centred on
SWiNe
The Newsletter of Prairie Swine Centre Inc.

In This Edition

Summer 2004 Volume 11, Number 2

Program funding provided by

Sask Pork

Manitoba Pork Council

Alberta Pork

Saskatchewan Agriculture, Food and Rural Revitalization

Practical Aspects of On-Farm Artificial Insemination

Murray Pettitt, Ph.D.

During the last decade, the use of Artificial Insemination (AI) has become common as producers wish to realize the benefits of AI within their herds. Among others, these benefits include the use of genetically superior boars, a reduction in disease transmission and a lower boar housing cost.

Careful attention to detail is required to successfully use AI in a production system.

A successful AI program depends on effective heat detection, proper hygiene, correct handling and storage of insemination doses, and proper insemination technique.

The following is a checklist to ensure a successful A. I. Program.

Temperature Fluctuations

Temperature changes are harmful to boar sperm and must be avoided. Cold shock is a rapid decrease in the temperature of the sperm from its current temperature, and heat shock is a rapid increase in the temperature of the sperm from its current temperature. These sudden changes are very detrimental to the health of the sperm. Examples of cold and heat shock would be placing a tube of extended semen that was stored at 17°C on top of a window ledge, counter or penning in the winter or on top of a heated window ledge in the summer. Insemination doses must also be protected from cold or hot drafts in the barn as these can also damage the sperm. These drafts are often around fans and doorways.

Attention to detail is an important part of every A.I. program including a good laboratory.

In order to prevent temperature changes in semen doses while inseminating, the doses should be removed from the 17°C storage cabinet and placed into a plastic cooler. This cooler is then used to transport and store the semen in the breeding barn. The temperature of this cooler should be stabilized by placing two or more gel ice packs in it that were also stored in the 17°C storage cabinet. This will maintain an even temperature in the cooler that is safe for the sperm. Due to the risks of cold and heat shock, each insemination dose should not be removed from the cooler in the barn until just before it is needed for insemination.

Multiple small changes in temperature and reversal of the direction of temperature change of a semen dose are also harmful. For this reason, only the number of doses that will actually be used for insemination should be removed from the 17°C storage cabinet and placed into the plastic cooler to be taken out to the sows. When the insemination

A.I. Continued on page 5

Management Alternatives with Electronic Sow Feeders

Harold Gonyou, Ph.D.

The Need for Alternative Systems

Since the Brambell Report identified freedom of movement as a basic requirement for animals in intensive agriculture the pig industry has had to consider alternatives to gestation stalls. In some countries this has led to legislation. In others, producers have adopted group housing in order to maintain export markets. In North America various consumer and special interest groups advocate marketing contracts that would require alternative housing systems. We decided to include group housing within our research facility and program.

Selection of an Alternative System

Rather than looking at ways to remodel an existing facility, we decided to consider alternatives for new housing. We identified four basic group housing systems, largely based on the means used to feed the animals. These were: floor feeding; trickle or bio-fix feeding; feeding stalls; and, electronic sow feeders (ESF). Floor feeding and trickle feeding have limitations in controlling individual feed intake of the animals. To achieve reasonable control of intake in these systems it would be necessary to sort and manage animals by parity, size and body condition. We felt that such management requirements would limit the use of these systems in high production herds, and eliminated them from consideration. Individual feed stalls would provide good control over intake, but were considered more expensive and did not provide the flexibility in feeding within a group as did electronic sow feeders.

Improvements in ESF Technology

Numerous problems have been associated with earlier models of electronic sow feeders, but have been addressed in current designs. The use of ear tag transponders has reduced the cost and loss rate compared to collars used in earlier systems. Side and front exit systems, along with better gating mechanisms, have reduced the incidence of vulva-biting that once plagued the system. The use of lock-outs on either the station entrance or at the feed trough for sows that have already consumed their daily allowance has greatly reduced the recycling of animals through the stations which contributes to a high level of aggression at the feeder entrance.

Choice of Management Alternatives

We chose partial slatted floors, without bedding, in an environmentally controlled building to house our system. We selected an ESF model that locked fed sows out at the entrance to the station preventing sows from recycling through the feeding station. During the initial four reproductive cycles reported here, we trained gilts to ESF prior to breeding and housed them with sows during their gestation. Our initial project examined two animal management options within the system: regrouping pre or post-embryonic implantation, and maintaining static or dynamic social groups.

Pre vs Post Implantation

It is generally recognized that there is a period early in pregnancy, prior to embryonic implantation, when the sow is susceptible to stress-induced reproductive failure. However, the effect of grouping in ESF systems during this time has been poorly documented. We chose to interfere with our breeding management as little as possible, and moved all sows bred during the previous week from the breeding stalls to their gestation system on the same day each week. Pre-implant sows were moved to group housing 3-10 days post-breeding. Post-implant sows were held in gestation stall housing for 6 weeks before entering ESF.

Static vs Dynamic Groups

Animals within ESF systems can be managed as either static or dynamic social groups. We define static groups as having all animals enter the group on the same day, and that for the remainder of the gestation the only social changes occur if animals are removed because they return or are moved to farrowing. Static groups are expected to be more stable and have few socially upsetting events. We combined a week of pre-implant and a week of post-implant sows together to form our static groups (approx. 40 animals). Dynamic groups have animals added to the continuing group at regular intervals. Thus the group composition is changed frequently and social upset occurs at regular intervals. In our case we added a pre-implant and a post-implant breeding cohort to the Dynamic group at five-week intervals. At any one time the group

Table 1. Farrowing rate (% of bred sows that farrow) of gilts and sows in Stalls and various management programs within an Electronic Sow Feeder system[1].

		Pre-implant		Post-implant	
	Stalls	Static	Dynamic	Static	Dynamic
Gilt	77.9	70.1	71.4	74.1	75.5
1st parity	84.3	84.1	85.5	91.0	87.0
2nd parity	87.7	83.1	82.6	80.8	89.5
Mature	88.9	83.5	77.5	86.5	88.8
Adjusted[2]	85.0	80.2	78.5	83.3	85.2

[1]Results of four reproductive cycles with new gilts added each cycle.
[2]Based on a theoretical herd demographic of 25% gilts, 20% 1st parity, 18% 2nd parity and 37% mature (approximates a 15% culling rate per cycle to a maximum 6th parity).

consisted of approximately three such combined additions (approx. 120 animals).

Preliminary Results

We will continue this study through six reproductive cycles. The farm was in its fifth cycle since construction when the study began. All animals that were to be assigned to the ESF system were trained and spent at least one gestation period under that system before the trial began. Animals are culled and replaced by gilts as per normal management. As indicated above, gilts were trained to ESF before breeding and housed with sows during gestation. Data are presented as raw values, with the exception of 'Adjusted' values which reflect a theoretical herd demographic of 25% gilts, 20% 1st parity, 18% 2nd parity and 37% 3rd or higher parity.

> Post implant groups on ESF exceeded the productivity of stalls by approximately 2% overall, and 5% for mature sows

Farrowing Rate

Farrowing rates (percentage of sows bred that farrow to that breeding) are presented in Table 1. The values reflect a lower farrowing rate for gilts than for sows as would be expected. There was no difference between Static and Dynamic groups, but animals grouped prior to implantation had a 5% reduction in farrowing rate compared to the Post-implant treatment. The stall and post-implant treatments were essentially the same, differing by only 1%. It should be noted that the reduction in farrowing rate among Pre-implant animals was similar for all parities. It would appear that Pre-implant animals are susceptible to the social stress of grouping, and that this susceptibility was similar for all parity levels.

Live Litter Size

Live litter size results are presented in Table 2. Differences in live litter size were less than those observed for farrowing rate. As for farrowing rate, Static and Dynamic social management treatments did not differ in live litter size. The differences among Stall and Pre vs Post implantation treatments were small and likely will not be significant. Live litter sizes for Pre-implant and Post-implant treatments were 1% and 3% higher than that for Stalls. When expressed as a percentage of the Stall results, the live litter size for the ESF treatments increased from 99% for gilts to 105% for mature sows. It would appear that as animals age, those in Stalls are at a disadvantage compared to those in ESF in terms of live litter size.

Total Productivity

A measure combining both farrowing rate and live litter size (live piglets per 100 sows bred) is presented in Table 3. One value in the table, that for 2nd parity Post-implant Static animals seems low when compared with other Post-implant values. This is attributable to a low farrowing rate for this group (Table 1). As before, there is little difference between Static and Dynamic management treatments. However, the Post-implant groups exceeded the productivity of Stalls by approximately 2% overall, and 5% for mature sows, while that of the Pre-implant grouping treatment was 6% below that of Stalls.

ESF Management

Every management system has its own advantages and problems. Our stockpersons generally find the ESF sows more difficult to locate prior to, but easier to move to farrowing. We encountered lameness problems in the ESF

E. S. F. Continued on page 5

Table 2. Litter size (liveborn piglets) of gilts and sows in Stalls and various management programs within an Electronic Sow Feeder system[1].

		Pre-implant		Post-implant	
	Stalls	Static	Dynamic	Static	Dynamic
Gilt	9.8	9.5	9.5	9.9	10.1
1st parity	10.6	10.6	10.0	10.6	10.5
2nd parity	11.1	10.9	11.6	11.5	11.4
Mature	10.7	10.9	11.4	11.5	11.2
Adjusted[2]	10.5	10.5	10.7	10.9	10.8

[1]Results of four reproductive cycles with new gilts added each cycle.
[2]Based on a theoretical herd demographic of 25% gilts, 20% 1st parity, 18% 2nd parity and 37% mature (approximates a 15% culling rate per cycle to a maximum 6th parity).

Table 3. Liveborn piglets per 100 sows bred for gilts and sows in Stalls and various management programs within an Electronic Sow Feeder system[1].

		Pre-implant		Post-implant	
	Stalls	Static	Dynamic	Static	Dynamic
Gilt	763	666	678	734	763
1st parity	894	891	855	965	914
2nd parity	973	906	958	929	1020
Mature	951	910	884	995	995
Adjusted[2]	897	845	840	912	925

[1]Results of four reproductive cycles with new gilts added each cycle.
[2]Based on a theoretical herd demographic of 25% gilts, 20% 1st parity, 18% 2nd parity and 37% mature (approximates a 15% culling rate per cycle to a maximum 6th parity).

Afforestation Applications for the Hog Industry

Ken Engele, BSA.,
Lee Whittington, MBA

Canada has made a commitment to reducing Greenhouse Gas Emissions and animal agriculture, though a small contributor has an obligation to contribute. Creating significant carbon sinks is one way to do this.

What is Afforestation?

Afforestation is the establishment of tree plantations on agricultural land that has not been previously managed for forests for at least 12 years. Emphasis is placed on maximizing the use of available land and resources with high yield species, with the objective of producing yields 8-10 times greater than rates associated with the commercial natural forests. Trees can either be of similar species or mixed in a manner that will result in a stand or forest.

Afforestation and the Hog Industry

- Potentially less land and closer proximity to barn required for manure application
- Tree plantations act as a shelterbelt/windbreak, thereby potentially reducing odours generated in the vicinity of he production facility
- Create additional value added opportunities within the immediate area of the production facility such as future wood fibre harvest

What kinds of trees have the greatest growth potential in Western Canada?

- Hybrid poplar
- Spruce
- Pine
- Larch

How fast will they grow?

Site selection will play an important role in determining the growth pattern of tree plantations. However, fast-growing hardwood species like hybrid poplar can mature in 20 years after establishment. At maturity they will measure 20 m (66') tall and 30 cm (12") in diameter, at breast height.

Conifers will mature in 50-60 years after establishment. At maturity they will measure approximately 20 m (66') in height and 25 cm (10") in diameter at breast height.

How many trees are planted per hectare/acre?

- 1,100 - 2,000 stems/hectare
- 445 - 809 stems/acre

What are the costs associated with establishment and maintenance of a fast-growing plantation?

- $1,500 - $3,000 /hectare
- $607 - $1,214 /acre

How large an area do I need to plant?

In order to be commercially viable a plantation should be at least 8 hectares, or 20 acres, although as little as 0.5 hectares, or 1.25 acres, classifies as afforestation.

How many trees does it take to sink a tonne of carbon from the atmosphere?

Six to eight mature trees (20 years old) are required to sink a tonne of carbon. Therefore, one hectare of trees can sequester approximately 150 mt of carbon.

Site Selection Guidelines

- Soil texture: loams, silty clay, silty sand, and sandy clay
- Moderately well drained to rapidly drained
- pH of 5.0 to 8.0
- Non-saline
- Light stoniness (surface boulders, bedrock, and cobble should be avoided)
- Flat to gently rolling topography
- Annual precipitation of 380 mm or 15"

Site Preparation

Autumn prior to planting

- A broadcast Glyphosate application if the area was previously used for cropping practices
- Tilled (deep disced) to a depth of 30 cm (12"). The discing process should be completed using two passes, in which the second pass is carried out in a perpendicular direction to the first pass
- Three weeks following the deep discing, a shallow discing or harrowing should be completed, creating a more level and mixed surface

At Spring Planting

- A broadcast Glyphosate application following the first flush of weeds
- Tree position marking. Trees should be marked in straight parallel rows, perpendicular to the primary access route

Natural Resources Canada / Ressources naturelles Canada
Canadian Forest Service / Service canadien des forêts

The preceding information on site selection and recommended practices were developed for agricultural lands , that at a minimum have not been forested for at least 12 years. Recommended afforestation practices are intended as guidelines, specific practices will depend on the condition and previous management of the site.

A.I. Continued from page 1

doses are moved from the 17°C storage cabinet to the plastic cooler, they will slowly begin to warm up, even though gel ice packs that were stored in the 17°C storage cabinet were placed in the cooler with the sperm. If some of the doses are not used for insemination and are returned to the 17°C storage cabinet, they will cool to 17°C. This reversal of temperature change should be avoided.

The use of storage cabinets and portable coolers to control the temperature of the extended semen has an additional benefit. Ultraviolet light can also damage the sperm and these containers minimize the exposure to these harmful rays.

Inseminator Fatigue

Inseminator fatigue occurs when a breeding technician inseminates too many animals in a short time period. After 10 consecutive inseminations/technician, farrowing rates begin to drop. A good target is for 7-8 inseminations/technician/hour with each insemination taking 5-7 minutes. A short break should be scheduled after every hour. This can be accomplished by loading the plastic cooler with no more doses than can be inseminated in an hour. At the end of the hour, the technician receives a break from inseminating by having to return to the 17°C storage cabinet to pick up more doses and fresh gel packs. This also helps to avoid the multiple small changes in temperature and reversal of the direction of temperature change of a semen dose previously described.

Heat checking and Insemination Timing

While heat checking in the presence of a boar, a sow in standing heat will exhibit the standing reflex for 10 – 15 minutes following stimulation. For the following hour or so, she will not stand again, even in the presence of a boar. Care must be taken to avoid having the boar too far ahead of the AI technician while heat checking and breeding. If the boar is too far down the sow line the sows will be stimulated too early, when the breeding technician cannot observe for estrus. Sows in heat may then not be showing signs of estrus by the time the technician reaches them. This can result in incorrectly determining a sow is not in heat, even though she is. Restricting access by the boar to just a few sows ahead of the one currently being inseminated by using gates or boards will greatly reduce the chance of a sow becoming refractory to additional stimulation and missing her heat.

Moving sows following insemination

If sows must be moved following breeding, move either during the first 3 days after breeding or after the 30th day of gestation. The period between days 3 and 30 is the period of embryo migration and implantation; moving sows during this time may result in spontaneous abortions and/or reduced litter sizes.

A properly resigned boar collection area is important for in-barn collection.

The Bottom Line

Changes in temperature of extended semen can be minimized by keeping the insemination doses in plastic coolers with 17°C gel freezer packs while in the breeding barn.

Avoid inseminator fatigue by taking only those doses that can be inseminated in an hour into the breeding barn.

While heat checking, avoid stimulating sows too early as they may become refractory to boar stimulation and the estrus may be missed.

Do not move sows between day 4 after breeding and day 30 of gestation.

E.S.F. Continued from page 3

pens. We attributed these to dunging on the solid floor and the failure of feces to work through the slats, leading to slippery conditions. We addressed these by changing to solid penning between lying areas and adding sprinklers over the slats. The problem has largely been resolved. In our case lameness in the ESF system was due to poor management within that system, rather than the system itself. Once managed properly, the problem disappeared. We identified animal flow problems within the ESF system when we increased the number of gilts being brought in for another study. We had to modify our training procedures to accommodate this challenge. Again, as in any system, problems need to be identified and corrective action taken.

The greatest production difference observed was the reduction in farrowing rate in the Pre-implant grouping treatment. Compared to Stalls, a 6-7% reduction in productivity was observed. Producers may choose to live with this reduction, either due to legislative or contract requirement to move animals out of stalls within a week of breeding, or because of personal preference. To achieve similar levels of piglet production, those using a Pre-implant grouping program would have to increase breedings by 5-6 sows per 100. Those that return would be bred again, likely 3-4 weeks later. The net effect on herd size would be less than 2%, although breeding labour and supplies would be up.

The Post-implant grouping treatment increased productivity slightly, particularly in older sows. In this case farrowing rate is similar to Stalls but live litter size seems to be increased. The same production as in Stalls, in terms of live piglets, could be achieved with 2% fewer sows. The Post-implant grouping management does involve an additional movement of sows if separate breeding and gestation stalls are used.

The Bottom Line

Additional production data are being collected through another two reproductive cycles. We are also assessing the level and nature of injuries at various times during gestation and lactation in all treatments. Cortisol concentrations following re-grouping and at several points during gestation are being determined to assess both acute and chronic stress. The social behaviour of animals during and subsequent to re-grouping is also being studied to identify animals at risk. Although all of these measures need to be considered before making an assessment of the animals' welfare, the production results thus far collected indicate that animals in ESF systems, particularly mature sows under a post-implantation grouping management program, can perform as well as (or slightly better) than those in stalls. Our experience has been that with any system it is necessary to identify problems and implement solutions.

Innovations in Barn Manure Handling

Karen Stewart, B.Sc.

Air quality has always been an important consideration in intensive livestock operations. Research on swine barn air quality has led to a number of improvements in the barn, but air quality can still be a challenge. There is also not a firm understanding of where the individual components in the contamination come from. In an effort to understand the sources of the air contamination in a swine barn, this study proposes to isolate the contributing factors (feed, manure, and the animals themselves), try to moderate and eliminate the effect of each on air quality, and study the effects of the clean environment on the health and productivity of animals and barn workers. The first tests study the contamination from the manure handling system.

> The idea is to design practical building and equipment systems that will optimise welfare of animals and health and safety of workers.

Manure is known to contribute to the bioaerosol levels in the building, and the decomposition of the manure (if it remains in the building for any length of time) adds more contamination.

Various methods of reducing the contamination from the manure have been explored and some methods have made improvements, but the best solution seems to be to remove the manure from the building as quickly as possible. Two systems will be tested in this study. The first uses a modification of a flushing gutter, which has been found to be effective in the past but has the disadvantage of using large quantities of water.

The other method uses a conveyer belt. Similar devices have been used under slatted flooring in swine barns and under poultry cages, and found to be effective at removing the manure. The belts have the advantage of separating the solid and liquid portions of the manure when used in swine buildings, resulting in a reduction of ammonia production.

Long and Short Term Objectives

The long-term goal of this research program is to develop practical building and equipment systems that will optimise the welfare of animals and the health and safety of barn workers. In particular, the air quality should not limit the potential for the growth rate and efficiency of the animal, and the barn workers should be able to work in the building without needing personal respiratory protection. In addition, large-scale livestock buildings should not have adverse effects on the external environment due to expelled airborne contaminants.

The general hypothesis of this program is that by starting with a clean area, the source of the air contamination in commercial swine housing can be quantified. The specific contribution of the feeding process, the manure handling system, and the presence of animals can be separated and measured. It is believed that experimental housing units can be designed where the individual processes produce no air contaminants.

Figure 1 Washing gutter used as a dunging area

Two "clean" rooms for pigs were designed and built to test several related hypotheses pertinent to air quality, animal performance, and worker health and safety. The specific objectives are to:

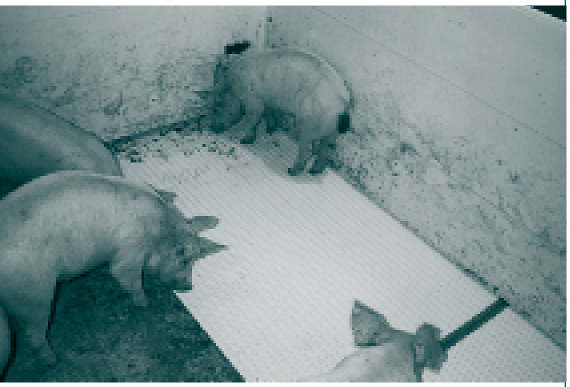
(a) design and test a system for manure removal that will eliminate the release of contaminants from the excreta into the pig space (pig space is used to refer to that portion of the building space where pigs spend most of their time either in rest or exercise).

(b) design and test a pig feeding system that will eliminate the release of contaminants from the feed into the pig space.

(c) combine the various features of the room as noted in (a) and (b) to quantify the rate of contaminant production and control the release of contaminants from the three individual sources (excreta, feed, and pigs) into the airspace and to characterise the bioaerosols from each source.

(d) test the hypothesis that pig productivity can be improved by radical improvements in the animal environment.

Figure 2 Conveyer belt used as a dunging area



Manure Handling Systems

Based on an extensive literature review, it is believed that a flushing gutter and a conveyer belt will minimise airborne contamination from the manure. Because they originate almost completely from the manure, ammonia and fecal coliforms are good indicators of the system's performance and will be measured for each trial.

Flushing gutters have been proven to be effective at timely removal of the manure (and thus the contamination from the manure) from swine buildings. One of the major disadvantages is the amount of water that is used in this system. One of the rooms will be equipped with a gutter that is washed by pressurised water jets at intervals to get the advantages of the flushing gutter while using less water than the traditional flush (Figure 1).

Conveyer belts have been used to transport manure, and to separate the liquid and solid portions of the manure, but no references were found that had used the conveyer belt without slatted flooring over it, which is what is in place for the other room. It is desired to get the advantages of the timely removal and the separation of the manure without the disadvantages of having a dirty floor above the belt (Figure 2).

Trials are being currently performed that have the manure systems run every half hour, every hour, and every two hours. Adjusting the manure handling system to produce a variety of levels of contamination in the room will allow future studies on health and productivity to be done with a range of air qualities.

The Bottom Line

Two rooms have been built at the Floral site of Prairie Swine Centre to be used as air quality labs in a study of air contamination in intensive swine units. Two manure handling systems are presently being tested in order to decide which manure handling system is better at reducing the airborne contamination from manure. This will be followed by studies on feed and feeders, to allow future testing of the effects of various air qualities on pigs and people in these rooms. Future designs of buildings and equipment can then concentrate on reducing the air contamination that is the most harmful to pigs and workers.

Personal Profile

Dr. Bernardo Predicala

Dr. Bernardo Predicala

Dr. Bernardo Predicala joined Prairie Swine Centre in April 2004 as Research Scientist in Engineering. Bernardo came to Saskatoon by way of Manhattan, Kansas, where he obtained his Ph.D. in Biological and Agricultural Engineering at Kansas State University in 2003. His dissertation work was on characterization and modeling of concentrations and emissions of particulate matter in swine buildings. After obtaining his degree, Bernardo continued on his postdoctoral training at the same university, working on a project funded by the U.S. Department of Agriculture that investigated methods to control dust emissions from animal feeding operations. At the same time, he was also involved with another project that dealt with particle transport and smoke reduction research for applications in urban operations, funded by the U.S. Department of Defense. Prior to coming to the U.S., Bernardo worked for four years researching ways to improve coffee quality through innovative post-harvest processing in Bangkok, Thailand, where he also obtained his M.Eng degree in Agricultural and Food Engineering. Bernardo is originally from the Philippines; he taught for four years at the University of the Philippines Los Baños, where he earned his B.Sc. in Agricultural Engineering.

His research at PSC deals with improvement in indoor air quality and reduction of odour and gaseous emissions from pig barns, as well as development of housing systems that optimize pig welfare and productivity. He feels very fortunate to come into a well-established engineering research program that is well-recognized and highly-supported by the swine industry. Currently, he is working on sustaining the program's research activities, with on-going projects dealing with control of gaseous emissions such as hydrogen sulfide and ammonia, and developing innovative building and equipment systems that could lessen or eliminate sources of air contamination in a swine barn. Presently, his priorities include getting to know the industry better, establishing working relations with existing and new collaborators and partners, as well as setting up new research activities in line with the program's and the Centre's strategic objectives.

Coming Events

Tri-Provincial Livestock Conference
October 5-7, 2004
Winnipeg, Manitoba

Prairie Swine Centre Directors' Lecture
October 25, 2004
Sheraton Cavalier Hotel
Saskatoon, Saskatchewan

Swine Technology Workshop
October 26-27, 2004
Red Deer, Alberta

Saskatchewan Pork Industry Symposium
November 16-18, 2004
Saskatoon Inn
Saskatoon, Sasaktchewan

Pork Interpretive Gallery Silent Auction
November 17, 2004
In conjunction with the Saskatchewan Pork Industry Symposium

Banff Pork Seminar
January 18-21, 2005
The Banff Centre
Banff, Alberta

PRAIRIE SWINE CENTRE INC.

Centred on Swine is a quarterly newsletter produced by Prairie Swine Centre Inc. (PSCI).

Subscription Rates (includes GST):

$32.00/1 year
$61.50/2 years

Please send your cheque or money order to:

Lee Whittington, Managing Editor
Prairie Swine Centre Inc.
P.O. Box 21057, 2105 - 8th St. E.
Saskatoon, SK S7H 5N9 Canada

Tel: (306) 667-PIGS (7447)
Fax: (306) 955-2510
www.prairieswine.ca

Prairie Swine Centre is an affiliate of