineralization potential in soil types as well as soil mechanics differences, timing of N applications could be critical.

How we determine

- Account for carry over N amounts by adequately soil sampling.
- Use past years cropping history to determine yield potential.
- Use the proper multiplier (lbs. N per projected tons expected to be grown) to determine crop requirement of N.
- Subtract carry over N from N use requirement to determine additional application need.

Carry over N in soil

Account for carry over N amounts by adequately soil sampling.

1st foot- 10 ppm +

2nd foot- 12 ppm +

3rd foot- 8 ppm +

30 ppm X 4 = 120 lbs. N

3-5 years cropping history

Tons previously produced

Don’t use a years history which was irregular due to weather or disease problems.

If sugars or brei nitrates were low and high respectively, N inputs were too high.

Use 8 lbs. or lower X average tons = cropping requirement.

How it looks

Average T/A = 32 x 8 lbs./ton = 256 lbs. N

(-)

Carry over N = 30 ppm x 4 = 120 lbs. N

(=)

Additional N to apply 136 lbs. N

Which is it ?

- N use requirement = lbs. N needed per projected tons of beets which will be grown.

Average T/A = 32 x 8 lbs./ton = 256 lbs. N
Or is it 6 lbs./ton = 192 lbs. N ?
Or is it 5 lbs./ton = 160 lbs. N ?

What we wanted to know

- Because different soil types have different potentials for mineralization could we better regulate our management of N input on that basis ?
- By how much would soil type change the multiplier by which we gage lbs. N use required per ton produced ?

Over a 3 year period

- Looked at silt loam soils at 4 sites.
- Looked at sandy loam soils at 3 sites.
- Looked at clay loam soils at 2 sites.


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KIRKLAND
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DATE:
CONTENTS:
D.E.
Jerome N
#65
DATE:
CONTENTS:
D.E.
Jerome N
#61


FORD


LOW BAT
MOTION
PRINT
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TARE
NET
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lb
kg
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CLASS III/III L
n max 10,000
MENU
PRINT SELECT
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GROSS NET
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UNITS
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ON
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SERIAL NO
709
WEIGH-TRONIX
WI-152

Nitrogen Use Rate Study- Silt Loam Soils

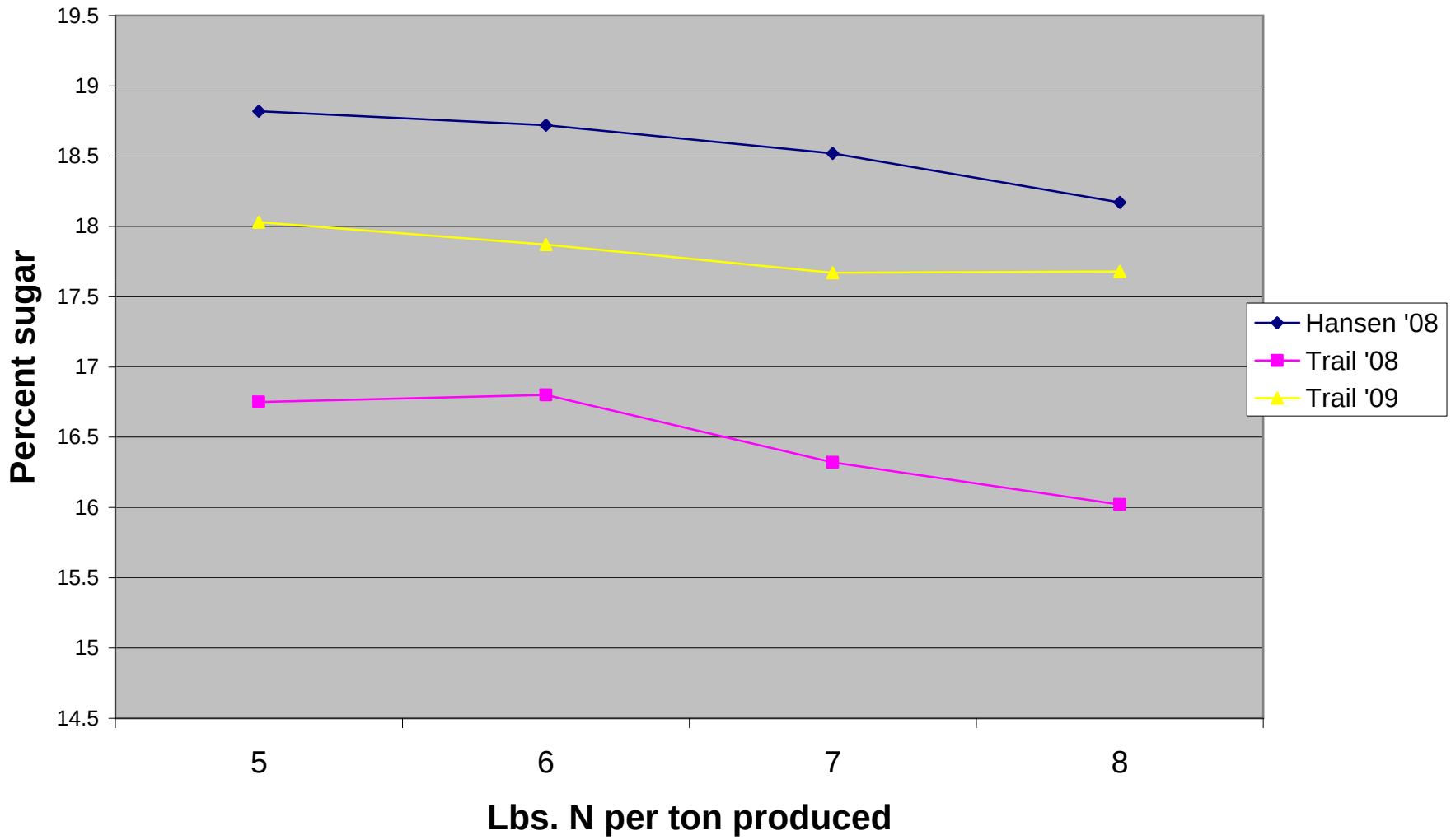
Two years, 2008-'09 Three Locations

Treatment	Root Yield (T/A)	Sugar Content (%)	Nitrate Content (ppm)	Conductivity (mmhos)
Five Lbs Nitrogen	36.06	17.85	56	0.601
Six Lbs Nitrogen	37.19	17.85	57	0.601
Seven Lbs Nitrogen	36.04	17.57	79	0.621
Eight Lbs Nitrogen	37.08	17.29	101	0.645
LSD (0.05)	ns	0.36	19	0.025
LSD (0.1)	ns	0.30	16	0.021
CV (%)	6.0	3.0	36.8	6.0
PR > F	0.2049	0.0151	0.0001	0.0009
Grand Mean	36.59	17.63	74	0.618
Five Lbs Nitrogen		a	a	a
Six Lbs Nitrogen		a	a	a
Seven Lbs Nitrogen		ab	b	ab
Eight Lbs Nitrogen		b	c	b

Nitrogen Use Rate Study- Silt Loam Soils
Two years, 2008-'09 Three Locations

Treatment	Recov. Sugar lbs/ton	Recov. Sugar lbs/acre	Gross $ per ton	Gross $ per acre	Net $ per acre		
Five Lbs Nitrogen	310.9	11186	$ 49.24	$ 1,770.00	$ 1,680.00	avg.	differ.
Six Lbs Nitrogen	310.9	11557	$ 49.23	$ 1,830.00	$ 1,729.00	$ 1,704.50	$72.00
Seven Lbs Nitrogen	304.9	10983	$ 48.27	$ 1,739.00	$ 1,632.00	avg.	
Eight Lbs Nitrogen	298.8	11062	$ 47.30	$ 1,751.00	$ 1,633.00	$ 1,632.50	
LSD (0.05)	7.0	ns	1.24	ns	ns		
LSD (0.1)	5.8	ns	1.03	ns	65		
CV (%)	3.3	6.7	3.7	6.7	6.8		
PR > F	0.0044	0.1650	0.0152	0.1688	0.0762		
Grand Mean	306.2	11190	$ 48.48	$ 1,771.00	$ 1,667.00		
Five Lbs Nitrogen	a		a		ab		
Six Lbs Nitrogen	a		a		a		
Seven Lbs Nitrogen	ab		ab		b		
Eight Lbs Nitrogen	b		b		b		

Silt Loam Soil, Sugar%, 2 yrs. at 3 locations



Nitrogen Usage per ton- Sandy Loam soil- K. Bowen Farm 2009

Lbs. N per projected ton yield	over-all lbs. N available per acre	tons/acre actual yield	actual lbs. N used per ton of yield	ERS per ton	based on $25.80 nets ERS per acre	value $ per ton	value $ per acre
8	242.3	27.6	8.8	275.7	7635.7	$ 41.42	$1,148.06
7	212.3	28.6	7.4	280.0	8011.0	$ 42.16	$1,206.24
6	181.8	24.3	7.5	277.3	6759.3	$ 41.59	$1,014.30
5	151.6	20.7	7.3	276.2	5709.6	$ 35.49	$ 733.48

Nitrogen Usage Trial- Sandy Loam Soil, 2009, C Jones Farm

Lbs. N per projected ton yield	over-all lbs. N available per acre	tons/acre actual yield	actual lbs. N used per ton of yield	ERS per ton	based on $25.80 nets		
					ERS per acre	value $ per ton	value $ per acre
8	250.5	35.33	7.1	304.1	10735.2	$ 48.28	$1,705.37
7	219.1	34.31	6.4	297.9	10177.4	$ 47.17	$1,611.80
6	188.7	33.04	5.7	302.6	10027.1	$ 47.94	$1,589.40
5	184.8	34.95	5.3	305.7	10675.7	$ 48.60	$1,697.10

Nitrogen Use Rate- Sandy Loam Soil, Jerome location 2010

Lbs. N per projected ton yield	over-all lbs. N available per acre	tons/acre actual yield	actual lbs. N used per ton of yield	ERS per ton	based on $26.11 nett		
					ERS per acre	value $ per ton	value $ per acre
0	157.7	38.29	4.1	253.8	9717.3	$ 42.37	$1,622.40
4	161.2	38.35	4.2	253.8	9733.6	$ 42.03	$1,611.69
6	213.4	39.81	5.4	255.1	10154.6	$ 42.37	$1,686.81
8	285.4	41.31	6.9	256.3	10589.3	$ 42.72	$1,764.65
11	392.8	39.87	9.9	253.0	10085.3	$ 42.03	$1,675.57

SAND Y LOAM SOIL, K. BOWEN SITE, 2009

Treatment	Root Yield (T/A)	Sugar %	Nitrate ppm	conduc. Mmhs
Five Lbs Nitrogen	20.67	15.62	49	0.452
Six Lbs Nitrogen	24.29	15.62	55	0.432
Seven Lbs Nitrogen	28.59	15.78	59	0.44
Eight Lbs Nitrogen	27.64	15.57	60	0.448
LSD (0.05)	2.70	NS	NS	NS
LSD (0.1)	2.22	NS	NS	NS
CV (%)	8.7	3.8	41.9	8.8
PR > F	0.0001	0.9271	0.8397	0.8107
Grand Mean	25.30	15.65	56	0.443

Five Lbs Nitrogen	c
Six Lbs Nitrogen	b
Seven Lbs Nitrogen	a
Eight Lbs Nitrogen	a

SANDY LOAM SOIL, K. BOWEN, 2009

Recov. Sugar lbs / ton	Recov. Sugar lbs /	Gross $ per ton value	Gross $ per acre value
276.5	5729	$ 41.59	$ 861.00
277.3	6759	$ 41.59	$ 1,014.00
280	8011	$ 42.16	$ 1,206.00
275.7	7636	$ 41.42	$ 1,148.00
NS	895	NS	138
NS	736	NS	114
4.3	10.3	4.9	10.6
0.9258	0.0003	0.9270	0.0004
277.4	7034	41.69	1057

c	c
b	b
a	a
ab	ab

Driscoll Farms, Nitrogen Rate Study, 2010

Treatment	Root Yield (T/A)	Sugar Content (%)	Nitrate Content (ppm)	Cond. Mmhs	Recov. Sugar lbs/ton	Recov. Sugar lbs/acre	Gross $ per ton	Gross $ per acre	Net Per Acre (Dollars)
Eleven Lbs Nitrogen	39.87	15.55	548	1.020	252.1	10052	$ 41.85	$ 1,669	$ 1,507
Four Lbs Nitrogen	38.35	15.63	412	1.000	254.5	9742	$ 42.14	$ 1,613	$ 1,517
Six Lbs Nitrogen	39.81	15.68	412	1.007	255.0	10134	$ 42.31	$ 1,682	$ 1,565
Eight Lbs Nitrogen	41.31	15.75	542	1.023	255.4	10548	$ 42.55	$ 1,757	$ 1,618
LSD (0.05)	ns	ns	ns	ns	ns	ns	ns	ns	ns
LSD (0.1)	ns	ns	ns	ns	ns	ns	ns	ns	ns
CV (%)	4.9	4.0	31.4	7.6	5.2	6.3	5.1	6.3	6.7
PR > F	0.1169	0.9532	0.2395	0.9445	0.9734	0.2294	0.9531	0.1814	0.2686
Grand Mean	39.84	15.65	479	1.013	254.3	10119	42.21	1680	1552

N USE RATE, CLAY SOIL, B. BOWEN SITE, 2010

Treatment	Root Yield (T/A)	Sugar Content (%)	Nitrate Content (ppm)	Conductivity (mmhos)	Recoverable Sugar (lbs/T)
Four Lbs Nitrogen	31.57	18.40	67	0.766	313.0
Six Lbs Nitrogen	32.30	18.10	110	0.810	305.5
Eight Lbs Nitrogen	32.48	17.78	161	0.882	296.6
Eleven Lbs Nitrogen	33.44	17.12	289	0.967	281.2
LSD (0.05)	NS	0.36	71	0.066	9.1
LSD (0.1)	NS	0.30	58	0.055	7.5
CV (%)	4.3	1.6	34.6	6.1	2.4
PR > F	0.2088	0.0001	0.0001	0.0001	0.0001
Grand Mean	32.49	17.82	161	0.860	298.5
Four Lbs Nitrogen		a	a	a	a
Six Lbs Nitrogen		ab	ab	a	ab
Eight Lbs Nitrogen		b	b	b	b
Eleven Lbs Nitrogen		c	c	c	c

N USE RATE, CLAY SOIL, B. BOWEN 2010

Recoverable Sugar (lbs/A)	Gross $ per Ton	Gross $ per Acre	Net $ per Acre		
9879	51.71	$ 1,632.00	$ 1,553.00	avg. 4 & 6	
9866	50.67	$ 1,636.00	$ 1,538.00	$ 1,545.50	**differ.**
9629	49.58	$ 1,610.00	$ 1,494.00	avg. 8 & 11	**$ 80.50**
9394	47.27	$ 1,580.00	$ 1,436.00	$ 1,465.00	
NS	1.26	NS	NS		
NS	1.03	NS	NS		
4.7	2.0	4.4	4.6		
0.2730	0.0001	0.5395	0.2359		
9684	49.72	1614	1503		

a
ab
b
c

Nitrogen Use Rate Trial- Clay Loam Soil- Big D Ranch, 2010

Treatment	Root Yield (T/A)	Sugar Content (%)	Nitrate Content (ppm)	Conductivity (mmhos)	Recoverable Sugar (lbs/T)	Recoverable Sugar (lbs/A)	Gross Per Ton (Dollars)	Gross Per Acre (Dollars)	Net Per Acre (Dollars)	
Four Lbs Nitrogen	38.85	16.72	82	0.590	291.0	11296	$ 45.90	$ 1,781.00	$ 1,684.00	$ 79.00
Six Lbs Nitrogen	38.42	16.62	85	0.592	289.1	11096	$ 45.55	$ 1,749.00	$ 1,633.00	
Eight Lbs Nitrogen	39.72	16.16	128	0.644	278.6	11059	$ 43.96	$ 1,745.00	$ 1,605.00	
Eleven Lbs Nitrogen	39.50	16.14	178	0.650	278.1	10989	$ 43.89	$ 1,734.00	$ 1,566.00	
LSD (0.05)	ns	ns	63	ns	ns	ns	ns	ns	ns	
LSD (0.1)	ns	ns	52	ns	ns	ns	ns	ns	ns	
CV (%)	7.2	3.2	38.8	7.5	3.9	6.8	4.0	6.8	7.0	
PR > F	0.8790	0.2167	0.0195	0.1166	0.1878	0.9262	0.2169	0.9307	0.4382	
Grand Mean	39.12	16.41	118	0.619	284.2	11110	$ 44.83	$ 1,752.00	$ 1,622.00	

Four Lbs Nitrogen	a
Six Lbs Nitrogen	a
Eight Lbs Nitrogen	ab
Eleven Lbs Nitrogen	b

N USE RATE, CLAY SOIL- COMBINED DATA TWO SITES- 2010

Treatment	Root Yield (T/A)	Sugar Content (%)	Nitrate Content (ppm)	Conductivity (mmhos)	Recoverable Sugar (lbs/T)
Four Lbs Nitrogen	35.21	17.56	75	0.678	302.0
Six Lbs Nitrogen	35.08	17.43	98	0.711	298.1
Eight Lbs Nitrogen	35.77	17.05	146	0.774	288.4
Eleven Lbs Nitrogen	36.19	16.67	238	0.823	279.8
LSD (0.05)	ns	0.36	49	0.055	8.4
LSD (0.1)	ns	0.30	41	0.046	7.0
CV (%)	6.1	2.4	39.5	8.3	3.3
PR > F	0.4366	0.0001	0.0001	0.0002	0.0001
Grand Mean	35.57	17.17	141	0.748	291.8

Four Lbs Nitrogen		a	a	a	a
Six Lbs Nitrogen		a	ab	a	a
Eight Lbs Nitrogen		b	b	b	b
Eleven Lbs Nitrogen		c	c	b	c

N USE RATE, CLAY SOIL- COMBINED DATA 2010

Recoverable Sugar (lbs/A)	Gross Per Ton (Dollars)	Gross Per Acre (Dollars)	Net Per Acre (Dollars)	
10588	48.80	1707	1619	$ 74.00
10425	48.34	1687	1581	
10279	47.02	1671	1545	
10119	45.73	1650	1495	
ns	1.25	ns	80	
ns	1.04	ns	66	
5.9	3.0	5.7	5.8	
0.5604	0.0001	0.7359	0.0455	
10347	47.44	1678	1558	

a	a
a	a
b	ab
c	b

Comparison of projected lbs. N/ ton produced to actual lbs. N/ ton produced

Silt Loam	0	4 or 5	6	7	8	11
2008 Hansen		4.3	4.9	5.7	6.7	
2008 Trail Rnch		4.6	5.8	6.1	7.1	
2009 Trail Rnch		5.7	6.6	7.6	8.2	
2010 Trail Rnch	3	5.4	8.1		9.8	13.6

Sandy loam	0	4 or 5	6	7	8	11
2009 Jones		5.3	5.7	6.4	7.1	
2009 K. Bowen		7.3	7.5	7.4	8.8	
2010 Driscoll	4.1	4.2	5.4		6.9	9.9

Clay loam	0	4 or 5	6	7	8	11
2010 B. Bowen	3.2	4.6	5.8		8.6	10.4
2010 Big D	3.9	4.2	5.7		6.5	9.6

Does soil type significantly affect the proper timing of N application ?

Timing of N application

- Between 2009 -2010 looked at 6 sites; 6 trials dealing with time of N application
- Used a low rate and higher rate of N input
- Timing of N applications were:
    1) At short after planting.
    2) 60 % of N input short after planting and the remainder, 40 %, between 4-6 true leaf development.

What happened?

Making N inputs **up-front** or **split** applying 60-40 % between up-front and 4-6 true leaves of development **made little difference in silt and clay loam soils**.

The lower rate of N input was always better.

Sandy loam soils

- Timing of application favored the 60-40 % split, but only at the LSD (0.1) level.
- Quality factors showed no difference relevant to timing statistically.
- Only very slight interaction between rate and time.

Thank you