

# Use of Best Management Practices in the Marketing and Management of a Biosolids Derived Biofertilizer Product



PRESENTED BY:

Sam Halloran  
Project Coordinator  
Lystek International Inc.



# Presentation Overview

- Company, Process and Product Overview
- Lystek's Best Management Practices
- Product Marketing Strategies
- P regulations



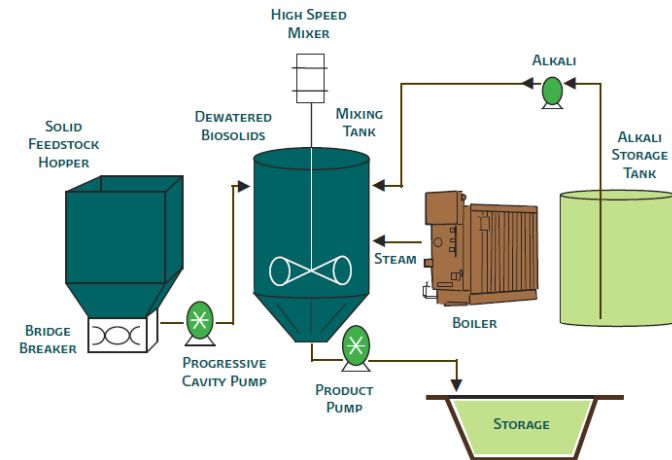
# Lystek - The Company

- Biosolids and organics management and processing company
- Developed at University of Waterloo in year 2000
- Thermal alkali hydrolysis process producing a Class A EQ product

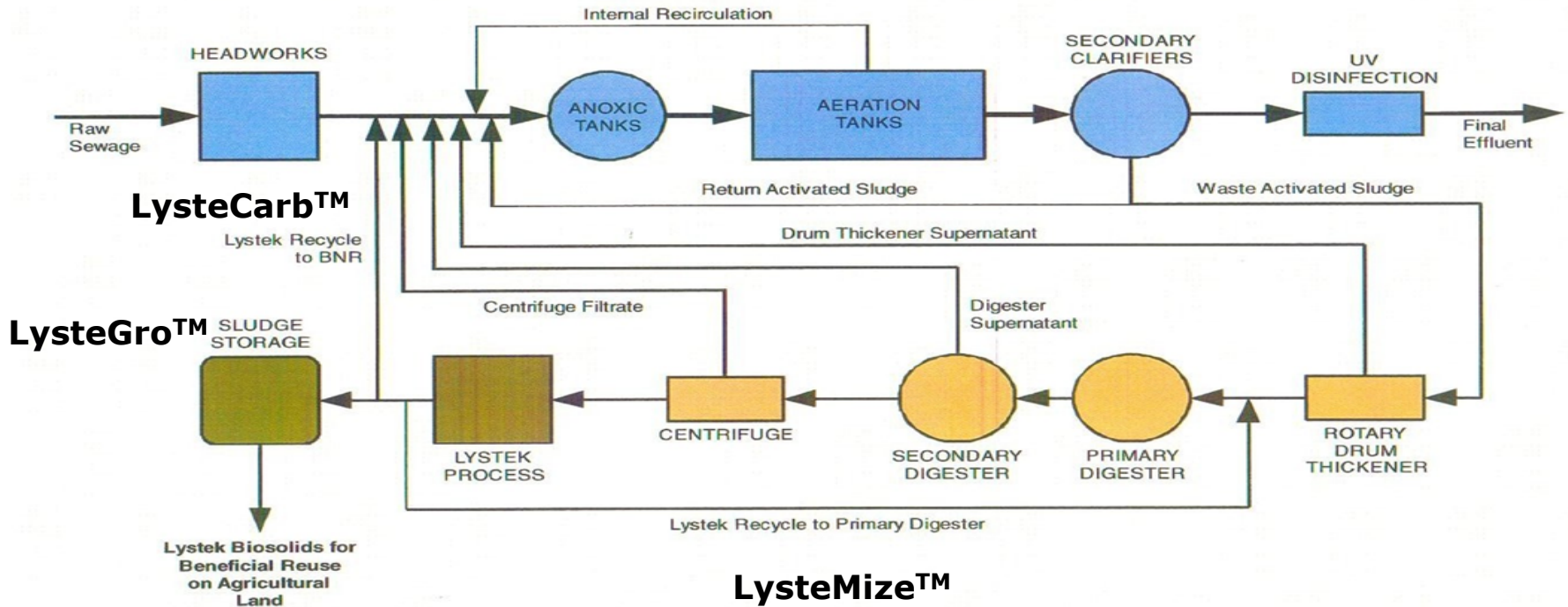


# Process

- Hydrolysis (Temperature, pH adjustment, shearing)
  - Heat ( to 170°F)
  - Alkali Addition - increase pH to 9.5
    - Lime, KOH, etc.
  - High speed shearing (Lysing)



# LysteGro™, LysteMize™ & LysteCarb™ Fertilizer and Plant Optimization



# Current Lystek Installations

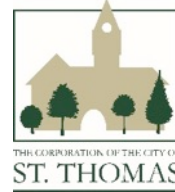
Location	Status	Capacity (WT/Y)	Location	LysteGro Class A EQ/ CFIA	LysteMize Digester Enhancement	LysteCarb BNR Carbon Source
<b>Guelph</b>	2008	18,000	On Site	Yes	Full Scale Pilot	No
<b>St. Mary's</b>	2010	3,500	On Site	Yes	Full Scale	Yes
<b>*Southgate</b>	2012	150,000	Off Site	Yes	No	No
<b>*Iroquois</b>	2012	40,000	Off Site	Yes	No	No
<b>Elora</b>	2014	3,500	On Site	Yes	Aerobic	No
<b>North Battleford</b>	2014	3,500	On Site	Yes	Aerobic	No
<b>*Fairfield, CA</b>	2016	150,000	On Site	Yes	Full Scale	Possibly
<b>St. Thomas</b>	2018	5,600	On Site	Yes	No	No
<b>Innisfil</b>	2018	5,500	On Site	Yes	Aerobic	No
<b>St. Cloud, MN</b>	2018	15,000	On site	Yes	Anaerobic	Possibly



- Regional facilities serving several cities
  - Ontario - Toronto, Ottawa, Waterloo, Niagara, Peterborough; Owen Sound
  - California - Fairfield, San Francisco, EBMUD, Santa Rosa, Central Marin, Petaluma



# Canadian Customers



TAY TOWNSHIP



# United States Customers



San Francisco  
**Water  
Power  
Sewer**

Services of the San Francisco Public Utilities Commission



# On-site Processing

- Elora
- Guelph
- St. Marys
- North Battleford
- St. Thomas\*
- Innisfil\*
- St. Cloud, MN\*





# Regional Processing Facilities

- Southgate, ON
- Iroquois, ON
- Fairfield, CA



# LysteGro™ Product



- Homogeneous liquid/ high solid (~15%) product
- Viscosity <5,000 cP
- Fully pumpable using conventional liquid equipment
- Canadian Food Inspection Agency registered fertilizer
- Class A EQ Biosolids in US
- Long-term storage stability – no settling



# US EPA Region 9 Review: Lauren Fondahl



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION IX  
75 Hawthorne Street  
San Francisco, CA 94105

February 27, 2014

Ward Janssens  
Lystek International Inc.  
1425 Bishop St. N. Unit 16  
Cambridge, Ontario, N1R 6J9

Re: Demonstration of Vector Attraction Reduction using Option 2 for Lystek Thermo-Alkaline Treatment

Dear Mr. Janssens,

Thank you for your e-mail and attached paper from Dr. George Nahida of February 3, 2014 with results of ~~volatile solids reduction tests on anaerobically~~ digested biosolids treated with the Lystek Thermo-Alkaline treatment process.

The results showed that for the sampling periods in question, VAR Option 2 was met, as the volatile solids were reduced by less than 17% during additional digestion. This option may be used in the future to demonstrate vector attraction reduction.

The frequency at which the test must be run is specified in 40 CFR 503.16, ranging from once per year for facilities producing less than 290 dry metric tons of biosolids per year, to once per month for facilities producing over 15,000 dry metric tons per year.

Demonstration of VAR using this method, in conjunction with demonstration of Class A pathogen reduction and pollutant concentrations meeting 40 CFR 503.13 Tables 1 and 3 limits, demonstrates "exceptional quality" biosolids that may be distributed without further restrictions.

Please contact me at 415 972-3514 or [Fondahl.lauren@epa.gov](mailto:Fondahl.lauren@epa.gov) with any questions regarding this.

Thank you,

Lauren Fondahl  
Biosolids Coordinator, WTR-5



## US EPA Region 9 Review: Lauren Fondahl

“The use of biosolids provides a valuable renewable source of nutrients and soil structure enhancement for the agricultural industry. Treatment of biosolids into a liquid fertilizer, with sub-surface application at computer system-controlled loading rates, allows for an additional level of management of nutrient loadings and for ensuring compliance with US EPA regulations. We support innovative technologies such as this which provide benefits to generators and enhance the quality of the product for end-users.”

-Lauren Fondahl, Biosolids Coordinator, USEPA, Region 9  
San Francisco, California



# Biosolids - Pathogens

Pathogens	MDL	Class A Criteria	Untreated dewatered biosolids	Lystek treated biosolids
Fecal coliforms (MPN/g dry wt)	1.8	< 1,000	> 1,600	< 1.8
<i>Escherichia coli</i> (MPN/g dry wt)	1.8	-	> 1,600	< 1.8
<i>Salmonella</i> (P-A / 25 g)	1	< 3 MPN/4g	POS	NEG
Polio virus (pfu / 4g)*	1	< 1	776	< 1
<i>Ascaris</i> eggs (per 4g)*	1	< 1	131	< 1



**LysteGro Fertilizer Composition**

	LysteGro Average <sup>a</sup>	Maximum Allowable Concentration <sup>b</sup>	Units
Organic Matter Content	9.28		% on a wet weight basis
Total Organic Carbon	5.40		% on a wet weight basis
<b>Total Nutrient Content</b>			
Total Nitrogen (TKN)	4.90		% on a dry weight basis
Total Available Nitrogen (Ammonium + Nitrate)	1.28		% on a dry weight basis
Total Organic Nitrogen	3.62		% on a dry weight basis
Total Phosphorus (elemental)	2.73		% on a dry weight basis
Total Phosphorus (P <sub>2</sub> O <sub>5</sub> )	6.25		% on a dry weight basis
Total Potassium (elemental)	1.54		% on a dry weight basis
Total Potassium (K <sub>2</sub> O)	1.85		% on a dry weight basis
<b>Metals Regulated by MOE</b>			
Arsenic	2.64	170	mg/kg
Cadmium	2.03	34	mg/kg
Cobalt	3.22	340	mg/kg
Chromium	69.21	2800	mg/kg
Copper	547.07	1700	mg/kg
Mercury	0.58	11	mg/kg
Molybdenum	8.93	94	mg/kg
Nickel	21.32	420	mg/kg
Lead	33.57	1100	mg/kg
Selenium	3.39	34	mg/kg
Zinc	657.49	4200	mg/kg
<b>Other Relevant Macro and Micronutrients</b>			
Boron	0.034		lbs/1,000 gallons
Calcium	66.84		lbs/1,000 gallons
Copper	0.82		lbs/1,000 gallons
Iron	115.83		lbs/1,000 gallons
Magnesium	7.60		lbs/1,000 gallons
Manganese	0.52		lbs/1,000 gallons
Selenium	0.0051		lbs/1,000 gallons
Sulphur	18.40		lbs/1,000 gallons
Zinc	0.98		lbs/1,000 gallons
<b>Total and Available Nutrients (during 1st growing season) - Imperial</b>			
Total Nitrogen	73.15		lbs/1,000 gallons
Total Available Nitrogen <sup>b</sup>	40.75		lbs/1,000 gallons
Total Phosphorus (P <sub>2</sub> O <sub>5</sub> )	93.37		lbs/1,000 gallons
Total Available Phosphorus (P <sub>2</sub> O <sub>5</sub> ) <sup>c</sup>	37.35		lbs/1,000 gallons
Total Potassium (K <sub>2</sub> O)	27.64		lbs/1,000 gallons
Total Available Potassium (K <sub>2</sub> O) <sup>d</sup>	24.88		lbs/1,000 gallons
<b>Pathogens</b>			
Fecal coliform	<1.8 <sup>e</sup>		MPN/g(mL)
Salmonella spp.	Absent <sup>f</sup>		P-A/25g(mL)

<sup>a</sup> Values represent the mean of 52 samples collected on a weekly basis from January 1 - December 30, 2016

<sup>b</sup> As per Ontario Regulation 338/09 Schedule 5

<sup>c</sup> The sum of Ammonium + Nitrate + assume 40% mineralization of Organic Nitrogen during first growing season

<sup>d</sup> Assume 40 % availability of Phosphorus during first growing season

<sup>e</sup> Assume 90% availability of Potassium during first growing season

<sup>f</sup> Results were consistent for all sampling events



Lystek Southgate Organic Materials Recovery Centre (OMRC)  
 191 Eco Park Way, Dundalk, Ontario N0C 1B0



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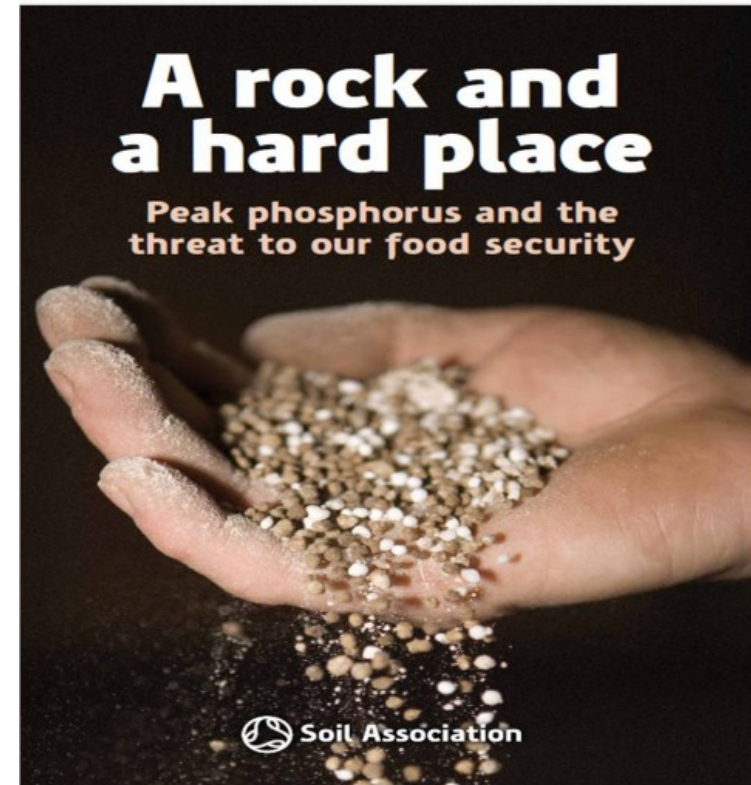
# Focus on the Benefits and Reasons for Beneficial Use

- Integrate biosolids into the Circular Economy
  - Resources are used and by-products are managed to reduce waste and re-purpose the materials
    - Metal, paper, plastics
    - Organics are separated for digestion/composting
    - Biosolids are beneficially utilized as a fertilizer and organic amendment
  - Focus on the value while also ensuring compliance
  - Understand that proper management is necessary and possible



# Focus on the Benefits and Reasons for Beneficial Use

- Nutrients – macro and micro
  - Often better source of nutrients than manure
- Resource Recovery
  - P – not a renewable resource – limited global resources
  - N – Haber-Bosch process – energy intensive



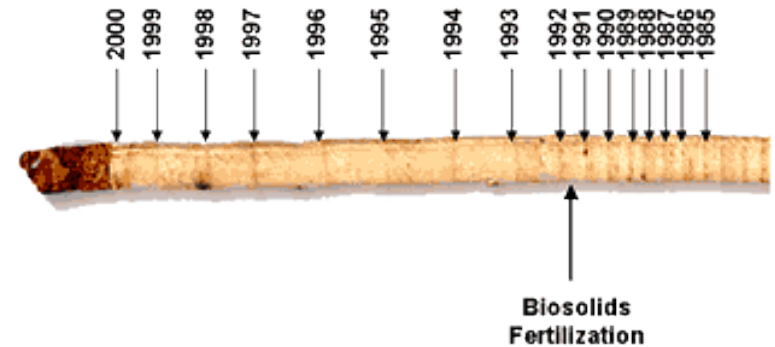
# Focus on the Benefits and Reasons for Beneficial Use

- Carbon Sequestration
  - Excellent source of Organic Carbon
  - Improve vegetative growth – above and below ground
- Soil Health
  - Improve Soil Microbial Activity
  - Improve Soil Water Holding Capacity
  - Improve Aggregate Stability
  - Improve resilience to extreme weather

**Biosolids Forest Fertilization – Malaspina Woodlot**



**Douglas-fir - 44 years old to DBH**



Arrows delineate tree growth to that year-end. Biosolids applications August 1992, 20 dt/ha supplying 800 Kg TKN /ha.



# The Challenge

How to change perspectives on something that has traditionally been considered a “waste”

- Focus on positive messaging
- Provide a PRODUCT and SERVICE
- Prove it works - Third Party, Independent Studies
  - Ensure the work is done well



# Best Management Practices



## LysteGro – Application and Setback Guidelines.

### ***Application Method***

LysteGro must be **injected**

### **Application – Ground Condition**

LysteGro cannot be applied to Frozen or Snow-covered soil (as defined by the Nutrient Management Act).

### **Depth to Groundwater**

There must be at least 30 cm of unsaturated soil at the surface of the land at the time of application.

### **Depth to Bedrock**

There must be at least 50 cm separation distance from ground surface to bedrock.

### **Set-backs**

Setbacks for application of nutrients to agricultural land in Ontario are regulated based on the following criteria:

- **100 m** from municipal wells for all applied nutrients
  - (O. Reg. 338/09, s. 43)
  - 30 m from any other well (O. Reg. 338/09, s. 43)
- No application is permitted within **25 m** of a dwelling. (O. Reg. 338/09, s. 43.)
- No application is permitted within **50 m** of a residential area or



# Best Management Practices

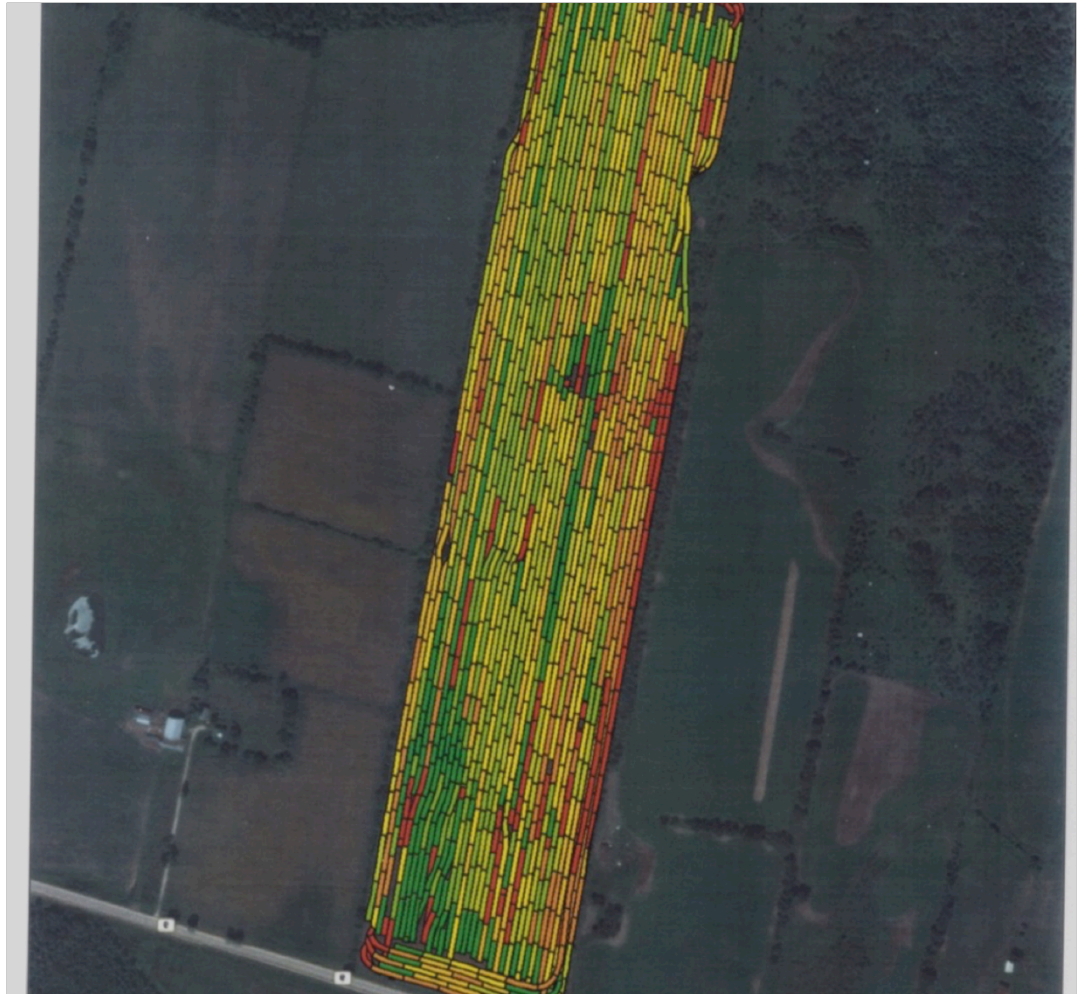
- Apply based on Agronomics rather than maximum loading rates
- Soil tests, future cropping plans and farmer requirements determine rate
- Require payment
  - When they pay for it, they only use as much as they need





# Utilize Agricultural Technology

- Focus on producing a quality product and providing a quality service to the customer
- GPS
- Flow meters















# Third Party Trials

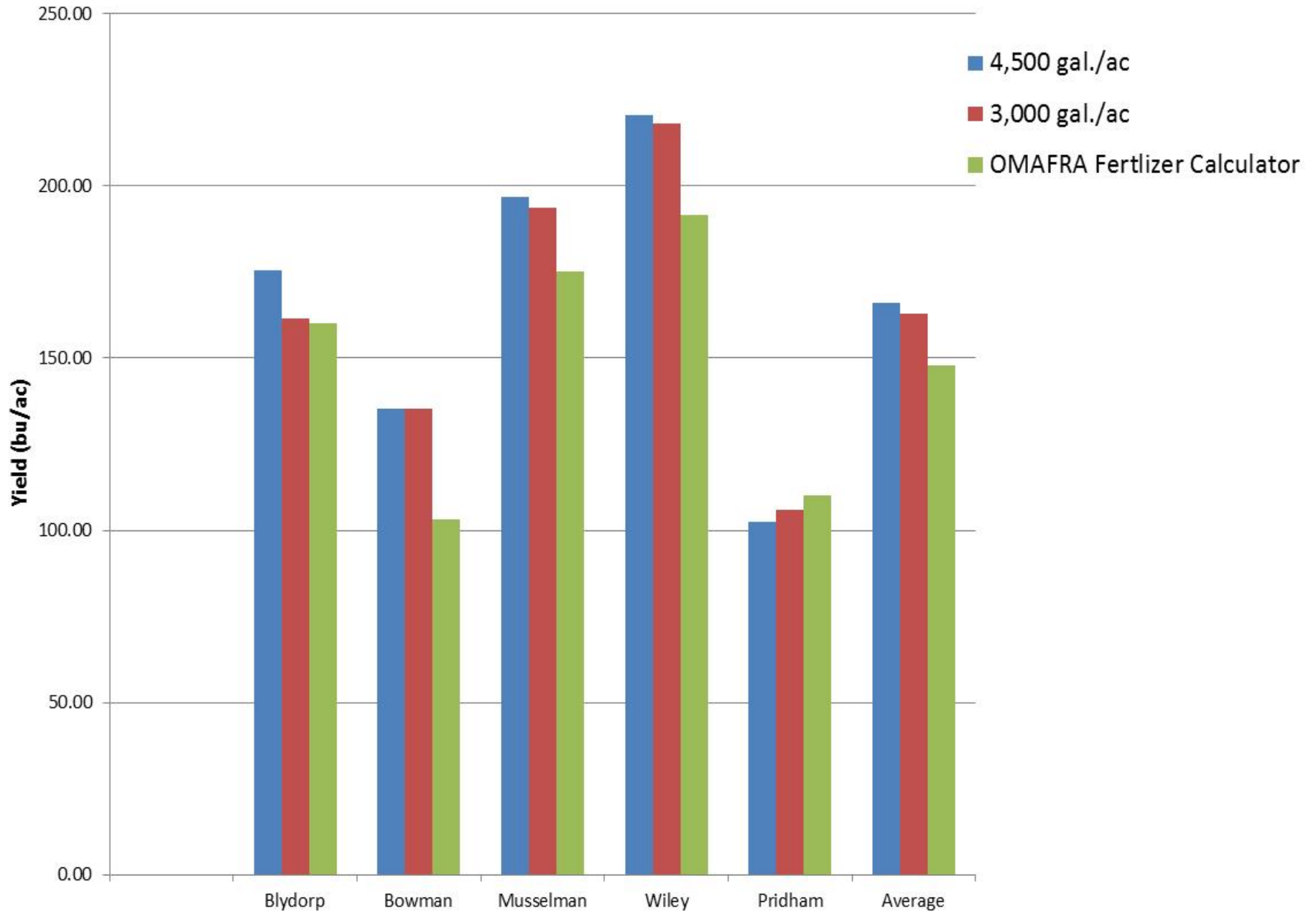
2015 - 2017

- Georgian Central Soil and Crop Improvement Association + OMAFRA
  - 13 sites (farms)
  - 3 treatments, replicated 3 times at each site
  - 2 rates of LysteGro, 1 rate of comm. Fert.
  - 1 site comparing manure vs. LysteGro
  - 1 site comparing Anaerobic Digestate vs. LysteGro



# Lystek Yield Data

## 4,500 and 3,000 gal/ac vs Fertilizer



# Meeting Corn Nutrient Needs with LysteGro™ Fertilizer

2015 Georgian Central Soil & Crop Improvement Association Project



*Third-Party Field Trials  
with LysteGro  
Biofertilizer Yields  
Amazing Results*

*In 2015, Lystek International Inc. participated in a trial with the Georgian Central Soil and Crop Improvement Association (GCSCIA) to evaluate the effectiveness of LysteGro, a registered fertilizer with the Canadian Food*

## WHAT IS LYSTEGRO?

Lystek utilizes its innovative technology to process biosolids and other organics to produce a high quality, pathogen free, nutrient rich, fertilizer product called LysteGro. The product is registered at the federal level (CFIA) in Canada and is also recognized as a Class A (EQ) biofertilizer by the US EPA. It is currently utilized by farmers throughout Ontario as a commercial fertilizer replacement, and/or supplement.



# Sold Out!!

- Demand far outweighs supply
- Significant price increases year over year
- Customer lists growing throughout Ontario and California



# Fertilizer Sales

- 2014: **\$300,005**
- 2015: **\$521,721**
- 2016: **\$775,000**
- 2017: **~\$1,000,000**



# \$\$ Savings

- Within 50 miles of facility- local market
- One pass of the field
- Reduced labour in field
- Fast, efficient truck loading at the plant
- Drag line system



# Alternative Products

- Products for golf and turf
  - UofG
- Products to the horticultural and container industries
  - Ontario, BC and California studies in 2017







# Phosphorus Management Tools, and.....Regulation

- Working within P regulations (e.g. Maryland)
  - Utilize the product as efficiently as possible
    - Injection (lower rate) and other BMP's
    - Apply based on agronomics- not maximum loading rates
    - Flow meters/GPS that regulate flow
    - Consider Source Coefficient- Water Extractable P
  - Can increase N:P ratio through addition of synthetic N
    - Produce a more marketable material that will provide both P and N requirements of crop



# Phosphorus Regulation

- Consequences for LysteGro application:
  - PMTs consider:
    - FIV, exchangeable Fe & Al
    - buffers, slope, tillage, rotation, etc
  - Maryland: Some locations (depending mainly on soil type and FIV) will have a PMT score between 0 – 50, which would allow for 3-year crop removal application rate
    - Is this possible?
      - » For some crops (corn, corn silage and alfalfa)
        - ~ Based on application rates of 2,000 – 2,500 US Gallons/ac OR 8 – 10 tons/ac





# Thank You!



**Nothing wasted.  
Everything to gain.**

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e: [info@lystek.com](mailto:info@lystek.com)  
w: [www.lystek.com](http://www.lystek.com)

s:     

