

Research at the National Centre for Livestock and the Environment
in support of
Achieving Manure Phosphorus Balance in Manitoba



Background

Efforts at NCLE focus on environmental and economic sustainability of livestock production systems, taking a systems-based approach. We are working on this on four fronts:

- Research (primary focus) – multi-disciplinary research teams
- Technology transfer
- Outreach and extension
- Public Education

We see strong partnerships as key—collaborations with:

- industry
- federal government
- provincial government and
- university partners

Our researchers, partners and infrastructure are our resources.

We are intensifying our efforts for processing both solid and liquid manure, working to expand our capacity for both liquid and solid manure processing/treatment at a commercial scale for use by NCLE and our partners.

UM NCLE multidisciplinary researchers currently engaged in manure P balance research:

Whole systems: *multidisciplinary projects in place for pigs, dairy and beef*

**Summary article available: http://umanitoba.ca/afs/ncle/Newsletters/Newsletter_Jan-Feb_2010.pdf

Feed management: *feed ingredients, processing, diet formulation, feeding practices (e.g. phase feeding), etc.*

Kees Plaizier (dairy), Martin Nyachoti (swine), Juan Carlos Rodriguez-Lecompte (poultry), Jim House (poultry)
Kim Ominski (beef)

Field management: *manure form/source and (long term) in-field application practices; rotation management; P cycling, movement and plant uptake of manure P (raw, treated, processed) in agricultural soil*

Don Flaten, Mario Tenuta, Wole Akinremi, Francis Zvomuya

Manure management: *processing and/or treatment of liquid and solid manure; manure storage*

Nazim Cicek (liquid manure treatment/processing), Francis Zvomuya (liquid manure treatment, agronomic use of manure treatment end products)

Economics: Derek Brewin

Feed Management

Swine:

Project leader Martin Nyachoti

- Dietary manipulation strategies and nutrient management planning to minimize N and P in manure while maintaining pig growth and health
 - Nutrient Management Planning for Sow Operations Using Extant and New Feed Consumption Models and Manure Analysis. MLMMI funded. Read the report at http://umanitoba.ca/afs/ncle/Reports/Kebreab_MMP_Sows_MLMMI_FR_2010.pdf

- Whole Farm Nutrient Balance: evaluating diets containing zero tannin faba beans and DDGS for the whole pig production and manure management system. Collaboration with the Puratone Corporation. Funded by MRAC, MPGA and Farmer's Edge.

Cattle:

Project leader Kees Plaizier

- **New – (Dairy)** Reducing whole-farm surpluses of phosphorus and potassium in intensive livestock operations. DFM, MRAC and MLMMI funded.

**Summary article available: http://umanitoba.ca/afs/ncle/Newsletters/Newsletter_Nov-Dec.pdf

Project leader Kim Ominski

- **(Beef)** Nutrient utilization and nutrient excretion from cattle during the overwintering period: Implications for supplementation of low quality forage diets with DDGS. MCPA, BCRC, MRAC, ARDI, MITACS, Greencover funded.

Poultry:

Project leader Juan Carlos Rodriguez-Lecompte

- Inclusion of DDGs in poultry diets and manure P content: Implications for feeding strategies to decrease P loading. MLMMI funded

Project leaders Jim House and Ermias Kebreab

- Development of Manitoba-based computer models for nutrient management in the laying hen industry: strategies to reduce phosphorus excretion. MEF and MRAC funded.



Field Management

La Broquerie Long Term Pasture and Manure Management Study (hog manure on grasslands)

Projects leader Mario Tenuta

- Long term fate of manure nutrients in soil and groundwater at the La Broquerie site. This long term study has been in place for 6 years. Visit <http://umanitoba.ca/afs/labroquerie> to learn more.
- **Proposed** next phase - Adaptation of integrated livestock systems to high soil test phosphorus in Southeastern Manitoba: manure, forage, soil and whole system-level management. **Full proposal submitted to MLMMI for funding consideration June 2010** "Integrated Livestock Systems to Sustain Hog Slurry Application onto Soil Testing High in Phosphorus in Southeastern Manitoba"

NCLE Long Term Manure and Crop Management Study

Projects leader Don Flaten

- Long term nutrient cycling under different livestock manure and crop management scenarios: Nutrient movement (from solid dairy and liquid pig manure and synthetic fertilizer) and crop uptake over time under annual and annual/perennial cropping rotations
- Nutrient release from solid cattle manure in a perennial forage system

Manure Behavior in Soil

Projects leader Wole Akinremi

- Downward movement of nutrients for different manure sources, soil type and crop management scenarios
- Indirect implications for P Balance: N release from solid cattle manure with different C:N ratios: Developing a calculator for estimating the fertilizer equivalence of different manures

Manure Management



Manure Treatment

Project leader Nazim Cicek

- Literature Review: Evaluation of the opportunity for manure treatment/processing technologies to achieve manure phosphorus balance in Manitoba. MLMMI funded. Read the review at http://umanitoba.ca/afs/ncle/Reports/Cicek_ManureP_Treat_Review_MLMMI_2010.pdf

Project leader Francis Zvomuya

- **New** - Assessing the efficacy of chemically-enhanced solid-liquid separation for management of phosphorus in hog manure. MLMMI funded

Value Added Treatment Products

Project leader Nazim Cicek

- Reclaiming phosphorus from liquid pig manure: Precipitation of P as struvite ($MgNH_4PO_4$) from liquid pig manure. ARDI funded. Read the ARDI article and watch the video feature at <http://www.gov.mb.ca/agriculture/research/ardi/2008-2009activityb.html>
- **Proposed** next phase - Opportunities for struvite recovery from covered and open lagoons at commercial scale operations in Manitoba. **Full proposal submitted to MLMMI** for funding consideration **June 2010** "Comparing phosphorus recovery potential as struvite from a covered versus open primary lagoon storage system at a full-scale livestock production facility"

Project leader Francis Zvomuya

- Agronomic suitability of manure processing/treatment products for use as fertilizer
 - **New** - Anaerobically digested solid beef feedlot manure (N_2O emissions, nutrient availability and release – N, P). Also temperature effects on nutrient availability. Lab scale comparison with fresh manure, digested manure, pelletized digested manure and synthetic N+P. Collaboration with Lethbridge where are running field trials.
 - **Future** – precipitated struvite and pure struvite evaluation in MB soils
 - **Future** – separated solids from s/l separation evaluation in MB soils

Economics

Project leader Derek Brewin

- **Completed (2010)** - A regional dynamic assessment of emerging manure management in Manitoba. MRAC funded

Other Related Materials Completed by NCLE/University of Manitoba Researchers

- Evaluation of the opportunity for manure treatment/processing technologies to achieve manure phosphorus balance. Joe Ackerman and Nazim Cicek. Prepared for MLMMI. Available on MLMMI website <http://www.manure.mb.ca/projects/viewproject.php?id=80>

- A Report on Current Knowledge of Key Environmental Issues Related to Hog Production in Manitoba (2007). Don Flaten, Karin Wittenberg, Qiang Zhang. Prepared by the University of Manitoba for the Clean Environment Commission
Relevant sections:
 - Manure Nutrient Management and Water Quality – Christine Rawluk and Don Flaten
 - Assessment of Potential Hog Manure Processing Strategies in Manitoba – Nazim CicekAvailable on NCLE website <http://umanitoba.ca/afs/ncle/CECFinalReport2007.pdf>
- Forms of phosphorus in different manures and their impact on phosphorus runoff and leaching losses from manure amended soils. Don Flaten and Darshani Kumaragamage. 2009
Available on MLMMI website <http://manure.mb.ca/projects/viewproject.php?id=66>
- Economic Assessment of the New Environment Regulations for the Pig Industry in Manitoba
Don Flaten, E. Salvano, C. Grant, G. Johnson, J. Mann, C. Grant. 2007
Available on MLMMI website <http://www.manure.mb.ca/projects/viewproject.php?id=32>
- Acceptable Phosphorus Concentrations in Soils and Impact on the Risk of Phosphorus Transfer from Manure Amended Soils to Surface Waters Don Flaten et al. 2004
Example of content:
 - Reducing Phosphorus Contribution from Animal Agriculture in Manitoba – Kathy Buckley and Grant PennAvailable on MLMMI website <http://www.manure.mb.ca/projects/viewproject.php?id=17>

For more information on these and other NCLE projects, contact

Christine Rawluk (Christine_Rawluk@umanitoba.ca) (204-474-8127), research development coordinator, National Centre for Livestock and the Environment

OR visit the NCLE website <http://umanitoba.ca/afs/ncle>