

NITROGEN RESPONSES WITH GLYPHOSATE TOLERANT SUGARBEET

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Glyphosate tolerant sugarbeet varieties are available to the growers. Nitrogen management has been and continues to be top priority for efficient and profitable sugar production. Little is known about the new varieties and their response to nitrogen fertilizer. Some observations have been since the glyphosate tolerant sugar beet plant will not be set back by conventional herbicide applications, the yield potential will be greater. Will sugar beet plant need more nitrogen to maximize the sugar beet plant's yield and quality? or will the plant be more efficient at using nitrogen and thus have a larger yield without additional nitrogen? The most recent N response research used in Minnesota nitrogen guidelines was before 2000, (Lamb et. al 2001) using non-glyphosate tolerant sugar beet varieties. At that time the optimum N guideline was 130 pounds per acre. The 130 pounds per acre was from the combination of soil nitrate-N to a depth of 4 feet and applied nitrogen fertilizer. The objective of this study is to determine the response of glyphosate tolerant sugar beet to nitrogen application.

Materials and Methods:

An experiment at four locations in the Southern Minnesota Beet Sugar Cooperative growing area was conducted in 2009. The soil test information is listed in Table 1. The treatments were five nitrogen fertilizer rates (0, 20, 40, 60, and 80 lb N/A) applied during the fall prior to the 2009 growing season. The nitrogen source was urea which was incorporated into the soil after application. Phosphorus and potassium were applied to the sites if the soil test indicated a need. The study was planted to a glyphosate tolerant variety in 2009. Sugarbeet roots were hand harvested and quality was determined at the Southern Minnesota Beet Cooperative Quality Laboratory.

Table 1. Soil test information for the four sites with glyphosate tolerant sugar beet in 2009.

Soil test	Site number			
	901	902	903	904
Organic matter 0-6" (%)	3.0	3.9	4.5	4.8
pH	7.5	8.0	7.9	7.5
Nitrate-N 0-4' (lb/A)	74	30	36	64
Olsen-P 0-6" (ppm)	3.6	3.6	3.4	10
K 0-6" (ppm)	97	116	125	129

Results and Discussion

The four sites had soil test nitrate-N for the surface four feet that ranged from 30 to 74 lb nitrate-N per acre. The data for the four sites is listed in Tables 2, 3, 4, and 5. Sugar beet root yield, extractable sucrose per acre, and revenue were increased with the application of nitrogen at 3 of the 4 sites. The quality parameter, extractable sucrose per ton of sugar beet was not affected by the application of nitrogen at any of the sites. Normally nitrogen application reduces the amount of sucrose extracted from the beet root. This has occurred in other studies with non-glyphosate tolerant varieties but is not the norm.

Table 2. Treatment means and statistics for sugar beet root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue for site 901 in 2009.

N rate	Root yield	Extractable sucrose		Revenue
		lb/ton	lb/A	
lb/A	ton/A	lb/ton	lb/A	\$/A
0	38.5	277	10652	1289
20	39.1	276	10766	1300
40	35.9	281	10063	1233
60	39.4	275	10844	1307
80	36.6	279	10225	1247
Statistics				
N rate	NS	NS	NS	NS
N rate linear	NS	NS	NS	NS
N rate quadratic	NS	NS	NS	NS

Table 3. Treatment means and statistics for sugar beet root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue for site 902 in 2009.

N rate	Root yield	Extractable sucrose		Revenue
		lb/A	ton/A	
0	30.0	266	7996	938
20	31.1	271	8433	1004
40	34.4	267	9195	1083
60	33.5	268	8969	1058
80	32.5	269	8727	1033
Statistics				
N rate	0.01	NS	0.04	0.12
N rate linear	0.01	NS	0.03	0.06
N rate quadratic	0.01	NS	0.03	0.06

Table 4. Treatment means and statistics for sugar beet root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue for site 903 in 2009.

N rate	Root yield	Extractable sucrose		Revenue
		lb/A	ton/A	
0	28.5	305	8725	1138
20	27.7	297	8250	1055
40	30.3	298	9034	1158
60	30.8	300	9229	1187
80	31.8	297	9470	1212
Statistics				
N rate	0.22	NS	NS	NS
N rate linear	0.04	NS	0.10	0.20
N rate quadratic	NS	NS	NS	NS

Table 5. Treatment means and statistics for sugar beet root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue for site 904 in 2009.

N rate	Root yield	Extractable sucrose		Revenue
		lb/A	ton/A	
0	24.3	276	6753	819
20	24.0	286	6871	855
40	29.2	291	8514	1071
60	25.5	274	7021	847
80	20.6	275	5856	724
Statistics				
N rate	0.03	NS	0.09	0.17
N rate linear	NS	NS	NS	NS
N rate quadratic	0.01	NS	0.03	0.05

How do the results of this study with glyphosate tolerant sugar beet varieties compare to the results of other nitrogen response studies with non-glyphosate tolerant varieties? If the relative revenue for these sites from 2009 is compared with the 2001 nitrogen guideline data, they are very similar. The optimum N guideline from the 2001 data, Figure 1, is from 110 to 150 pounds per acre. In Figure 2, the relative revenues are graphed with the respective soil nitrate-N from 0 to 4 feet plus the fertilizer N applied. For sites 901, 902, and 903, the results are similar. Site 904 does not fit. The root yields at this site were less than the root yields at the other sites. At this time with only one year of data, it looks like the glyphosate tolerant varieties are responding to nitrogen similarly to the non-glyphosate tolerant varieties. At this time, N guidelines do not need to be modified because of sugar beet variety.

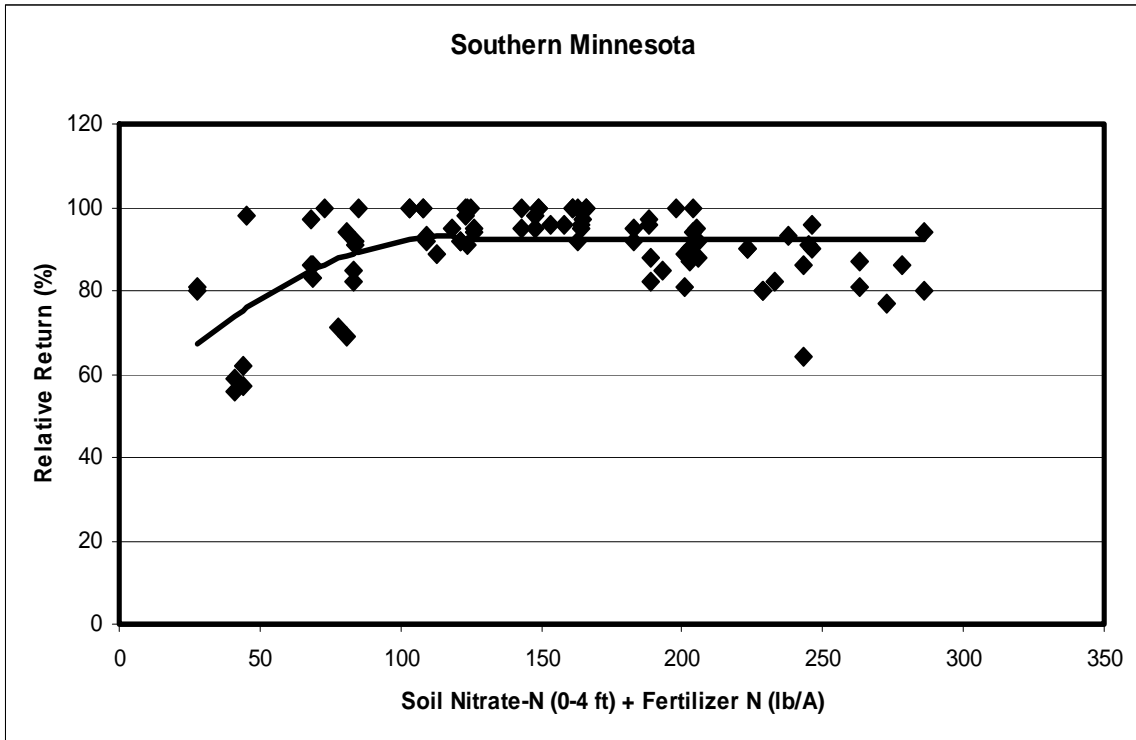


Figure 1. Nitrogen guidelines developed from non-glyphosate tolerant varieties, Lamb et al. 2001.

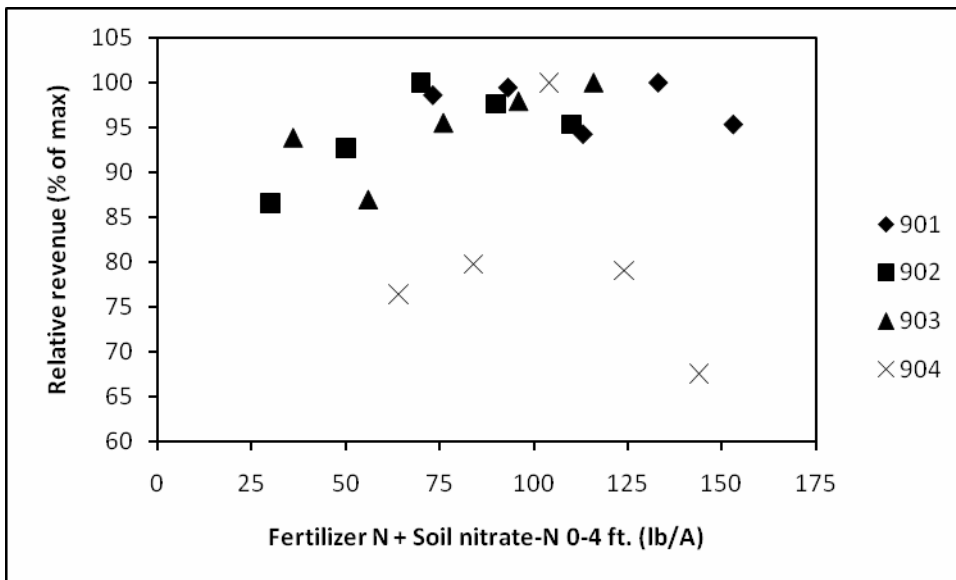


Figure 2. Relative revenue for the four sites in 2009.

Literature Cited:

Lamb, J.A., A.L. Sims, L.J. Smith, and G.W. Rehm. 2001. Fertilizing Sugar Beet in Minnesota and North Dakota. Univ. Minn. Ext. Ser. FO-07715-C 2001