FINE-TUNING A NITROGEN BUDGET SYSTEM FOR EARLY
AND MAIN HARVEST SUGARBEET PRODUCTION

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Objective: To fine-tune nitrogen recommendations for irrigated sugarbeets harvested during the early harvest period and during the main harvest campaign

Procedure: Previous crop was malt barley. Residual soil N to 4 feet was 69 lb/ac. Residual soil P to 6 inches was 12.6 ppm. Residual soil K to 6 inches was 375 ppm. 100 lb/ac granular 18-46-0 was applied to all plots on August 30, 2001. Six rates of granular 46-0-0 were applied August 31, 2001 (Holly rates per Kerry Rasmussen). Liquid N (28-0-0) at a rate of 30 lb/ac was supposed to be applied through the sprinkler during the early part of the growing season, but construction of the sprinkler system took longer to complete than anticipated, and no liquid N was applied.

Desired treatment	Entry	Available soil N*	Applied N 18-46-0	Fall applied N, 46-0-0	Sprinkler applied N , 28-0-0	Total applied N	Desired available N	Actual available N
Sidney Sugars - 20	1	120	18	2	0	20	170	140
Sidney Sugars - 10	2	120	18	22	0	40	190	160
Sidney Sugars -rec	3	120	18	42	0	60	210	180
Sidney Sugars + 10	4	120	18	62	0	80	230	200
Sidney Sugars + 20	5	120	18	82	0	100	250	220
EARC	6	124	18	68	0	86	240	210

*Sidney Sugars using 25 lb N/acre for each percent OM, EARC using 30 lb N/acre for each percent OM; Sidney Sugars considering only 80% of soil N from 2-4 feet available, EARC considering all available; EARC considering uptake of N by residue of previous crop

Plots were planted to stand with the variety HH111 on 1 May 2002 with a commercial six-row planter. Ro-Neet 6E (3.5 lb AI/ac) and Counter (1 lb AI/ac) were applied in 7" bands at planting. Betamix (1.5 pt/ac) and Poast (1.6 pt/ac) were applied on 30 May. Eminent (13 oz/ac) was applied by ground rig on July 25 and Quadris (6 oz/ac) was applied by ground rig on August 6.
Plots were trimmed to 30-foot plots on June 10. Plots were sprinkle irrigated on July 1, July 12, July 17, July 24, July 31, August 12, and August 26. Growing season precipitation was 9.34 inches. Plots were harvested on September 24 and October 3.

Results: Heavy snow fell four days after planting, and temperatures in May were cooler than average, which delayed emergence and early growth. Hot, dry weather was experienced in mid to late June. The sprinkler system took longer to complete than anticipated, so the first irrigation did not happen until July 1.

Because no N was applied through the sprinkler, all treatments were 30 lb N/ac less than originally planned. No differences were seen among nitrogen treatments at either harvest date. Sugarbeets harvested at the later harvest date had significantly greater yield, sucrose and sucrose yield (Table 1) and significantly lower impurities and loss to molasses (Table 2).

Summary: Six rates of available N were applied to sprinkle irrigated sugarbeets that were harvested at two dates, one in mid September and the second about 10 days later. The several N treatments had no effect on yield or quality of sugarbeets at either harvest date, but sugarbeets harvested at the later date had significantly greater root yield, sucrose content, and significantly lower impurities and loss to molasses than sugarbeets harvested at the early harvest date. This study will continue under flood and sprinkler irrigation, with the harvest date portion eliminated.

Table 1. Yield of sugarbeets with six N-rates. Data analyzed using ANOVA.

ANOVA, single factor						
Available N, lb/ac	Harvest date	Harvest Stand, plants/acre	Percent sucrose	Root Yield T/acre	Gross Sucrose Yield, Lb/acre	Extractable Sucrose, Lb/acre
140	1	27350	17.30	28.5	9877	9107
160	1	25410	17.31	29.3	10110	9267
180	1	27830	17.16	30.0	10300	9542
200	1	30730	17.25	32.0	11010	10210
220	1	27470	17.60	29.0	10170	9432
210	1	27100	16.81	30.9	10390	9577
Probability		0.154	0.840	0.233	0.472	0.402
CV s/mean		11.6	5.5	8.8	9.4	9.4
LSD$_{0.05}$		ns	ns	ns	ns	ns
140	2	30730	19.06	31.1	11830	11140
160	2	31100	18.62	31.6	11770	11100
180	2	30130	19.05	31.3	11900	11220
200	2	31940	19.32	31.6	12190	11540
220	2	33880	18.85	31.2	11730	11050
210	2	32430	18.79	30.6	11520	10850
Probability		0.304	0.767	0.962	0.788	0.719
CV s/mean		9.2	4.3	5.9	6.4	6.4

LSD$_{0.05}$		ns	ns	ns	ns	ns
ANOVA, multiple factors						
140		29040	18.18	29.8	10850	10120
160		28250	17.97	30.4	10940	10180
180		28980	18.10	30.6	11100	10380
200		31340	18.29	31.8	11600	10870
220		30670	18.22	30.1	10950	10240
210		29770	17.80	30.8	10950	10210
	1	27650	17.24	29.9	10310	9522
	2	31700	18.95	31.2	11820	11150
N rate		0.164	0.790	0.415	0.303	0.224
Harvest date		<0.001	<0.001	0.023	<0.001	<0.001
N x HD		0.270	0.816	0.436	0.844	0.848

Table 2. Quality of sugarbeets with six N-rates. Data analyzed using ANOVA.

ANOVA, single factor						
Available N, lb/ac	Harvest date	Na ppm	K ppm	Amino-N ppm	Sucrose loss to molasses	Percent extraction
140	1	506	1984	242	1.36ab	92.1
160	1	554	2070	261	1.44 b	91.6
180	1	455	1860	217	1.24a	92.7
200	1	495	1873	210	1.26a	92.7
220	1	419	1957	220	1.27a	92.8
210	1	504	1899	236	1.31ab	92.2
Probability		0.380	0.266	0.240	0.060	0.188
CV s/mean		22.1	8.6	16.7	8.8	1.0
LSD$_{0.05}$		ns	ns	ns	0.14	ns
140	2	332	1798	189	1.12	94.1
160	2	328	1725	170	1.06	94.3
180	2	292	1812	187	1.10	94.2
200	2	248	1748	171	1.03	94.6
220	2	275	1826	180	1.09	94.2
210	2	305	1811	177	1.09	94.2
Probability		0.783	0.902	0.978	0.876	0.885
CV s/mean		36.5	9.3	25.3	11.4	0.8
LSD$_{0.05}$		ns	ns	ns	ns	ns
ANOVA, multiple factors						
140		419	1891	216	1.24	93.1
160		441	1897	215	1.25	93.0
180		374	1836	202	1.17	93.4
200		371	1811	190	1.14	93.7
220		347	1891	200	1.18	93.5
210		404	1855	206	1.20	93.2
	1	489	1940	231	1.31	92.3
	2	297	1787	179	1.08	94.3
N rate		0.369	0.755	0.732	0.359	0.384
Harv date		<0.001	<0.001	<0.001	<0.001	<0.001
N x HD		0.878	0.355	0.628	0.398	0.632