IMPACT OF REDUCED NITROGEN MANAGEMENT IN SUGAR BEET PRODUCTION ON SILT LOAM SOILS IN THE GRANDE RONDE VALLEY OF EASTERN OREGON

Bill Wahlert*[1], Greg Dean[1] and David Elison[2]
[1]The Amalgamated Sugar Company LLC, P. O. Box 8787, Nampa, ID 83653 and
[2]The Amalgamated Sugar Company LLC, P.O. Box 700, Paul, ID 83347

Introduction:

In recent years, The Amalgamated Sugar Co. has used eight pounds of nitrogen per projected ton of sugar beets produced as a basis for nitrogen recommendations. The Grande Ronde Valley of Eastern Oregon has a soil organic matter of two to three percent which can be as much as two percent higher than the more typical soils in the Amalgamated growing area. While the mineralization rate is unknown and is an inherent factor of nitrogen management, it is believed that these higher organic soils will have higher mineralization of nitrogen. When combined with changes in seed varieties and the advent of Roundup Ready® sugar beet seed, leads me as crop consultant in this growing area to think that the eight pound rate is too high. This past year, with the help of company agronomists on a silt loam soil, I conducted a study to see if I was correct.

Objective:

In 2010 we conducted a study on a silt loam soil with higher organic matter to determine if a lower nitrogen rate could be used.

Material and Methods:

All plots were located inside a cooperators commercial field. Attempts were made to get the most uniform area within the field to conduct the study. The plots were replicated six times and laid out in a randomized complete block design. The growers 5 year average of 30T/A for this farm was used as a yield goal. Soil tests in each plot were then pulled by one foot increments to a depth of three feet to determine available nitrogen (figure 1). Nitrogen treatments of 3, 5, 7, and 9 pounds per historical tons per acre (T/A) was used. Soil test nitrogen figures were given in pounds per acre and all three feet were added together to give total available nitrogen for each plot. The nitrogen treatments (3, 5, 7, 9) were then multiplied by historical T/A to give needed nitrogen requirements. The available nitrogen was subtracted from the nitrogen requirement to give the amount of nitrogen needed for each plot. The needed fertilizer (regular urea) was then spread to each plot using a Scott's® drop type lawn spreader (see picture 1). The plots were six rows (22 "rows) wide and 40 feet long. The trial was planted on April 6th. They were planted with a 12 row Milton planter using a 5.5 inch drop and planted using Syngenta® M9122 seed. A three foot alley was later cut between each plot. The plots were defoliated using a six row triple drum defoliator. The trials were harvested on September 26th. The center two rows were then harvested using a one row sugar beet plot harvester.

After harvesting the beets were cleaned of excess dirt, weighed and sampled. Two samples were taken from each plot and sent to the tare lab for analysis. Samples were analyzed for percent tare, sugar content, brie nitrate, and conductivity. Quality analysis and field data were combined and statistical analysis were run on the combined data with the help of Dr. Paul Foote, Sr. Research Technician for The Amalgamated Sugar Company.

Material and Methods:

All plots were located inside a cooperators commercial field. Attempts were made to get the most uniform area within the field to conduct the study. The plots were replicated six times and laid out in a randomized complete block design. The growers 5 year average of 30T/A for this farm was used as a yield goal. Soil tests in each plot were then pulled by one foot increments to a depth of three feet to determine available nitrogen (figure 1). Nitrogen treatments of 3, 5, 7, and 9 pounds per historical tons per acre (T/A) was used. Soil test nitrogen figures were given in pounds per acre and all three feet were added together to give total available nitrogen for each plot. The nitrogen treatments (3, 5, 7, 9) were then multiplied by historical T/A to give needed nitrogen requirements. The available nitrogen was subtracted from the nitrogen requirement to give the amount of nitrogen needed for each plot. The needed fertilizer (regular urea) was then spread to each plot using a Scott's® drop type lawn spreader (see picture 1). The plots were six rows (22 "rows) wide and 40 feet long. The trial was planted on April 6th. They were planted with a 12 row Milton planter using a 5.5 inch drop and planted using Syngenta® M9122 seed. A three foot alley was later cut between each plot. The plots were defoliated using a six row triple drum defoliator. The trials were harvested on September 26th. The center two rows were then harvested using a one row sugar beet plot harvester. After harvesting the beets were cleaned of excess dirt, weighed and sampled. Two samples were taken from each plot and sent to the tare lab for analysis. Samples were analyzed for percent tare, sugar content, brie nitrate, and conductivity. Quality analysis and field data were combined and statistical analysis were run on the combined data with the help of Dr. Paul Foote, Sr. Research Technician for The Amalgamated Sugar Company.

Results and Discussion:

Root yields ranged from a low of 21.55 T/A to a high of 28.82 T/A as nitrogen rates increased from the 3 pound rate to the 9 pound rate (see table1). There was a significant difference from the 3 pound treatment to the 5, 7 and 9 pound treatments, suggesting that the 3 pound rate was to low and caused economic damage.

Sugar content generally increased as the nitrogen rates decreased with the 3 pound rate giving the highest sugar content of 19.12% and the 9 pound rate the lowest with 18.18%. There was no significant difference between nitrogen treatments in sugar percentages.

Recoverable sugar in pounds per ton followed the same pattern as the sugar content with the 3 pound rate having the highest amount at 332.4 pounds/ton and the 9 pound rate the lowest amount at 313.2 pounds per ton. Again there was no significant difference between nitrogen treatments. There is a significant difference in the amount of

recoverable sugar per acre between the 3 pound treatment and the 5, 7 and 9 pound treatments. The 7 pound rate had the highest ERS/A of 9173 pounds per acre and the 3 pound rate the lowest at 7153 pounds per acre.

The brie nitrate levels for all 4 treatments had no significant differences between nitrogen treatments with results going from a low of 42 ppm to a high of 56 ppm. These readings are very low when compared to the La Grande station average of 202 ppm for the last five years. This suggests that available nitrogen was used prior to harvest.

The dollars value per acre showed a significant difference between the 3 pound rate and the 5, 7 and 9 pound rates. The 3 pound rate was the lowest with a gross return of $1166 per acre and the 7 pound rate had the highest return of $1503 per acre.

The results of this study are based on one year's data and will continue for 2 more years. The 5 and 7 pound rates are both below the Amalgamated Sugar Company's recommended rate of 8 pounds per ton of beets. Therefore individual growers should look at their 5 year brie nitrate history and field history, to decide if they can reduce their nitrogen application per ton of beets.

Table 1:
Difference of reduced nitrogen rates on sugar beet yields, quality and economic returns

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)
Three Lbs Nitrogen	21.55 b	19.12	42	0.630	332.4	7153 b	54.20	1166 b
Five Lbs Nitrogen	26.06 a	18.70	42	0.683	322.4	8383 a	52.76	1371 a
Nine Lbs Nitrogen	28.82 a	18.18	56	0.679	313.2	9004 a	50.95	1464 a
Seven Lbs Nitrogen	28.06 a	18.99	51	0.676	327.7	9173 a	53.73	1503 a
LSD (0.05)	3.20	ns	ns	ns	ns	1015	ns	152
LSD (0.1)	2.13	ns	ns	ns	ns	834	ns	127
CV (%)	12.1	3.2	30.1	4.7	3.2	9.8	3.9	3.9
PR > F	0.0052	0.2291	0.2828	0.1662	0.1520	0.0029	0.2291	0.0015
Grand Mean	26.12	18.75	48	0.667	323.9	8428	52.91	1376