SUGARBEET PROFITABILITY AS AFFECTED BY HARVEST DATE, NITROGEN RATE AND VARIETY

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Rhizomania resistant varieties now occupy the majority of the sugarbeet acres planted in Minnesota and North Dakota. The majority of these varieties are diploids, which in general have smaller canopy growth and somewhat lower early season vigor, as opposed to the non-rhizomania triploid varieties previously grown. The resistant varieties, as a rule, also have higher tonnage, but somewhat lower sugar content. This has resulted in questions relative to the nitrogen (N) fertilization recommendation (130 lb/A[soil 0-4' + added]) being too high, too low or accurate. Some will argue that the higher tonnage from the resistant varieties will necessitate higher amounts of N to achieve this increased tonnage, while others argue that the reduced top growth will offset this and result in higher sugar content. Adding to the confusion are some seed suppliers recommending reductions of approximately 25% of the recommended N rates. Previous research by the main author has also shown that harvest date can have equal or greater impact on gross return per acre, at any reasonable N level, depending on the variety grown.

In 2006, a study was initiated at the NWROC, Crookston, MN to determine how three popular rhizomania resistant varieties would be affected by different nitrogen levels and harvest dates, as it relates to yield, quality and profitability under non-rhizomania conditions.

Materials and Methods

Nitrogen rates of 80, 105, 130 and 155 lb/A (soils + added) were spring applied as urea. Beta 1305 and Van der Have 46519, both diploids (2N) and Crystal R308 a triploid (3N) were planted in 22-inch rows and later thinned to uniform populations of 41,500 plants per acre on June 4, 2006. All treatments received season-long chemical and cultural recommendations. Plots consisted of six rows, 35 feet in length with the center two rows machine harvested for yield and quality. Harvest dates were September 14, September 28, and October 13, 2006. Quality traits were determined at the ACSC Quality Laboratory, East Grand Forks, MN.

Results and Discussion

The statistical analysis of the variables measured are shown in Table 1. Harvest date (HD), nitrogen rate (NR) and variety (V) showed significant differences for all variables measured. HD x V interactions were significant for recoverable sugar/A (RSA), yield , % sucrose and gross returns. No other interaction was statistically significant.

The main effects of HD (averaged over NR and V) are shown in Table 2. The largest increase in RSA, recoverable sugar/T (RST), yield and gross return occurred between the Sept. 14 and Sept. 28 harvest dates. This is consistent with previous research involving rhizomania resistant and conventional varieties on this subject. In 2006, the Sept. 14 harvest was significantly higher in % sugar than a Sept. 21 harvest in 2005 (17.66 vs 15.99) using the same three varieties. The overall gain in % sugar over the various HD was the smallest (0.96%) in five similar trials conducted by the main author on both rhizomania resistant and conventional varieties. This was probably due to above normal growing degrees days in 2006 and drought conditions at harvest dates. RSA, RST, yield, % sugar and gross return increased 3,170 lb, 23.3 lb, 7.54 ton, 0.96% and $476, respectively between the Sept. 14 and Oct. 13 harvest dates.

The main NR effects (ave. over HD and V) are shown in Table 3. There was non-significant differences in RSA between the 105, 130 and 155 lb/A NR. The 105 lb/A NR had significantly higher RST and % sugar, but had a significantly lower yield. Gross return was equal between the 105 and 130 lb/A NR. In none of the variables measured, did the 155 lb/A NR outperform the recommended NR (130 lb/A), and reduced gross return by $39/A, not taking into account the added cost of the extra 25 lb/A of N, which would have brought the loss to over $45/A.

The main V effect (ave. over HD and NR) is shown in Table 4. VDH 46519 had significantly higher RSA, yield and gross return than the other two varieties. Crystal R308, the triploid variety, had significantly higher RST and % sugar than the other varieties. Canopy growth at harvest was also greater for R308.

The individual effects of HD and NR for the three varieties used in this trial on yield, quality, and gross return are shown in Table 5. Gains in RSA and gross return for the three varieties between HD and NR are shown in Tables 6 and 7. The significant interactions noted in Table 1 for HD x V are mainly attributed to Beta 1305. This variety had significantly greater increases in RSA and gross return between the Sept. 14 and Sept. 28 harvest dates, but significantly lower increases in these two variables between the Sept. 28 and Oct. 13 harvest dates compared to the other two varieties. This is almost exactly opposite of how this variety performed in a similar trial in 2005, but with different NR and HD. Between HD (across NR) of Oct 4 and Oct. 18, 2005, Beta 1305 gained 1351 lb RSA, whereas between HD (across NR) of Sept. 28 and Oct. 13, 2006, it gained only 500 lb/A. Between the first two HD in 2005 (Sept. 8 and Sept. 21) it averaged 500 lb/A less than the other two varieties. As I cannot explain this difference in performance between the two years, I will "blame it on the weather."

Summary

Based on two years of trials relating to HD x NR x V on rhizonmania resistant varieties, there is no basis for making major changes to the current N recommendations. Slight adjustments such as reducing the recommended rate by 10-15 lb/A, may or may not increase gross return. All the whining about the current recommendations being too low to optimize yield, that were heard in 2006 due to premature yellowing (blame the weather), did not come to fruition when the final tonnage for 2006 set new records (blame the weather). In no case did increasing the NR above the recommended level increase gross return, yield or quality in this or other nitrogen trials conducted in either 2005 or 2006.

Table 1. ANOVA

	Significance level [1]					
Source	RSA (lb/A)	RST (lb/T)	Yield (T/A)	Sucrose (%)	LTM (%)	Gross Return[2] ($/A)
HD	***	***	***	***	***	***
NR	***	***	***	***	***	***
HD x NR	NS	NS	NS	NS	NS	NS
V	***	***	***	***	***	***
HD x V	***	NS	**	*	NS	**
NR x V	NS	NS	NS	NS	NS	NS
HD x NR x V	NS	NS	NS	NS	NS	NS

[1] NS, *, **, ***, represent non-significant and significant levels of 0.05, 0.01 and 0.001 respectively.
[2] Basis: ACSC November 15, 2006 payment.

Table 2. Main Effects of HD (Ave. Over V and NR)

HD	RSA (lb/A)	RST (lb/T)	Yield (T/A)	Sucrose (%)	LTM (%)	Gross Return ($/A)
Sept 14	7660	325.3	23.56	17.66	1.40	934
Sept 28	9786	338.5	28.95	18.11	1.18	1240
Oct 13	10830	348.6	31.10	18.62	1.19	1410
LSD_{05}	518	10.4	1.05	0.61	0.12	92

Table 3. Main effects of NR (Ave. over V and HD)

NR (lb/A[0-4'])	RSA (lb/A)	RST (lb/T)	Yield (T/A)	Sucrose (%)	LTM (%)	Gross Return ($/A)
80	8989	346.0	25.9	18.48	1.18	1166
105	9553	340.4	28.0	18.29	1.27	1220
130	9657	334.6	28.8	17.99	1.26	1215
155	9503	328.9	28.8	17.76	1.32	1176
LSD_{05}	193	5.4	0.5	0.27	0.04	37

Table 4. Main effects of V (Ave. over HD and NR)

Variety	RSA (lb/A)	RST (lb/T)	Yield (T/A)	Sucrose (%)	LTM (%)	Gross Return ($/A)
VDH 46519	9871	336.2	29.3	17.98	1.17	1247
Crystal R308	9278	343.5	26.9	18.46	1.28	1195
Beta 1305	9127	332.8	27.4	17.95	1.32	1142
LSD_{05}	162	4.06	0.4	0.19	0.04	30

Table 5. V, HD, NR effects on yield, quality and return

Variety	Harvest Date	NR (lb/A[0-4'])	RSA (lb/A)	RST (lb/T)	Yield (T/A)	Sucrose (%)	LTM (%)	Gross Return ($/A)
VDH46519	9/14	80	7634	330	23.2	17.80	1.30	944
	9/14	105	8336	336	24.8	18.05	1.25	1050
	9/14	130	8395	328	25.6	17.65	1.28	1032
	9/14	155	7984	314	25.5	17.05	1.38	936
	9/28	80	9514	342	27.9	18.15	1.08	1216
	9/28	105	9889	336	29.4	17.88	1.10	1245
	9/28	130	10340	330	31.4	17.58	1.10	1278
	9/28	155	10386	325	32.0	17.38	1.13	1267
	10/13	80	11428	357	32.0	18.88	1.05	1518
	10/13	105	11584	352	33.0	18.68	1.10	1519
	10/13	130	11437	345	33.1	18.38	1.13	1476
	10/13	155	11531	343	33.7	18.25	1.13	1478
R308	9/14	80	7229	336	21.5	18.20	1.40	911
	9/14	105	7894	340	23.2	18.30	1.33	1004
	9/14	130	7796	327	23.8	17.75	1.40	956
	9/14	155	7557	318	23.8	17.48	1.58	901
	9/28	80	8988	356	25.2	18.90	1.10	1192
	9/28	105	9616	347	27.7	18.63	1.28	1248
	9/28	130	9868	338	29.2	18.15	1.25	1250
	9/28	155	9623	338	28.5	18.15	1.25	1218
	10/13	80	10266	370	27.8	19.60	1.10	1405
	10/13	105	10606	353	30.1	18.90	1.28	1395
	10/13	130	11091	352	31.6	18.83	1.25	1454
	10/13	155	10810	349	31.0	18.68	1.23	1409
Beta 1305	9/14	80	7036	327	21.6	17.70	1.38	862
	9/14	105	7337	322	22.8	17.55	1.45	886
	9/14	130	7322	318	23.0	17.38	1.48	872
	9/14	155	7400	310	23.9	17.05	1.55	857
	9/28	80	9306	344	27.1	18.35	1.15	1197
	9/28	105	10081	341	29.6	18.33	1.28	1287
	9/28	130	10002	336	29.8	18.05	1.28	1258
	9/28	155	9823	331	29.7	17.80	1.25	1221
	10/13	80	9496	354	26.9	18.70	1.03	1252
	10/13	105	10635	339	31.4	18.30	1.38	1348
	10/13	130	10662	340	31.4	18.20	1.23	1356
	10/13	155	10421	334	31.3	18.08	1.40	1303

Table 6. Gain in RSA between HD at various NR

Variety	HD	NR(lb/A[0-4']) 80	105	130	155	$\bar{x}$
VDH46519	1-2	1880	1553	1945	2402	1945
	2-3	1914	1695	1097	1145	1463
	1-3	3794	3248	3042	3547	3408
Crystal R308	1-2	1759	1722	2072	2066	1905
	2-3	1278	990	1223	1187	1170
	1-3	3037	2712	3295	3253	3075
Beta 1305	1-2	2270	2744	2680	2423	2529
	2-3	190	554	660	598	500
	1-3	2460	3298	3340	3021	3030

Table 7. Gain in gross return ($/A) between HD at various NR

Variety	HD	NR(lb/A[0-4']) 80	105	130	155	$\bar{x}$
VDH46519	1-2	272	195	246	231	261
	2-3	302	274	198	211	246
	1-3	574	469	444	542	507
Crystal R308	1-2	281	244	294	317	284
	2-3	213	147	204	191	189
	1-3	494	391	498	508	473
Beta 1305	1-2	335	401	386	364	372
	2-3	55	61	98	82	74
	1-3	390	462	484	446	446