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Sow Management and Housing What Does the Industry Think?

Lee Whittington, B.Sc., MBA

Background

Maintaining research facilities that have the capability to meet industry needs is at the core of Prairie Swine Centre's mandate to serve the industry with near-market research information. Two years ago a review of the 300 sow farrow and gestation facilities at Floral resulted in an application for funding to the province of Saskatchewan. A significant effort by Saskatchewan Agriculture and Food to replace the ageing 1980 barns was developed with the Federal government and the result is a shared federal/ provincial grant for the renovation of the gestation, breeding and farrowing facilities. The resulting facility will allow PSC to accomplish several objectives.

Firstly, the current facility will be challenged to meet the current standards of animal care expected of a research farm. Secondly the construction of the new barn will actually reduce the operating costs of the farm through improvements in energy efficiency, but more importantly labour. This improved efficiency in labour will come from the fact the staff currently service the sow heard and gilt development spread over four separate buildings, and in the new design all animals will be within the same building. As well the labour currently used to hand feed sows will be better utilized for other activities when gestation and farrowing sows will be fed automatically in the new barn. Lastly the old barn had reached a point where 'band-aid' maintenance solutions to fix penning, equipment, and flooring where becoming significant.

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Industry Stakeholder Input

Once the funding of the new facilities was confirmed we developed a strategy for ensuring that the facility would meet internal as well as external stakeholder interest and needs. This included a thorough discussion with three distinct groups within industry: 1) pork producers with direct experience with alternative sow housing either in Canada or elsewhere, 2) pork producers with interest in the area of sow housing; and 3) producer boards, governments, and farm animal councils interested in the policy implications of alternative sow housing and welfare.

Thank you to all of the pork producers and industry personnel that participated in the many meetings in late April and throughout the month of May. The review involved in-person and telephone interviews conducted by Lee Whittington and Harold Gonyou with a total of 27 companies and agencies. A total of 89 people participated, 61% of which were primary pork producers. This industry review took place in the provinces of BC, Alberta, Saskatchewan, Manitoba, and Ontario. The resulting information, and opinions expressed can be organized into three broad categories: challenges and opportunities with alternative sow management; other opinions regarding alternatives; and research opportunities in the area of sow management and housing.

The topic of sow management was focused, timely and apparently highly valued based on the excellent response of industry to meet with us in a short period of time. This area is of immediate concern as all pork producers are considering what if any changes they will make to their operations in light of the announcements by Smithfield, Maple Leaf Foods and Wendy's regarding group-housed gestating sows.

Industry Reaction

In general, the industry is well aware of changes in attitude taking place within the public, the media and special interest groups regarding animal welfare in the barn. There is concern that in fact there are housing and management options proposed to replace gestation stalls that provide questionable welfare improvements for the animals and at the same time are considered 'animal friendly' by people outside the industry just because they allow animals to live in groups. An example of a quick-fix solution of concern to the industry includes maintaining the front two feet of penning and feeding trough of the original gestation stall, while allowing two rows of back to back stalls to share a common alley. This has left the industry very interested in developing experience and new information that will allow them to transition to new sow management systems that embrace some form of group housing but do not jeopardize the excellent production being achieved, and do not reduce the level of welfare provided by well-managed gestation stalls.

Group housing using trickle feeder system.
Photo courtesy of Tony Nichol, Alberta Pig Company

> There is a general acceptance of alternative systems evolving in the industry, however the reality is barns must continue to produce the target number of pigs per week, within the same barn footprint.

Some general observations:

- A general acceptance of alternative systems is evolving, however the reality is barns must continue to produce the target number of pigs per week, within the same barn footprint.
- All pork production groups are embracing the idea of alternative gestation housing. There is no consensus how that will be accomplished within the current barns, and new construction is unlikely.
- There is a concern that this move to groups is the start of the process that may bring farrowing crates into question. This is unanimously considered counter productive to animal wellbeing and productivity.
- Larger production companies are moving quickly. At least one group will start a conversion of one barn to groups in fall 2007 and two more companies will follow within the next 6-12 months.
- Renovation is considered the largest obstacle due to manure handling and penning investments in current barns. Renovation is also considered the most likely route to modified group sow management compared to building new structures. This is especially true in Manitoba where new construction is not an option, and the growth of the industry from 2 million sows to 9 million in the past 10 years means assets have high values.
- Alberta has several operating barns with straw-based manure systems. Many producers will not use straw for a variety of reasons that include manure handling, biosecurity and barn air quality, but for these Alberta producers they have overcome these challenges and are reporting excellent productivity.
- There will not be one 'ideal system', as renovation is going to be a part of most farms. Any research needs to investigate basic sow needs that can be applied across a wide variety of barn designs.
- The industry has a keen interest in seeing research done in the farrowing area to address the increasing litter size anticipated (in excess of 14 born alive in next 5+ years) combined with older weaning ages (3 to 4 weeks) making

improvements to current farrowing crate design, pen sizes and feeding programs required.

Research Capability

The question of how research could help address sow management generated a significant list of over 100 ideas! The new barn is being designed with these in mind. First on the list of priorities for the new barn is to produce piglets for the nursery and grower-finisher research program, so the facility must be a functional production facility. The current facility, although not pretty and somewhat labour intensive by new barn construction standards, has a dedicated staff currently producing 11.4 born alive, on over 800 farrowings each year with a preweaning mortality of 10%. In addition to being a good production facility, this unique opportunity to construct a new barn at a research farm does not come along that often and developing a barn that can rise to the challenges of the industry for the next 25 years is also taken seriously in the design. In summary, the new facility will fill two roles: as an efficient production unit, and to conduct novel sow research.

I have highlighted some of the suggested research projects that were noted by a high proportion of pork producers:

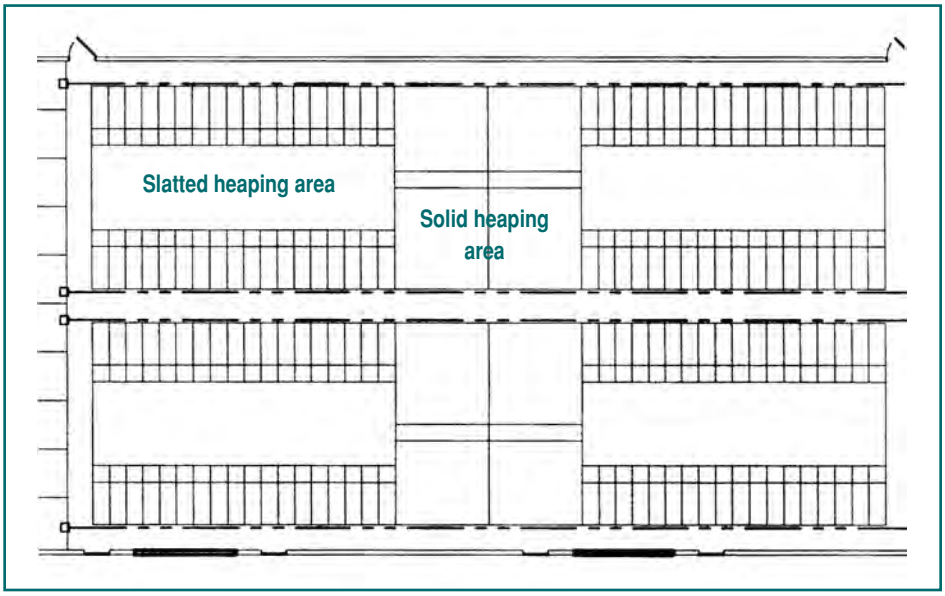
- Training mature sows previously housed in stalls to use ESF (Electronic Sow Feeders). How to determine as early as possible which sows cannot be trained so they can be returned to stalls for the balance of the pregnancy.
- What means are available to reduce space allowance per sow. For example, location, shape and size of loafing area.
- How to minimize space used when building a 'cafeteria' feeding system that requires sows to be moved daily from loafing area into feeding area.
- The size of stalls required varies depending on their use. Are they feeding versus sleeping stalls.
- The housing and management of gilts and 1st liter sows separately from mature sows. Is this age group best served by having some time in stalls or treated as a separate group not to be mixed with mature sows?

Walk-in lock-in stall.
Photo courtesy of Egeberg International

Barn Design

To address these and other research needs the barn will be designed to allow key elements like group size, space per sow, and feeding for stage of gestation and parity questions to be investigated. This has resulted in the gestation portion of the barn incorporating additional space

Figure 1. Partial floor plan of proposed dry sow barn showing two weeks breeding per group and use of walk-in, lock-in pen design.



to replicate the various scenarios that might be seen on a commercial farm. To do this the basic gestation barn will consist of six large pens each of which accommodate two weeks of breedings. Each of these two-week breeding groups will be housed in two rows of lock-in stalls separated by a shared slatted area of 10 feet. In addition, a solid floor area will form a 'T' on the end of the shared slatted area. This design allows the most popular systems to be tested, including standard 24 inch gestation stalls, walk-in lock-in stalls for group housing, replicating a cafeteria feeding system moving sows daily from a non-feeding group pen into the walk-in stall, and floor feeding in groups. ESF feeding is not anticipated in this facility since there are seven units at the PSC Elstow Research Farm. This design also allows the maximum flexibility to test space requirements under different scenarios and the effect that may have on animal behaviour. A schematic of the gestation area is shown in Figure 1.

The Bottom Line

Research capability is being designed into the new sow barn to accommodate studying the effect of key components of sow management, particularly those that have to do with gestation sow management and housing such as space allowance, group size and feeding. Each of these will be critical factors in developing any renovation that pork producers may wish to pursue in developing a system that ensures low cost productivity as well as embracing a group housing component.

Overview of on-going projects in the PSCI Engineering Research Program

B.Z. Predicala, D. Asis, E. Navia

Summary

Three research projects were started within the PSCI Engineering Research Program that involve controlling emissions using nanoparticles, assessing barn energy use to reduce utility costs, and evaluating a new housing system for grower-finisher pigs. The goals and the activities within each project are described.

Introduction

Research activities within the PSCI Engineering Research Program are aimed to address environmental sustainability concerns relevant to the pork industry and to optimize the physical and management systems within swine operations to improve net profitability. In line with these goals, three research projects were started within the program during the past year. However, these studies are in the early stages of the research process, thus, discussion of final results is not yet possible. This overview provides a brief description of each project and the activities that will be undertaken over the coming year.

Use of nanoparticles to control emissions from swine manure slurry

(B. Predicala, D. Asis; funded by the Natural Sciences and Engineering Research Council of Canada (NSERC))

The overall goal of this research is to determine the technical feasibility of using reactive nanoparticles to reduce odour and gaseous emissions from swine barns. The rationale for this research is to take advantage of recent advances in nanoparticle technology used in other industries to develop control measures for odour and gaseous emissions from swine facilities.

Nanotechnology refers broadly to the control and manipulation of atoms and molecules to create structures and devices at nanoscale dimensions with novel properties and functions attributed to their small size. Nanoparticles are nanoscale materials that are created by controlled processes to attain specific properties. The multitude of uses of nanoparticles includes environmental applications such as wastewater remediation, destruction of toxins and pathogenic microorganisms, as well as air filtration and purification. These applications were mainly due to inherent properties of nanoparticles which can be highly-reactive when in contact with the target compounds, particles, or microorganisms. Because emissions from swine barns consist mainly of gaseous compounds (e.g., odour, hydrogen sulphide (H_2S), ammonia (NH_3)) and aerosolized particles of biological origin (i.e., bioaerosols), it is hypothesized that reactive nanoparticles could also be effective in controlling emissions from swine operations.

Initial experiments were conducted to test the impact of nanoparticles on selected target gases at known concentration. Six types of nanoparticles were selected based on their performance in previous similar applications, their reported chemical and physical properties, and from consultation with technical staff of a company that manufactures these materials.

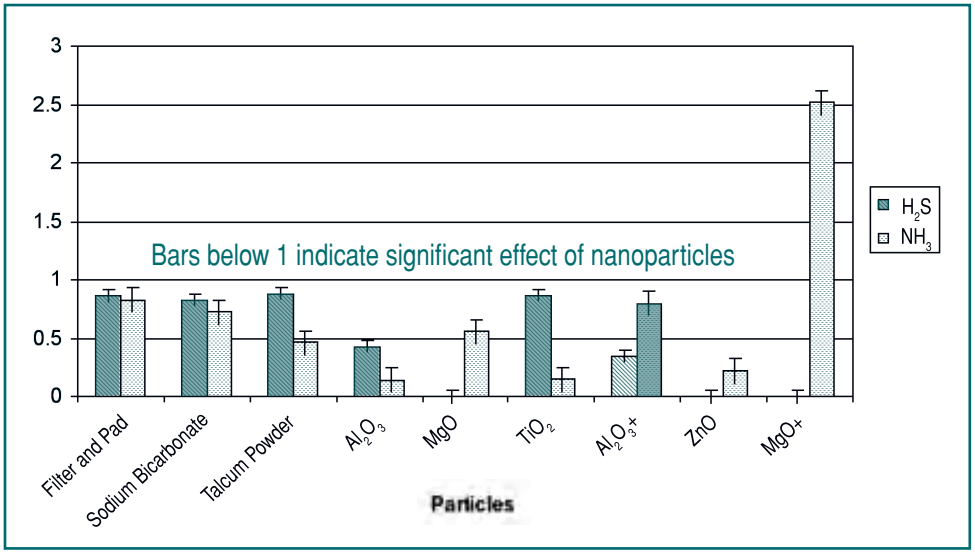
Using two gases of concern, H_2S (hydrogen sulfide) and NH_3 (ammonia), we tested the effectiveness of six different nanoparticles to take these gases out of the air. Using the sampling flow rate and amount of particles determined from preliminary tests, the results of the tests on these six types of nanoparticles and other common materials are shown in Figure 1. The values shown are the normalized concentrations, meaning lower values (<1.0) indicate better effectiveness in reducing the target gas concentration. Among the nanoparticles tested, the top three materials based on effect on 50-ppm NH3 target gas were Al_2O_3, TiO_2 and ZnO, which corresponded to a reduction of 85.6%, 85.2%, and 78%, respectively.

Using MgO, MgO+ and ZnO nanoparticles, the concentration of H_2S was reduced to <1.0 ppm (below detection level of the H_2S monitor used) from an initial 25-ppm concentration. Additionally, Al_2O_3 and TiO_2, which were previously found to be effective for NH_3, were able to reduce the concentration of H_2S by 57% and 13%, respectively.

Further tests will be conducted to test the impact of various nanoparticles on other target gases and on the actual gas mixtures emitted from swine slurry. In addition to air filtration, other deployment techniques such as mixing of the nanoparticles with slurry and dispersion of the particles to treat the emitted gas will also be evaluated. Additional room-scale tests will be conducted to ensure that the nanoparticles proven to be effective in controlling the gas emissions can be used safely in swine barns in a cost-effective manner.

Nano-particles are created to attain in specific reactions such as absorbing and taking gases like Ammonia and Hydrogen Sulphide out of the air.

Figure 1. Average normalized concentrations of target gases passed through various powder materials. Each value is the average of three replicates and the error bars represent standard error of the mean.



Reducing energy costs in swine barns

(B. Predicala, J. Patience, E. Navia, L. Whittington; funded by the Advancing Canadian Agriculture and Agri-food Saskatchewan (ACAAFS) Program)

The overall objective of this project is to reduce energy costs in swine operations in order to reduce overall production costs. With energy costs rising on a global basis, the ability to produce pork with lower energy inputs could represent a significant competitive advantage to our industry, particularly with respect to our main global competitors, which are typically dependent on intensive energy inputs. Current estimates of utility costs (gas and electricity) indicate that they range from about $6-10 per pig sold on a farrow-to-finish basis and thus are the third largest variable cost, after feed and labour. However, there is a need to conduct a comprehensive evaluation of actual energy use in typical swine production facilities in western Canada to be able to establish a relevant benchmark on current energy cost per pig sold and to identify the energy intensive tasks in barns and potential areas for improvement.

This project will be conducted in four phases. Currently, the first phase is on-going which involves a survey of a representative sample of different types of swine operations to gather baseline information on current energy usage. A series of energy audits of selected facilities will be done over winter and summer seasons to validate the survey results, to assess the relationship of level of energy input to overall productivity of the operation and indoor air quality, and to document current management practices for efficient energy utilization.

The second phase will involve the assessment of the impact of different energy-saving strategies on overall energy costs using computer simulation. Using information gathered from the survey and from barn audits, a computer model will be set up to enable us to conduct a thorough evaluation of various energy-conservation measures in a cost-effective manner without having to apply and test each measure in an actual set-up. In a subsequent phase of the project, the most promising measures based on the results of the simulation phase will be selected and applied in an actual swine barn to demonstrate their actual impact on total energy costs. The fourth phase will involve the development of a user-friendly software tool for use by pork producers to evaluate current energy use in their own facilities, and to help in the decision making process on adopting specific energy conservation measures appropriate for their operations.

Assessment of an alternative swine grow-out facility

(B. Predicala, J. Patience, H. Gonyou; funded by the Advancing Canadian Agriculture and Agri-food Saskatchewan (ACAAFS) Program and the Saskatchewan Pork Development Board)

Barn construction and capitalization represent a significant percentage of the cost of producing a market hog. Furthermore, because of the current construction environment in western Canada, this cost component can be a major disadvantage to our industry, especially with respect to our main global competitors. Additionally, barn design and construction can have a major impact on the operation and management of the barn, thus significantly influencing the performance of animals and the general work environment for barn workers. Hence, a newly- constructed grow-out facility using non-conventional, low-cost building techniques presents a valuable opportunity to closely investigate a means for reducing capital costs, while documenting as well its impact on overall productivity, and other operational aspects that could be affected.

The overall objective of this work is to conduct a comprehensive evaluation of the economic and operational aspects of building and operating a non-conventional confinement barn constructed using low-cost building methods and materials. The main approach of this work is to assess and monitor different parameters and various aspects of the operation that may likely be impacted by the difference in building construction approach, relative to a conventional barn. Additionally, any new costs or benefits and operational requirements unique to these swine housing units will also be documented.

This work will be divided into different modules, each dealing with a different aspect of the operation. The different modules include: 1. capital costs, 2. productivity and operational efficiency 3. environment and manure management, 4. animal welfare and handling, and 5. economic and feasibility analysis. Each module will be implemented as a sub-project, with its own protocols developed to meet the specific module objectives. The timeline for each module would include baseline data gathering for the initial year of operation, analysis of the data to identify strengths and weaknesses of the system, development of improvement measures whenever appropriate, implementation of those measures, and subsequent monitoring of the impact on the parameters within the scope of the module. Current activities for this project include the setting up of the environmental monitoring system in the barn, and collection of data on the construction of the barn units and on the performance of the first batch of pigs.

The Bottom Line

All these on-going studies are multi-year projects, thus, results from the activities over the coming year will be reported in subsequent Annual Research Reports. The bench-scale tests on evaluating various types of nanoparticles and deployment techniques will be completed next year, as well as the benchmark survey and energy audits for the energy cost reduction project. Over the next year, data on several room turns in the low-cost barn units will be collected. Combined with the data on barn construction and operation costs, this will enable us to make a preliminary assessment of the overall performance of the operation.

Biosecurity Pays Big Returns

Dave van Walleghem, BSA.
Sheridan, Heuser Provis Swine Health Services

An ounce of prevention is worth a pound of cure. This famous quote by Ben Franklin is the essence of Biosecurity. There are many very visual practices we undertake and are familiar with in the name of biosecurity. Entrance showering, downtime, cleaning of anything brought in to the farm….. What about inside the barn??? When we are finished a cycle we clean a room in preparation of the next cycle. The idea is to clean and disinfect the room, to reduce the challenge for the oncoming batch.

Disinfection not Sterilization.

Disinfection reduces the number of bacteria, not completely eliminates them. Sterilization (eliminates all microbial activity) is used for the tools, which can be submerged or super heated (autoclaved). Hospitals and barns sterilize instruments used in a surgery but the rest of the barn we just disinfect. To help disinfection be as efficient as possible we need to prepare the surface. How you ask, I thought you'd never ask? Lets go through a standard clean-up.

Step 1- Pre-clean, this is accomplished by removing the excess organic material, large manure areas, excess feed, etc. If removing it by water (pressure or a fire hose); allow some time to dry (stop dripping) before proceeding to the next step.

Step 2 – Apply a degreaser. A degreaser needs to be applied on all surfaces intended to be washed. It needs to be at the label concentration and wet enough to soak but not roll off the wall (just before dripping normally 250-500 ml/). All products need a minimum of 10 - 20 minutes to do their work. This step is important in a few ways. A degreaser is a soap or detergent. First it removes the protective layer around the bacteria and viruses, called Biofilm. This allows the disinfection in the later steps to penetrate and kill more effectively. There are 2 types of Biofilms and different detergents work better in removing them. An alkaline detergent is great to take off the greasy Biofilm (normally the biggest challenge, often described as that slimy film. This can be accomplished using products like Biosolve, Chlor-a-foam). An acid based detergent is very good at removing the mineral film (the visual staining eg. Biofoam, Acid-a-foam). It is a very good practice to rotate between these two types, normally a 3:1 respectively. Another positive is that the proper use of soaps will save a washer 30% - 50% washing time. This time saving alone will more than pay for the soap cost. Don't get caught up on the cost of the soap. Most expensive soaps are actually cheaper to use per room in a challenged area (such as the barn environment). The more expensive soaps normally have set concentration and cheaper ones vary with conditions, do the math, you'll see.

Step 3 - Pressure wash: Use your dirt blasters and remove the dirt, with the detergents from the step above you have loosened a lot of the protective Biofilm and the pressure washer will remove 85-90% of the films, bacteria, and viruses. This is a huge step in preparing the surfaces for an effective disinfection. Again allow some time for the room to dry as much as possible (stop dripping)

> "the proper use of soaps will save a washer 30% - 50% washing time. This time saving alone will more than pay for the soap cost."

before proceeding to the next step.

Step 4 – Disinfection, the final step. Disinfectants need to be applied at their working concentration. Read the label and make sure the final product hitting the wall is at the right concentration. With the surfaces prepared from the previous steps, the disinfectants can focus on what is remaining, and not be overwhelmed by the excess organic matter load. Allow the room to dry before animals enter, also be aware that some disinfectants are more toxic than others and feeding / sleeping areas may need to be rinsed before use, even if it is all dried.

The best analogy I can make about soaping and disinfecting is that it is like painting. Anytime you paint you make sure the consistency is right but you also make sure you have enough. One needs to measure all the surfaces that you are working with so that you get enough paint. Below is a typical 12 crate farrowing room calculation, figuring out how much product (paint or in our case disinfectant) is needed.

Farrowing room – 2 rows of 6 crates are 5 x 7 with a 3 foot alley and 2 feet in the back.
Length of the room – 35 feet
Width of room – 21 feet
Height – 10 feet

If you were using one big tank, and only drawing for that for application, the numbers above are all you need. However if you are using a proportioner, remember only a small portion of the soaking volume will be from your stock, a large percent will come from your water supply. However in the stock proportionate there must be at least the 0.777 liters of the pure product. Figuring out the working ratio of you proportioner is another topic all in itself.

Cleaning and disinfection is just another critical step in the Biosecurity process; a very important one. The better we "paint the room" (clean and disinfect) the better it looks and the less challenge for our new arrivals allowing them to utilize all of their energy on growing, instead of challenging volumes of Bacteria /Viruses. Good luck and good cleaning!!

Area	Sq. ft.		sq. ft./10 = sqm		
Floor	=	735			
Ceiling	=	735	3108/10	310.8	
End Walls (x2)	=	420			
Side Walls (x2)	=	700	250 x sqm = total fluid needed to soak a room		
			250 x 310 = 77700 ml or 77.7 litres		
Total	=	2590			
20% for crates	=	518	product working concentration 1 : 100 or 1%		
Final Total	=	3108	In 77.7 liters we needed 0.777 litres of pure solution		

Personal Profile

Raghavun Premkumar

Raghavun Premkumar is from India. He was born in Dharmapuri a small town in the province Tamil Nadu of Southern India. He grew up in a culturally rich environment with Tamil one of the classical languages of the world being his mother tongue. He had his schooling in a beautiful hill station the Nilgiris. Having been brought up close to nature and wild life he developed a love for animals which he aptly followed to ultimately join veterinary medicine in 1996 at the Century old veterinary school, Madras veterinary college of Tamil Nadu Veterinary and Animal Science University.

Having completed his Bachelors in veterinary science he practiced veterinary medicine for two years and then joined a multi national poultry firm as Assistant manager. In the fall of 2006 he joined the University of Saskatchewan to pursue a Master's degree under the supervision of Dr.Pascal Leterme. Having heard of the winter life in Saskatoon, He was thrilled to experience the first snow fall of his life, in October 16, 2006, but after the famous Jan10 blizzard of 2007, he has stopped craving about snow. His current project involves the Assessment of Net energy available from Field Peas in Gestating Sows and Invitro gas fermentation and the kinetics of starch degradation of Field Peas.

Brandy Street

Brandy Street joined the Manitoba Livestock Manure Management Initiative in January of 2007. A native of Moose Jaw Saskatchewan, she earned her Master's degree in ethology, the study of animal behaviour, at the University of Saskatchewan and Prairie Swine Centre in 2005, under the supervision of Dr. Harold Gonyou. She went on to become a Research Assistant in ethology at the Prairie Swine Centre upon graduation. In her role as the Executive-Director for the MLMMI, she is responsible for day-to-day operations, encouraging financial support for research into environmentally-friendly manure management technologies, and funding research projects with on-farm application potential

Manitoba Livestock Manure Management Initiative

"The Manitoba Livestock Manure Management Initiative is inviting proposals for innovative manure management research and demonstration projects. Deadlines are Sept. 1 or Nov. 1 for fall or winter consideration, respectively. For more on this request, proposal requirements, or an application form, please visit us at www.manure.mb.ca, or contact Brandy Street at (204) 945-2122 or brandy.street@gov.mb.ca."

Manitoba Livestock Manure Management INITIATIVE INC.

Coming Events

Swine Technology Workshop
October 23-24, 2007
Red Deer, Alberta

Saskatchewan Pork Industry Symposium
November 14-15, 2007
Saskatoon, Saskatchewan

Manitoba Hog Days
December 5-6, 2007
Brandon, Manitoba

Banff Pork Seminar
January 15-18, 2008
Banff, Alberta

Manitoba Swine Seminar
January 30-31, 2008
Winnipeg, Manitoba

Alberta Pork Congress
March 12-13, 2008
Red Deer, Alberta

Focus on the Future Conference
March 25-26, 2008
Red Deer, Alberta
Red Deer Lodge

PRAIRIE SWINE CENTRE

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