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Nitrogen and Harvest Date Interactions in Sugarbeets

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Sugarbeets in the Northern Great Plains are generally planted in April and May and harvested in October. The Holly Sugar factory in Sidney processes sugarbeets from the beginning of harvest until mid-February. Because of problems with spoilage, it is not prudent to store sugarbeets after the weather begins to warm up. One way to lengthen the period that the factory can process sugarbeets is to have an early harvest period. This expands the sugarbeet processing period by up to one month and increases the overall amount of sugarbeets that can be processed. Early harvest benefits both producers and processing companies by increasing the length of time that the processing plant operates. The lengthened processing time allowed by early harvest increases overall sugar production of the factory, decreases loss to spoilage, and expands sugarbeet acreage needed to meet the added demand. Early harvest usually starts before the optimum time for yield and quality, so it is important to identify practices to increase yield or quality of early harvested sugarbeets. Acres are contracted for early harvest, so growers can manage early harvested acres accordingly.

Nitrogen (N) management is one of the most important components of sugarbeet production. Too much N results in high root yields, but causes low sucrose content and high concentrations of impurities, particularly sodium and amino-N. High concentrations of impurities reduce the percentage of extractable sucrose. Too little N results in reduced root yield, although sucrose content and quality are improved. Nitrogen management may be one way to improve sucrose yield and quality of early harvested sugarbeets.

The objective of this study was to evaluate the response of sugarbeets to different rates of available N harvested during the early harvest period and main campaign. The study was conducted from 1992 through 1995 at the Eastern Agricultural Research Center in Sidney under furrow flood irrigation using gated pipe. Soil on the Eastern Agricultural Research Center is a Savage silty clay with 8.5 pH and 2.5% organic matter. Previous crop in all years was spring wheat. Following harvest of the spring wheat in the fall prior to planting the sugarbeets, residual soil N was measured to a depth of four feet in foot increments. The experimental site was disked, irrigated, plowed, mulched twice, leveled, and ridged.

The recommended N rate in the Holly district was developed in the 1970's and is based on a budget system of 10 lb/T of expected yield. The total available N amounts used in this study were 180, 240 and 300 lb N/a, which included the recommended rate, 75% of the recommended rate, and 125% of the recommended rate. Applied N rates used in this study were calculated by subtracting residual soil NO_3-N to four feet and N released by organic matter (25 lb N/a for each 1% of O.M.) from the total N recommendation. The different N rates were applied in strips through the field prior to planting by knifing liquid N (28-0-0) between ridges. Six replications of each N treatment were tested at each harvest date. The site was deridged and the cultivar 'Monohikari' was planted to stand at a rate of one seed every 5.6 inches. Plots were six rows wide with two feet between rows.

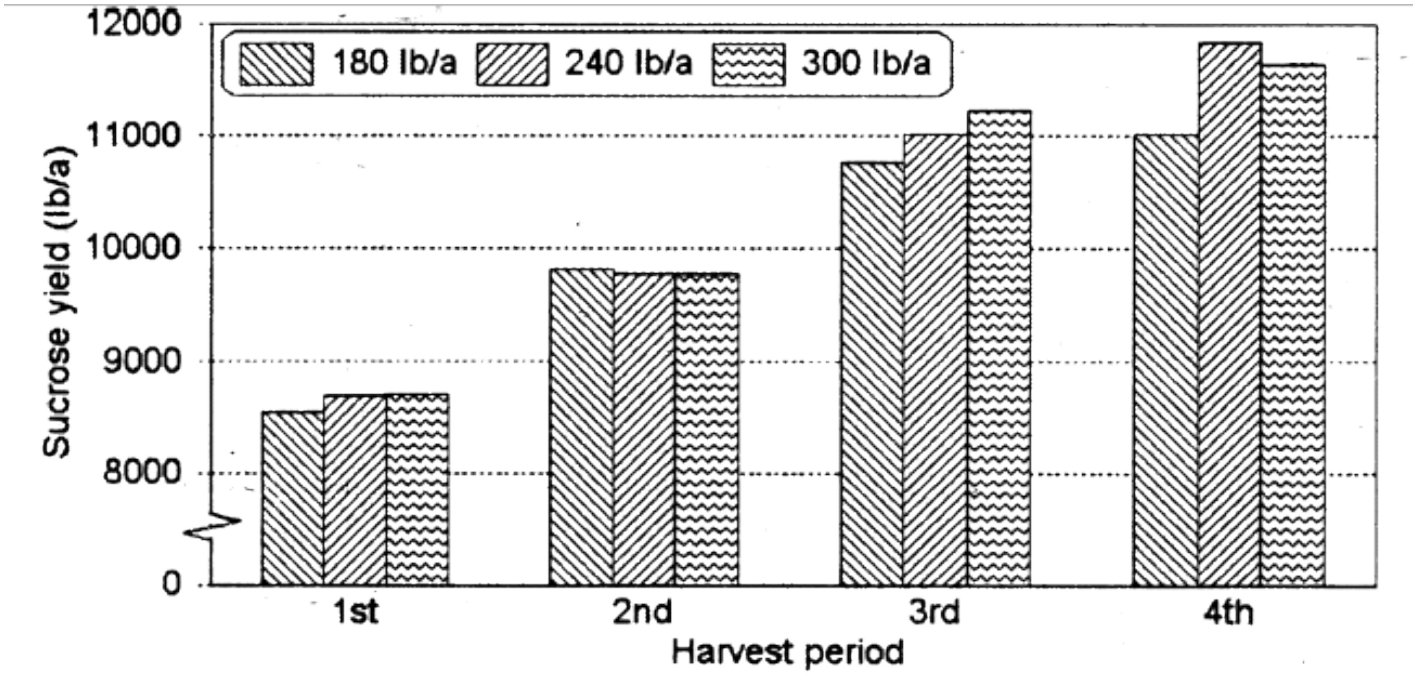
Conventional weed and insect control were conducted during the growing season. At harvest, thirty feet of row were harvested from the center of each plot (60 ft^2 of harvested area). Sugarbeets were harvested four times, with harvest dates approximately ten days to two weeks apart. The first harvest date was at the beginning of the early harvest period, the second date was during the last week of the early harvest period, the third date was during the first week of the main campaign, and the last harvest date was near the end of the main campaign.

Root yield increased as the harvest season progressed. The higher N rates resulted in higher root yields at all harvest dates except the first harvest date, when little difference was seen in root yield among the three N rates. Root yield increased under the lowest N rate during the early harvest period, but root yield under the lowest N rate did not increase after the third harvest date, which corresponded to the beginning of the main campaign. By the end of the main campaign, root yield of sugarbeets with 75% of the recommended N rate was about 2 T/a lower than sugarbeets with 100% or 125% of the recommended N rate.

Sucrose content increased as the harvest season proceeded, increasing by almost 3% from the first harvest date to the last harvest date. More difference in sucrose content was seen among harvest dates than among N rates. No difference in sucrose content was seen among N rates at the earliest harvest date, but as the harvest season progressed, lower N rates resulted in greater sucrose contents. Increased N also resulted in increased impurities.

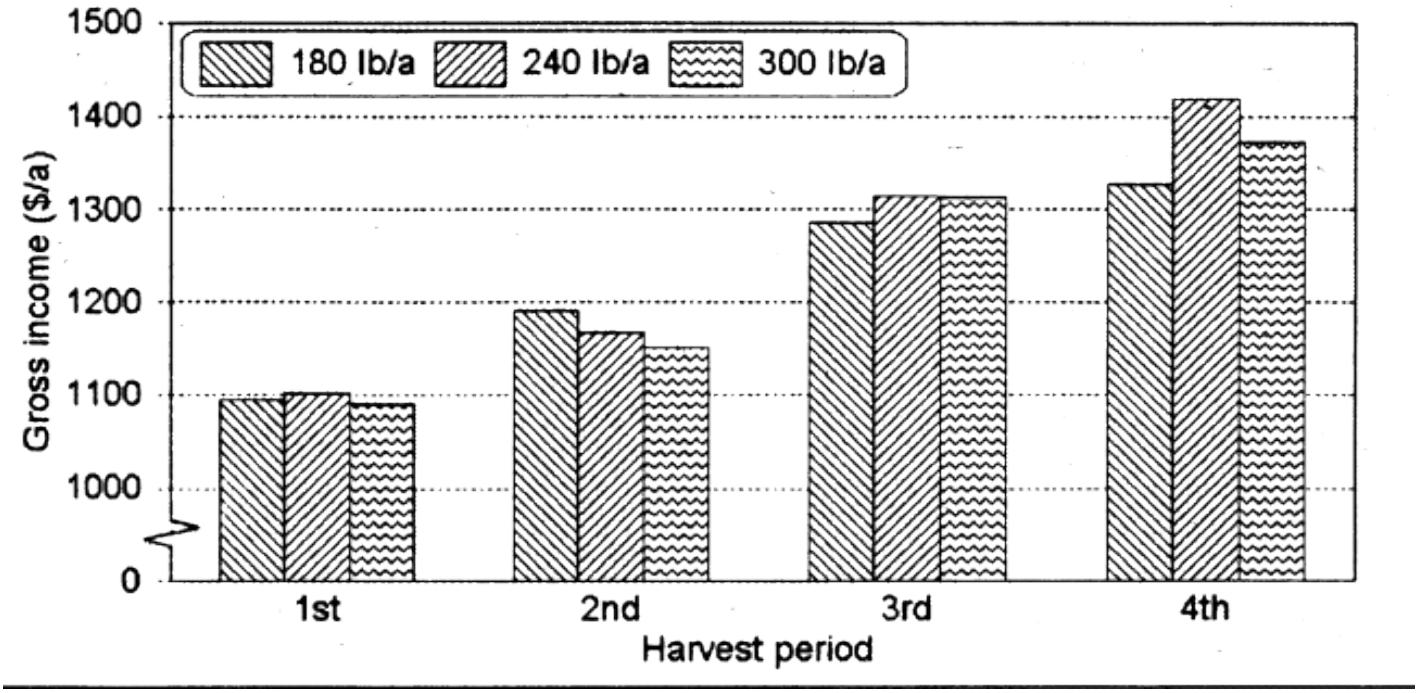
Gross sucrose yield is calculated by multiplying root yield by sucrose content. Little difference in sucrose yield was detected among N rates during the early harvest period (Fig.1). However, sugarbeets with the lowest rate of N had the lowest sucrose yield once the main harvest campaign started. By the end of the main campaign, sugarbeets with the lowest N rate had a sucrose yield of 800 lb/a less than the sugarbeets with the recommended rate, while the sugarbeets with the greatest rate of applied N had a sucrose yield of about 200 lb/a less than the sugarbeets with the recommended N rate.

Figure 1. Root yield of sugarbeets by harvest period at three N rates.



Gross income per acre was calculated for each N rate at each harvest date, and included the early harvest premium and the cost of applied N (Fig. 2). No difference in income was seen among N rates at the earliest harvest date, although the reduced rate of N resulted in the greatest income per acre during the later part of the early harvest period. The greatest income per acre during the main harvest campaign resulted from sugarbeets with the recommended N rate.

Figure 2. Gross sugarbeet income by harvest period at three N rates (includes early harvest premium and N costs).



Across years, the reduced amount of N was adequate for early harvested sugarbeets in terms of sucrose yield and gross income, but the recommended rate was necessary for maximum root and sucrose yield of sugarbeets harvested during the main harvest campaign. Increasing the N rate did not result in increased yield or income of sugarbeets harvested late in the season.

Fertilizer Facts:

- Reducing the amount of applied N does not decrease sucrose yield or gross income of early harvested sugarbeets. A reduced N rate is appropriate for early contracted sugarbeets.

- A rate of N above the recommended rate does not boost sucrose yield or gross income of sugarbeets harvested late in the season.

Edited by Jeff Jacobsen, Extension Soil Scientist