Meeting Corn Nutrient Needs with LysteGro® Fertilizer

2015 Georgian Central Soil & Crop Improvement Association Project

Lystek
Nothing wasted.
Everything to gain.

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 Inspection Agency (CFIA), in comparison to commercial fertilizer.

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. LysteGro® has proven to be extremely popular due to the high concentrations of Nitrogen (N), Phosphorus (P_2O_5) and Potassium (K_2O) (5.5 – 8 – 2.5 on a dry weight basis OR 65 – 100 – 30 lbs/1,000 imperial gallons), while also providing considerable concentrations of other valuable macro and micro-nutrients (including Sulphur, Calcium, Magnesium, Zinc and several others) and organic matter.

Approximately 75% of the total N within LysteGro® is in the organic form, which is released slowly through mineralization and transformed into plant available inorganic forms throughout the season as the crop progressively needs it. Assuming 40% of the organic N becomes available in the first year following application (as per the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) recommendations), approximately 35 of the total 65 lbs of N in every 1,000 imperial gallons is available to the crop in the first growing season. Similarly, approximately 40% of the total P will become available during the first growing season,

resulting in approximately 40 lbs of P_2O_5/1,000 imperial gallons applied, being available during the first year following application. It can be assumed that all of the K applied with LysteGro® will be available to the crop during the first growing season. The residual N and P not released and available to the crop in the first growing season will become available in subsequent years. The slow release characteristics of the N and P in LysteGro® can be, and is, leveraged by the farmer to increase N mineralization and P soil concentrations in their soil over the long-term.

WHO IS THE GEORGIAN CENTRAL SOIL AND CROP IMPROVEMENT ASSOCIATION?

The GCSCIA is an alliance of Soil and Crop Improvement Associations of Bruce, Grey, Dufferin, South Simcoe and North Simcoe in Western Ontario. The Ontario Soil and Crop Improvement Association (OSCIA), founded in 1939, is a unique non-profit farm organization made up of 53 counties across the province that has a dedicated membership which represents all commodity groups across the province. The association works at the grass roots level, hosting field days, crop tours and locally organized workshops to introduce new methods of crop and soil management. Additionally, the OSCIA, at the provincial and county levels, facilitate and participate in trials related to new practices, products and other areas of interest to the local agricultural community. This crop trial is a direct result of this initiative by the GCSCIA.

THE TRIAL

The project evaluated yield, grain protein content and late season stalk nitrate content of corn fertilized with 2 rates of LysteGro® fertilizer (3,000 and 4,500 imperial gallons/acre) injected pre-plant compared to commercial fertilizer in a field scale replicated trial. Commercial fertilizer rates were based on OMAFRA recommendations for 160 bushel/acre corn and the LysteGro® application rates were chosen to represent a range the upper and lower application rates utilized for corn fertilization (depending on yield goals and soil characteristics). The trial was undertaken at 5 separate sites within the counties of the GCSCIA (Note: one field was in Wellington County, outside of the GCSCIA boundaries). As detailed in Table 1, each site varied in soil type, preceding crops, corn variety grown and fertilizer utilized in the commercial fertilizer control treatments (NOTE: no starter fertilizer was used in the LysteGro® treatments).

TABLE 1 – SITE CHARACTERISTICS AND FERTILIZATION QUANTITIES

Site	Meaford	Dundalk	Stayner	Melancthon	Elora
Soil Type	Loam	Silt Loam	Silt Clay Loam	Loam	Loam
Previous Crop	Wheat	Old sod	Wheat	Soybeans	Wheat
Planting Date	May 2, 2015	May 6, 2015	May 6, 2015	May 6, 2015	May 15, 2015
Variety	DK 36 (3650 CHU)	DKC33-78 (2500 CHU)	DK38-03IB (2675 CHU)	DKC33-78 (2500 CHU)	P9188 (2675 CHU)
Fertilizer (starter)	135 lbs 8-32-16	19-34-22-6S–7Z	5-26-15	180 lbs 15-42-42-8S	No starter
Approximate Nutrients Applied (lbs/ac)					
Fertilizer check	131-43-22	154-106-94	~130-70-50	~160-76-76	~160-0-0
3,000 gal/ac	102-111-93	174-111-93	102-111-93	102-111-93	102-111-93
4,500 gal/ac	153-166-139	225-166-139	153-166-139	153-166-139	153-166-139

Yield was measured using a weigh wagon for each replicate individually to determine a mean yield for each treatment at each site. Additionally, in an effort to evaluate the effect of the organic N inherent in LysteGro® versus commercial fertilizer, stalk nitrate and grain protein content were also measured as part of the trial. During harvest a total of 20 stalk and 5 grain corn grab samples from each replicate were collected and wholly combined to create one representative composite sample for each material. These samples were sent to an accredited laboratory for analysis.

RESULTS

Overall the results indicate that LysteGro® at both application rates provided the nutrients required by the corn crop. At all but one site LysteGro® out-yielded the commercial fertilizer treatments by an average of 16.5 bushels/acre (range -6 to 32), as seen in Table 2 and Figure 1. Field conditions varied across the sites as evidenced by the wide range of yields. Of note, the corn variety used at the Dundalk site performed poorly throughout the entire field (not only the plot sections) and several other locations throughout Southern Ontario. The results of the Stayner site were poor overall and unlike the other four trial locations, the commercial fertilizer treatments performed better than the LysteGro® treatments, on average. The reason for this is not known, but could be due to poor drainage, compaction, applicator error or other unknown factors.

Another interesting observation was that at the Dundalk site, which had very low P soil levels, the corn fertilized with LysteGro® (where no starter fertilizer was used) demonstrated severe P deficiency during the initial growth stages until approximately the 5 leaf stage. It is believed that as LysteGro® is injected in 24" strips, the root system was not able to access the P provided by LysteGro® until the 5-leaf stage. Nevertheless, as evidenced by the yield results, the corn in the LysteGro® plots were able to recover and overall performed much better than the treatments fertilized with commercial fertilizer. It is recommended that for soils with low P concentrations that a starter be utilized with the seed in order ensure adequate P availability during the initial growth stages.

TABLE 2 – YIELD RESULTS

Site	Yield (bu/ac)			Yield Δ (LysteGro® vs fertilizer)
	LysteGro® Application		Commercial Fertilizer	
	4,500 gal/ac	3,000 gal/ac	N-P-K Equivalent	
Melancthon	175.6	161.6	160.3	8
Dundalk	135.3	135.4	103.0	32
Elora	196.7	193.5	175.2	20
Meaford	220.5	218.1	191.6	28
Stayner	102.6	105.9	110.0	(-6)
Average	166.1	162.9	148.0	16.5

Corn grain protein content, an important factor in feed quality, can provide an indication of late season N availability. As seen in Table 3, four of the five sites demonstrated that corn grown in the LysteGro® plots had a higher grain protein content than that of the commercial fertilizer control plots, which implies that the LysteGro® treatments provided higher soil nitrate concentrations than the commercial fertilizer treatments during the important late season growth stages.

TABLE 3 – GRAIN PROTEIN AND STALK NITRATE ANALYSIS SUMMARY

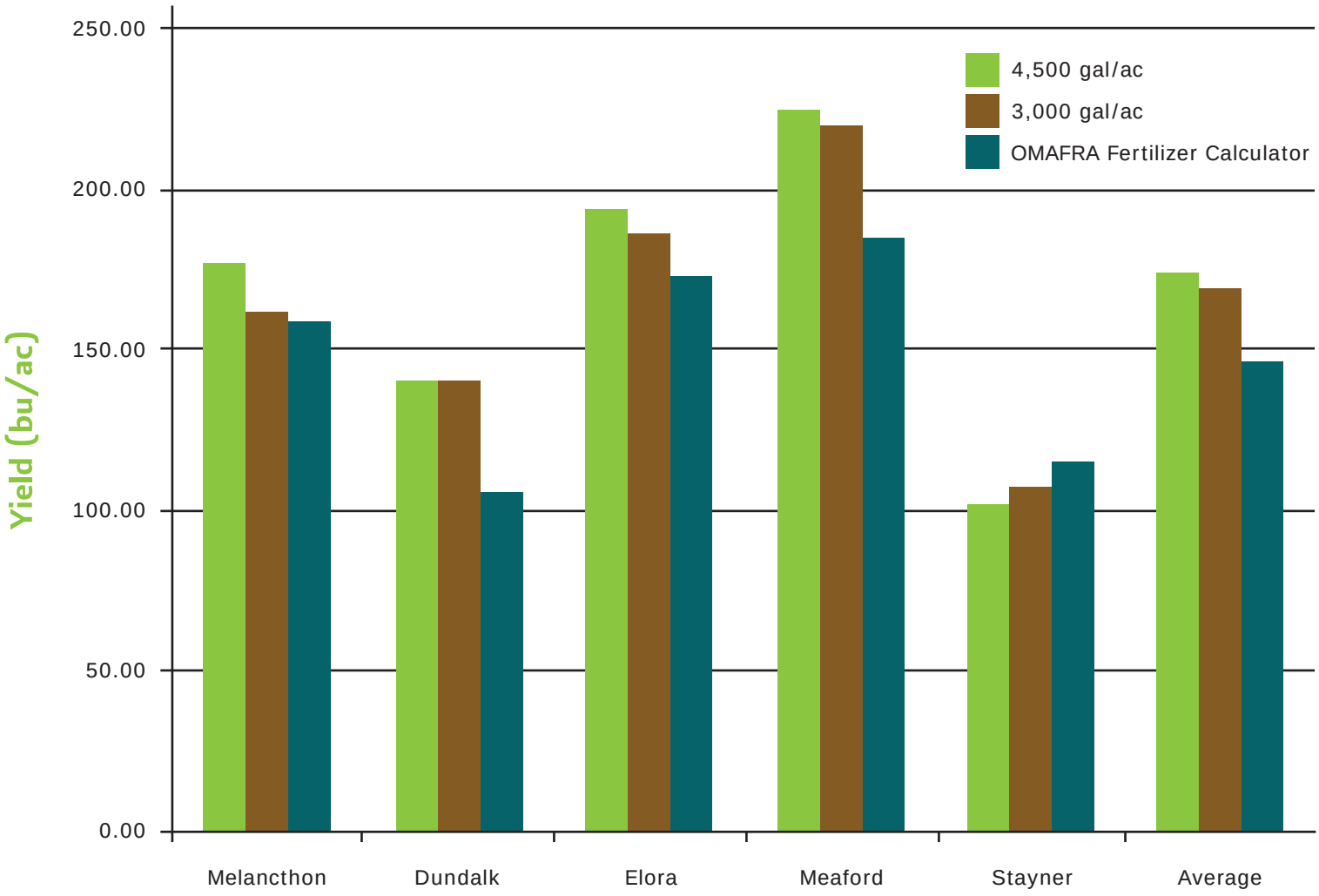
Site	Protein %			Stalk Nitrate (ppm)		
	LysteGro® Application		Commercial Fertilizer	LysteGro® Application		Commercial Fertilizer
	4,500 gal/ac	3,000 gal/ac	N-P-K Equivalent	4,500 gal/ac	3,000 gal/ac	N-P-K Equivalent
Melancthon	7.7	7.3	4.6	1,750	684	18
Dundalk	7.7	7.4	7.3	2,750	2,070	982
Elora	6.5	6.3	5.8	665	420	2
Meaford	7.8	7.7	6.6	120	109	4
Stayner	5.9	6.1	6.4	14	8	533
Average	7.1	7.0	6.1	1060	658	308

These trials demonstrate that LysteGro® provides the full suite of nutrients required by a corn crop

Another indicator of late season nitrate availability for crop uptake is stalk nitrate concentration. As shown in Table 3, with the exception of the Stayner site, there is an obvious correlation between the LysteGro® application rate and stalk nitrate concentrations. As per Christine Brown, the Nutrient Management Field Crops Program Lead for OMAFRA, "corn plants that do not have adequate N available will remove N from the corn stalks. A value under 200 ppm suggests more N may have helped the crop yield or that there was significant losses (i.e. denitrification from saturated soils) while a value over 2,000 ppm indicates more N was available at the end of the season compared to crop needs."

The corn grain protein content and stalk nitrate tests clearly demonstrate that there was more nitrate available later in the year in the LysteGro® treatments in comparison to the commercial fertilizer treatments. This is an indication that the organic N portion of LysteGro® is providing a slow release source of N, later in the growing year when the crop requires it. This is likely a major contributing factor to the increased average yields seen during the trial.

FIGURE 1 – LYSTEK YIELD DATA
4,500 and 3,000 gal/ac vs Fertilizer



CONCLUSIONS AND NEXT STEPS

As Christine Brown discusses in her report on the project, "these results demonstrate that LysteGro® can function as a commercial fertilizer replacement for corn in Western Ontario. The corn grain protein and stalk nitrate content results also indicate, as expected, that one likely reason for the success of LysteGro® is the organic N component (75% of the N in LysteGro® is in the organic form), which mineralizes and releases available inorganic forms of N throughout the growing season, when the crop actually needs it. Because the useable N is released later in the year, when corn has its largest demand for the nutrient, the crop benefts as the yield potential is less likely to be limited by N availability, as can be the case with crops fertilized with conventional fertilizer"

Christine also concludes that "In addition to the positive effects of the organic N within LysteGro®, these trials by proxy also demonstrate that LysteGro® provides the full suite of nutrients required by a corn crop, while also adding valuable organic matter and micronutrients that commercial fertilizer typically do not contain."

Lystek is currently planning on continuing to participate with OMAFRA to quantify the benefts of LysteGro® in 2016 where trials will be implemented to evaluate LysteGro® injected during side dress time for corn as well as prior to cover crop establishment following winter wheat harvest in the late summer.

ACKNOWLEDGEMENTS

All data, tables and graphs were taken directly from the trial report prepared by Christine Brown of OMAFRA. This report is available upon request.

In addition to Christine Brown, Lystek would like to thank the GCSCIA, the cooperators, Brian Hall (formerly of OMAFRA who initiated and oversaw establishment of the trials), Andrew Barrie (OMAFRA Environmental Specialist) who oversaw the completion of the trials after Brian's retirement and Derek Hutchinson (OMAFRA summer student) who assisted with trial set-up and data collection for undertaking and completing this trial.

QUESTIONS REGARDING THIS TRIAL OR THE LYSTEGRO® PRODUCT? CONTACT:

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About Lystek International

Lystek is a leading provider of Thermal Hydrolysis solutions for the sustainable management of biosolids and organics. The multi-use, award-winning Lystek system reduces costs, volumes and GHG's by converting municipal and industrial wastewater treatment facilities into resource recovery centers. This is achieved by transforming organic waste streams into value-added products and services, such as the patented LysteMize® process for optimizing digester performance, reducing volumes and increasing biogas production; LysteGro®, a high-value, nutrient-rich biofertilizer and LysteCarb®, an alternative source of carbon for BNR systems.