Agenda

• How is it made?

• Current usage

• University research data

• Recommendations/Lessons learned

• 2016 VersaLime web site
  www.cristalsugar.com
WHAT IS VersaLime

- Calcium Carbonate Limestone is heated and injected into the sugar purification process.
- Captures and absorbs the impurities in the juice.
- By-product left behind is spent lime.
- American Crystal Sugar produces 600,000 tons of spent lime annually.
# Lime Analysis - Moorhead

<table>
<thead>
<tr>
<th>Date</th>
<th>Total N lb/ton</th>
<th>Phosphate lb/ton</th>
<th>Potash lb/ton</th>
<th>Sulfur lb/ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/9/2016</td>
<td>4.6</td>
<td>16.0</td>
<td>0.9</td>
<td>4.4</td>
</tr>
<tr>
<td>2/17/2016</td>
<td>4.8</td>
<td>14.0</td>
<td>1.3</td>
<td>4.8</td>
</tr>
<tr>
<td>2/23/2016</td>
<td>4.9</td>
<td>14.0</td>
<td>0.8</td>
<td>4.5</td>
</tr>
<tr>
<td>2/29/2016</td>
<td>5.2</td>
<td>13.0</td>
<td>1.1</td>
<td>5.3</td>
</tr>
<tr>
<td>3/7/2016</td>
<td>5.6</td>
<td>20.0</td>
<td>1.0</td>
<td>6.4</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>5.0</strong></td>
<td><strong>15.4</strong></td>
<td><strong>1.0</strong></td>
<td><strong>5.1</strong></td>
</tr>
</tbody>
</table>
VersaLime Analysis

• Currently sampling weekly & will update numbers at end of campaign
• 10 ton rate gives approximately:
  50 lbs Nitrogen = $20/A
  154 lbs Phosphate=$80/A
  51 lbs Sulfur = $26/A

  Total Nutrient value=$126/A
VersaLime Tons Utilized (by Factory)

- Hillsboro
- Crookston
- Moorhead
- E Grand Forks
- Drayton

Year:
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015

Tons Utilized:
- 0
- 20,000
- 40,000
- 60,000
- 80,000
- 100,000
- 120,000
- 140,000
- 160,000
- 180,000
- 200,000
NWROC Lime Trials
Breckenridge, MN

- Trial began in 2004 with lime applied at 0, 5, 10, 15, 20 tons per acre rates
- 3 crops between beets (corn, soybeans, wheat)
- Combined data 2012-2014
- 2015 data-only used susceptible variety
- In 2015, 5 ton lime added to ½ of each previous plot

Data supplied by Dr Ashok Chanda and Jason Brantner NWROC
No Lime

Resistant Variety
45 g Tachigaren

Susceptible Variety
No Tachigaren
5 Ton Lime

Resistant Variety
45 g Tachigaren

Susceptible Variety
No Tachigaren
10 Ton Lime

Resistant Variety
45 g Tachigaren

Susceptible Variety
No Tachigaren
15 Ton Lime

Resistant Variety
45 g Tachigaren

Susceptible Variety
No Tachigaren
20 Ton Lime

Resistant Variety
45 g Tachigaren

Susceptible Variety
No Tachigaren
Root Comparison With Spent Lime Applied
### Breckenridge Lime Trial Results: 2012-2014

<table>
<thead>
<tr>
<th>Lime rate (Tons/Acre)</th>
<th>Aphanomyces rating (0-7)</th>
<th>Recoverable sucrose (lb/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Res. + Tach</td>
<td>Susc. No Tach</td>
</tr>
<tr>
<td>0</td>
<td>2.4</td>
<td>4.8</td>
</tr>
<tr>
<td>5</td>
<td>1.8</td>
<td>3.6</td>
</tr>
<tr>
<td>10</td>
<td>1.8</td>
<td>3.0</td>
</tr>
<tr>
<td>15</td>
<td>1.6</td>
<td>2.2</td>
</tr>
<tr>
<td>20</td>
<td>1.6</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Data supplied by Dr Ashok Chanda and Jason Brantner NWRORC
2015 Original by Supplemental Lime Interaction

Sugar beet stand

<table>
<thead>
<tr>
<th>Original lime rate (ton/A)</th>
<th>No. plants/100 ft of row</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>*</td>
</tr>
<tr>
<td>5</td>
<td>*</td>
</tr>
<tr>
<td>10</td>
<td>NS</td>
</tr>
<tr>
<td>15</td>
<td>NS</td>
</tr>
<tr>
<td>20</td>
<td>NS</td>
</tr>
</tbody>
</table>

Data supplied by Dr Ashok Chanda and Jason Brantner NWORC
2015 Original by Supplemental Lime Interaction

Recoverable sucrose

Data supplied by Dr Ashok Chanda and Jason Brantner NWROC
VersaLime Recommendations

• 10 ton rate – better control and longer lasting than 5 ton rate
• If already applied 5 ton rate, add additional 5 ton
• Use Aphanomyces Resistant variety with VersaLime for best return
VersaLime Application
Recommendations

• Apply 10 tons/acre
• Apply 1 year prior to sugar beets for best results
• Spread as evenly as possible
• Incorporate thoroughly with tillage
• Contact Ag Staff for assistance with procedure
Additional Benefits

• Windels/Brantner noted limed soil screened better than non-limed
• Better downward percolation and drainage
• Raise pH of acidic soils
• May increase beneficial soil microorganisms
ACSC Web Site

American Crystal Sugar Company Launches Its Own Facebook Site.

Like us on Facebook!
ACSC Web Site

SUGAR PRODUCTS
- Industrial Sugar
- Retail Sugar

AGRI-PRODUCTS
- Overview
  - Versalime
  - Agri Product SDS

SERVICES
- Product Quality

SUGAR FACTS
- Sugar FAQs
- Healthy Truth

Sugar & Agri-Products
- Versalime
- Product Quality
- Sugar FAQs

Sugar Processing

VersaLime

Hauling/ Spreading Services
- Lime Spreading Service Providers
- Lime Hauling Service Providers

Environmental Considerations
- Guidelines for Land Application of By-Product Limes
ACSC Web Site

VERSALIME

Crystal Careers
Cooperative Profile
Sugarbeet Agronomy
Sugar & Agri-Products
- Industrial Sugar
- Retail Sugar
- Agri-Products
- Versalime
- Product Quality
- Sugar FAQs
Sugar Processing
Members Only

VersaLime

Hauling/ Spreading Services
- Lime Spreading Service Providers
- Lime Hauling Service Providers

Environmental Considerations
- Guidelines for Land Application of By-Product Limes

VersaLime Locations

Crookston - VersaLime
Drayton - VersaLime
East Grand Forks - VersaLime
Hillsboro - VersaLime
Moorhead - VersaLime
VersaLime Procedures

- Required forms
  - Factory Specific Instructions
    - Contacts
    - Load-out locations
    - Times
  - VersaLime agreement
  - Site suitability checklist
- Environmental regulation
Procedure to Acquire VersaLime

- Use ACSC Byproducts Management System from your cell phone to reserve your VersaLime loads
TAKE HOME MESSAGE

• No detrimental effects on rotational crops
• Increase yields of Sugarbeet crops when severe Aphanomyces is present
• Every ton of lime applied will increase soil test P by approximately 1 ppm
• Increase soil pH of acidic soils
• Addition of numerous micro-nutrients to soil
• Benefits of VersaLime have been demonstrated to last more than 10 years
• VersaLime is free
Final Notes

• ACSC does not provide fertilizer or pesticide and is not registered as such
• Loading fees may apply (at some factories)
• ACSC will provide VersaLime nutrient analysis from outside laboratory
  • Benefits are to be determined by each grower
Any Questions