

Research Feature

Quantifying the benefits of processed manure and treatment co-products – going beyond single-purpose treatment

Manure is a valuable resource and applying it to agricultural land is a natural way to recycle nutrients such as nitrogen and phosphorus back into our food production system. There are, however, several well-recognized challenges and practical limitations to recycling the relatively low concentrations of nutrients in raw manure in an economically and environmentally sustainable manner in certain situations. Therefore, there is considerable interest in processing or treating manure to increase its usability and its value in such a way that the new and altered products generated, and the process itself, are more economically viable and environmentally sustainable than for the raw product.

Anaerobic digestion (AD) is a manure treatment process that generates a valuable commodity – biogas. The only catch is that in Manitoba, with our comparatively low energy costs and our cold climate, the current net energy value of conventional AD is negative. However, Dr. Nazim Cicek's AD research program is looking at ways to turn this around. "With our mini-biodigestors and temperature controlled chambers we can try out different recipes for boosting methane generation beyond the basic AD process. The recipe ingredients could be additives such as glycerol, dried distillers grains with solubles or other by-products from bioprocessing. Or the additives could be microscopic in size. For example, we're seeing what type of productivity we can get from microbial populations that operate in different temperature stratum," says Cicek of their activities to date.

Another possible benefit pathway is improved value and usability of digested solid or liquid manure. Recently Nazim's team identified the optimum conditions for recovering phosphorus as struvite from anaerobically digested liquid pig manure. This slow-release fertilizer potentially represents an additional revenue stream. On the solids side, soil scientist Dr. Francis Zvomuya leads the Manitoba contingent of a beef cattle feedlot biogas research project in collaboration with AAFC-Lethbridge and Highmark Renewables Research in Alberta. Alberta has several bio-digesters in operation to supplement other sources of energy generation in the province. The research group wants to quantify indicators of agronomic performance for the digested solid manure (in both loose and pellet form) in relation to synthetic N+P and raw cattle manure. While Francis and his team compare nutrient mineralization and N₂O emissions at a laboratory scale, his Lethbridge counterparts take their digested material to the field for larger scale agronomic evaluations.

Zvomuya sees benefit to both incubation- and growth room-scale studies and field-scale studies. "This is an evaluation approach we can take with processed manure in general. For example, this summer we'd like to run some preliminary lab-scale agronomic evaluations on the struvite PhD student Joe Ackerman generates in his P-recovery research over in Biosystems Engineering. Right now in the lab we're evaluating various flocculants for enhancing gravity-based settling of suspended phosphorus-rich solids in liquid manure. Once we identify the most effective settling agent, we can scale up the process and start working with the separated product to see how it performs agronomically and environmentally both in the lab and in the field," says Zvomuya of some future research directions.

Contact Francis Zvomuya (zvomuyaf@cc.umanitoba.ca) or Nazim Cicek (nazim_cicek@umanitoba.ca) to learn more about their research programs.

Learn more of the struvite phosphorus recovery research program through this [ARDI video](#) or contact Joe Ackerman (joe.ackerman@gmail.com).

Find more information on these and other **NCLE research projects** at <http://www.umanitoba.ca/afs/ncle/>



Waraidzo Chiyoka samples for N₂O from soil mixed with digested cattle manure. Waraidzo is a graduate student with Dr. Zvomuya.

Instant Update

Minister Struthers visits the Glenlea Research Station

Nazim Cicek toured Minister Struthers and a group of MAFRI staff, including Dori Gingera-Beauchemin (Assistant Deputy Minister), through the NCLE Anaerobic Digestion Facility, explaining the challenges and opportunities for utilizing this technology on Manitoba farms. The group also checked on the construction progress of the Bruce D. Campbell Farm & Food Discovery Centre and met with Glenlea Research Station staff, including Laurie Connor (GRS Director). Minister Struthers is looking to spend more time at the Glenlea Station on a more formal visit later this year.

Newly formed University of Manitoba Student Rangelands Team successful in first competition

NCLE graduate student Gwendolyn Donohoe (Mario Tenuta, advisor) helped coach the UM Student Rangelands Team to a 4th place finish in their first competition for the Rangelands Cup at the Society of Range Management Conference in Denver. To learn more of the team's many accomplishments in their successful first year, read Gwen's [summary article](#).

Our graduate students are on the move

Jennilee Bernier, MSc student with Kim Ominski and Karin Wittenberg, is the new Provincial Forage and Beef Research Specialist – a newly created position with Manitoba Agriculture Food and Rural Initiatives. Starting full time July 1st, Jennilee's role is to increase forage and beef research capacity and programming within the province. Until then Jennilee is focusing her efforts on completing her thesis ([learn more](#)). Congratulations!



Jennilee visits with her cow.

Research Update

Upcoming publication quantifies greenhouse gas emissions from manure-amended grassland soils. *Nitrous oxide and methane emission from a coarse-textured grassland soil receiving hog slurry.* Mario Tenuta, M. Mkhabela, D. Tremorin, L. Coppi, G. Phipps, D. Flaten, and K. Ominski. Accepted for Agriculture, Ecosystems and Environment March 17, 2010. This project is part of the long term La Broquerie Study and was part of Denis Tremorin's M.Sc. thesis project. Visit <http://umanitoba.ca/afs/labroquerie> for more results and publication listings for the La Broquerie Study.

Supplementing low protein forage-based cattle overwintering diets with DDGS. Posters presented at the 2009 Manitoba Grazing School by graduate students Jennilee Bernier and Gary Rent describe method of delivery, nutrient utilization, animal response and environmental sustainability components of this multi-component study. To learn more, see their [posters](#) or contact Kim Ominski (K_Ominski@umanitoba.ca).

Newly Funded Projects

Controlling the spread of Johne's disease: developing novel diagnostic tests for early-stage identification in beef and dairy cattle. The premise of this study is to identify other microorganisms that may accompany an infection with the bacterium that causes Johne's disease, but that lend themselves more readily for laboratory-based diagnostics. The same approach was used in the diagnosis of Crohn's disease in humans, which is thought to possibly be caused by the same bacterium (*Mycobacterium avium* sub *paratuberculosis* or MAP). Contact research project lead Denis Krause (denis_krause@umanitoba.ca) for more information. This study is coordinated through the Manitoba Cattle Producers Association and funded through Manitoba Rural Adaptation Council (MRAC).

Evaluating manure treatment/processing technologies for achieving manure phosphorus balance in Manitoba

This review will provide valuable third party evaluation of manure treatment processes and technologies that can be used to extract phosphorus from land-applied manure, recover valuable by-products and assist Manitoba's livestock producers in meeting upcoming phosphorus regulations. This review is one of the priorities identified at the Achieving Manure Phosphorus Balance in Manitoba Technical Workshop. Contact Nazim Cicek (nazim_cicek@umanitoba.ca) to learn more. Funding provided through Manitoba Livestock Manure Management Initiative (MLMMI).