Precision Farming Practices Impact on Sugarbeet Production in MN and ND

American Crystal Sugar Company
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Moorhead and Hillsboro Districts

Other Contributors
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• As early as 1993, Moraghan and Smith began defining the significance of available nitrogen being returned to the soil by beet tops.

• In 1997 Moraghan defined a plan for managing nitrogen credits found in beet tops.
## Available Nitrogen in Different Color Canopies

<table>
<thead>
<tr>
<th>Canopy</th>
<th>Dry matter</th>
<th>Total N</th>
<th>Total N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lb/acre</td>
<td>%</td>
<td>lb/acre</td>
</tr>
<tr>
<td><strong>Green</strong></td>
<td>7940</td>
<td>3.5</td>
<td>276</td>
</tr>
<tr>
<td><strong>Yellow-green</strong></td>
<td>6160</td>
<td>2</td>
<td>125</td>
</tr>
<tr>
<td><strong>Yellow</strong></td>
<td>4190</td>
<td>1.3</td>
<td>55</td>
</tr>
</tbody>
</table>
Aerial photo of sugar beet field
It all starts with an image of the sugarbeet field. A near infrared image of the field is taken during the late growing season. The image gives an accurate reading of how dense the crop canopy is at that time.
A management zone map is then created.

*Agriculturists can create a management zone map using density levels and ground-truthing.*
A profit analysis is also delivered by the Agriculturist to the Grower.

A profit analysis allows the grower to see the savings in Nitrogen dollars that he will realize using this program. Nitrogen savings usually pays for the added cost of the program.
How to Spread Less Fertilizer This Spring
By Managing Nitrogen The Year After Your Sugarbeet Crop

Prepared For:
Ron Mattson

Prepared For:

PhD Information:
County: Clay
Township: 141_43
Section 14
E Quarter Acres

Satellite Image Sept 5, 1998

Management Zone Map

There are many reasons to consider using nitrogen application based on sugar beet density. One reason is to reduce the amount of nitrogen that is applied without reducing yield. This will reduce input costs, and will help to prevent leaching into streams that are susceptible to that problem. Leaching can reduce yield by up to 20 bu/Acre. In this way, this technology will help to increase yield. Application of this type will assist in planning a long way in preserving variability of nitrogen from becoming a problem in the years between your sugar beet crops. This map is based on the New remote-sensing image of your 13.58 sugar beet fields. In some cases, a picture of the area of the field with the predicted areas of increased nitrogen transport may assist farmers and prevent setting more N in already high nitrogen areas. Please call for details.

<table>
<thead>
<tr>
<th></th>
<th>Acres</th>
<th>Use of LN</th>
<th>464-0</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>250.6</td>
<td>$190</td>
<td>$680.88</td>
<td></td>
</tr>
<tr>
<td>Variable Rate Method</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Areas</td>
<td>51.8</td>
<td>$190</td>
<td>$1,240.98</td>
<td></td>
</tr>
<tr>
<td>Yellow Areas</td>
<td>77.1</td>
<td>$180</td>
<td>$1,288.64</td>
<td></td>
</tr>
<tr>
<td>Green Areas</td>
<td>107.7</td>
<td>$150</td>
<td>$1,638.90</td>
<td></td>
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<tr>
<td>Variable Rate Totals</td>
<td>236.6</td>
<td>$180</td>
<td>$5,155.52</td>
<td></td>
</tr>
<tr>
<td>Fertilizer Savings</td>
<td>201.9</td>
<td>$400</td>
<td>$2,414.98</td>
<td></td>
</tr>
</tbody>
</table>

Notes: About average density. Saw a 70 lb N over the green areas, and 30% yellow.
## Cost Savings

Using Zone Spreading

<table>
<thead>
<tr>
<th>46-0-0</th>
<th>Acres</th>
<th>Rate</th>
<th>Lbs/Required</th>
<th>Price/Ton</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>157.30</td>
<td>326</td>
<td>51,293</td>
<td>$230</td>
<td>$5,899</td>
</tr>
<tr>
<td></td>
<td>18.65</td>
<td>326</td>
<td>6,082</td>
<td>$230</td>
<td>$699</td>
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<tr>
<td></td>
<td>37.89</td>
<td>261</td>
<td>9,884</td>
<td>$230</td>
<td>$1,137</td>
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<tr>
<td></td>
<td>46.64</td>
<td>239</td>
<td>11,153</td>
<td>$230</td>
<td>$1,283</td>
</tr>
<tr>
<td></td>
<td>46.13</td>
<td>196</td>
<td>9,025</td>
<td>$230</td>
<td>$1,038</td>
</tr>
<tr>
<td></td>
<td>1.66</td>
<td>152</td>
<td>253</td>
<td>$230</td>
<td>$29</td>
</tr>
<tr>
<td>Variable Rate Totals</td>
<td>231</td>
<td>36,397</td>
<td>$230</td>
<td>$4,186</td>
<td></td>
</tr>
<tr>
<td>Fertilizer Savings</td>
<td>95</td>
<td>14,896</td>
<td>$230</td>
<td>$1,713</td>
<td></td>
</tr>
</tbody>
</table>
No N Credit Given (lodging)

N Credit Given (no lodging evident)
Management zones created for 1999 Wheat using 1998 Sugarbeet images
1999 Wheat yield map - field avg 56.35 bu/ac
Zones created from Sugarbeet imagery for Corn
NH3 applied at variable rates
Corn moisture map
Yield map of Corn - Field average 144.7 bu/ac
Pete Carson Farm Data

Sugar

Field #2
1996

Field #2
1999
Y96 - Y99 % Sugar Increase

2.2%

Pete's Farm vs. St. Thomas

Pete's Farm

St. Thomas

1.3%
Grower example with 3yr rotation using precision farming methods

1999 Data

Grower
- 18.19 % sugar
- 20.8 TPA
- 1.34 SLM

Receiving Station
- 17.27 % sugar
- 20.6 TPA
- 1.54 SLM

Revenue Difference
- $113.54 per Acre
- $5.11 per Ton
Long-Term benefits of Nitrogen management.

• Savings in Nitrogen costs.
• Improved quality in Sugarbeets.
• Improved yield and quality in wheat and barley.
  • Higher protein.
  • Less Lodging.
• Improve yield and quality in other crops.
  • Less lodging and dry down in corn and beans.
  • Less disease problems caused by too dense foliage.
• Environmentally friendly.
- Overapplications leach or run off
- Underapplications create reductions in crop residues which can lead to increased erosion
- Site specific farming limits soil build up of nutrients
- Fertilizer utilized more effectively rather than lost to environment.
We are involved because:

- Mutually beneficial to our growers and company
- Shareholders need more info for better decisions
- ACSC needs a quality product
- No missed opportunities
Questions and Answers

American Crystal Sugar Company