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What Does Being Sustainable Really Mean?

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Sustainability is back on the agenda and replacing Survival as the 'S' word our industry has concentrated on for the past decade.

Sustainability is a term that has become very familiar to us. Some of the original uses of the term were in the science of ecology and pertains to the interaction of organisms and their environment. In today's media, an example is reducing the effect of global warming to 2°C should provide a sustainable balance between our economic desire to produce carbon and the environment's capacity to adapt. Beyond ecology, the term has become synonymous with developing projects, businesses and communities and even whole countries to include not only ecology but economics, politics and culture where the goal is often sustainable growth.

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Geothermal Systems for Heating in Pork Production

Bernardo Predicala, Ph.D.

Previous studies showed that energy costs in swine operations range from about $7 to $12 per pig sold; this has steadily increased over recent years and now represents the third largest variable cost in hog production (after feed and labour). Maintaining desired conditions year round in production facilities requires significant amount of energy, particularly in cold climates. A survey of 28 swine farms in Saskatchewan showed that heating and ventilation costs constitute almost 80% of energy used in various types of swine barns. Compared with conventional heating systems using either gas, oil or electricity, a geothermal system utilizes ground heat to provide primary heating and cooling.

Computer simulation analysis was done to calculate the overall heating energy use in a production room operated under normal management practices; this served as the basis for designing the required capacity and the associated components of the geothermal system needed to meet the projected heating energy consumption.

The geothermal system, or alternatively known as ground source heating system was composed of a heat pump and 550 m of 1.9 cm diameter polyethylene pipes buried in 2.6 m to 3 m deep trenches on the ground outside the PSCI barn. The buried pipes contained 20% methanol - 80% water solution for absorbing heat from the ground for heating and for using the ground as heat sink during the cooling trial. A 5-ton heat pump which used R-410a refrigerant was installed in the geothermal room and its air-handling unit was connected to the room's air recirculation duct. A 22-kW forced convection heater was also installed in the room as back-up heater.

Energy consumption for heating and ventilation

Energy consumption for heating and ventilation comprised the total energy use in each room. Energy consumption for heating included both the electrical and heating fuel consumption of the geothermal heat pump and heaters and ventilation included the electrical consumption for both ventilation and recirculation fans. For the three heating cycles used in this analysis, the heaters needed to operate only during the first 3 to 6 weeks of the trial when the pigs were still small and the room temperature setpoint were the highest (i.e. supplemental heat from the heaters were required to maintain the setpoint temperature). On subsequent weeks of the room cycle, the heaters were only needed minimally with negligible energy usage because the heat generated by the pigs was sufficient to maintain the setpoint temperature in the room.

Table 1 shows the energy consumed by the geothermal and control rooms for heating and ventilation during the period when heaters were running. On average, the room with the conventional gas-fired heater (Control) consumed

Table 1. Energy consumption for heating and ventilation in the geothermal and control rooms over three heating trials

Trial	Heating		Ventilation	
	Geothermal, kWh electricity	Control, m^3 natural gas	Geothermal, kWh	Control, kWh
1	1232	226.5	476	426
2	705	201.2	194	199
3	1682	141.6	175	181
Average	1206 ± 489	189.8 ± 43.6	282 ± 169	268 ± 136

Table 2: Average air temperature (°C) and relative humidity (%) in the geothermal and control rooms when heaters were in operation.

	Temperature at center of room, °C		Temperature near the exhaust fans, °C		Relative Humidity, %	
Trial	Geothermal	Control	Geothermal	Control	Geothermal	Control
1	20.9	21.2	18.4	19.2	67.3	67.5
2	21.8	22.3	20.0	19.8	59.9	65.9
3	21.3	21.9	20.3	20.2	53.5	61.5
Average	21.3 ± 0.5	21.8 ± 0.6	19.6 ± 1.0	19.7 ± 0.5	60.2 ± 6.9	65.0 ± 3.1

a total 189.8 ± 43.6 m^3 of natural gas for heating. The room with the geothermal heating system did not use any natural gas but consumed a total of 1206 ± 489 kWh of electricity mainly to run the heat pump. On the other hand, the energy consumption for ventilation in the control room was about 268 ± 136 kWh of electricity while the geothermal room used about 282 ± 169 kWh of electricity to ventilate the room during the heating season.

Since the heating fuel consumption was expressed in terms of cubic metres (m^3) of natural gas while electrical consumption of heaters and fans was in kWh, the weekly average energy consumption data of the two rooms were converted to gigajoules (GJ) to be able to compare the two heating systems. Results showed that the weekly energy consumption for heating the geothermal room was significantly lower ($p<0.10$) than in the control room. Additionally, the two rooms did not differ significantly in average weekly energy consumption for ventilation. Thus, over one growth cycle, the geothermal heating system required less energy (5.36 GJ) to extract heat from the ground and to heat the room air compared to the conventional natural gas-fired heater (8.43 GJ); this is about 36% significant reduction ($p<0.10$) in total energy needed for heating and ventilation compared to the control room.

Temperature and relative humidity

Average air temperature at the center of the rooms as well as the temperature and relative humidity near the exhaust fans when heaters were in operation are presented in Table 2. Both rooms had almost the same room air temperature and relative humidity over the three heating trials. On average, the temperature at the center of the room with the geothermal heating system was about 21.3 ± 0.5 °C while the control room had 21.8 ± 0.6 °C. Furthermore, an average temperature of about 19.6 ± 1.0 °C and relative humidity of 60.2 ± 6.9 % were observed near the exhaust area of the geothermal room; these were about 4.8% less than the corresponding temperature and relative humidity in the control room, respectively.

Conclusion

Based on the findings of this study, the following conclusions can be made:

In-barn evaluation of the geothermal system showed about 36% reduction in energy consumption for heating and ventilation in the room with the geothermal system during the heating season relative to the room with the conventional forced-convection heater. The mean air temperature, relative humidity, and air quality within the two rooms were relatively similar during winter season.

(What Does Being Sustainable...Cont'd from pg. 1)

One way to look at sustainability is simply how well systems and processes can endure given the fluctuating physical, political, economic and social environments where we operate in 2016. This topic is important and timely and not just theoretical. Prairie Swine Centre (PSC) turns 25 years old this year. The original buildings and some of the key staff which migrated into the non-profit research corporation date back 35 years ago. So for a new concept in industry-science collaboration, I think Prairie Swine Centre could define SUSTAINABILITY as embracing change and staying ahead of the curve. In a technology-driven industry where our business is the development and distribution of knowledge change is all around us and benchmarking progress is done against a background that is multi-factorial and moving rapidly.

Cost of production will always be important, that is the fuel to sustain an industry. Our focus, expertise and search for new technologies are firmly rooted here. However there is a sea change in expectations taking place outside the pork value chain and affecting every component of it. A partial list of these sustainability issues includes:

- Antimicrobial use
- Transportation
- Care and welfare of our animals
- Environmental impact
- Greenhouse gases
- Aging barn infrastructure and replacement
- Accommodating larger animal groups and freedom of movement
- Access to qualified personnel
- Occupational health and safety
- Access to financing to accomplish changes in the above list

PSC as an organization is committed to providing accurate and timely knowledge to businesses in the pork industry across Canada. That knowledge is based on developing science, very often in partnerships with other researchers and institutions, and going wherever the path leads to identify what is needed. Over the course of this next year you can expect PSC to be making a contribution to addressing all of these sustainability topics above.

We are very pleased to see the personnel resources serving the industry are growing. A new faculty position has been created at the

(What Does Being Sustainable...Cont'd on pg. 9

Can Flaxseed Replace Antibiotics in Nursery Diets?


Laura Eastwood, Ph.D. Denise Beaulieu, Ph.D.

Results from work at Prairie Swine Centre have shown that when piglets are raised in a high health situation, the use of in feed antibiotics post-weaning had no benefit, regardless of weaning age. Additionally, weaning piglets at 3 weeks of age may be more beneficial to the producer if they are able to produce piglets with the same nursery exit weights relative to pigs weaned at 4 weeks.

Introduction

Weaning is a stressful time in a piglets' life. During this time, they are exposed to 3 major stressors (nutritional, environmental, and social). Combined, these can activate the immune response in the piglet, which in turn can have negative impacts on animal performance post weaning (low or no feed intake, reduced or negative growth rates).

In order to help combat the stress/immune response at the time of weaning, piglets are often fed a diet containing a low level of antibiotics (Ab). This helps the piglets cope with any potential secondary infections which may be contracted while their immune system is vulnerable. In April 2015, Health Canada announced that the use of in-feed antibiotics will be phased out over the next 3 years. Finding alternate strategies to help piglets cope at the time of weaning is important, and nutritional modulation for this purpose is a growing area of interest.

Flaxseed is a rich source of omega-3 (n-3) fatty acids (FA), which are known to have many different health benefits, including anti-inflammatory properties. Omega-3's can be easily transferred to piglets via the milk when sows are fed diets containing a good quality source (Eastwood, 2014). Additionally, changing the FA profile of sow diets by adding n-3's can impact the inflammatory responses of their offspring (Eastwood et al., 2012). Perhaps by improving the health of piglets prior to weaning, through nutritional modulation of the sow, we can remove Ab's in the nursery diets.

Materials and Methods

A total of 103 sows were used for this trial, 52 weaned at 4 weeks of age and 51 at 3 weeks of age. Within each weaning group, sows were fed one of two diets (control or n-3) throughout lactation. At the time of weaning, 10 piglets from each litter were selected, moved to the nursery and housed in 2 groups of 5 piglets each (2 nursery pens per litter). One half of the litter (1 pen) was fed a starter diet containing Ab's (LS20, 0.1%), and the other half received the same diet without Ab's. After one week, all piglets were switched to a common phase 2 diet for the remainder of the study. Prior to weaning, nurseries skipped a single wash cycle, to ensure that each weaning cohort was immunologically challenged. Regardless of weaning age, all piglets completed the trial at 56 days of age.

Piglet performance was determined in both the farrowing and nursery rooms. Sow milk was collected during mid-lactation to determine the FA profile of milk being consumed by piglets. Piglet health was monitored by collecting blood for complete blood cell count (CBC) and chemistry blood panels 2 days post weaning. A total of 1,181 piglets completed the lactation portion of the trial. Of those, 1,021 piglets were used for the nursery portion.

Results and Discussion

There were no dietary effects (± n-3 FA's) on sow feed intake, numbers of piglets born, piglet growth or on the number of piglets weaned per litter ($P > 0.10$). As expected, sows fed a diet with added n-3 FA's had significantly more n-3's in their milk relative to control sows (5:1 vs. 8:1 n-6:n-3 ratio).

In the nursery, there was no impact of sow diet on ADG, ADFI, G:F or final body weight for piglets weaned at 3 or 4 weeks of age ($P > 0.10$). For piglets weaned at 3 weeks of age, ADFI was 20 g/d higher during the 4th week in the nursery for piglets who received no Ab's in their phase 1 diet ($P=0.03$); however, ADG and G:F were not affected ($P > 0.10$). Feed intake was not affected during any of the other weeks on trial for these piglets. For piglets weaned at 4 weeks of age, ADG tended to be greater in piglets fed diets with Ab's for week 1 of the trial ($P = 0.05$), which also lead to improved G:F ratios during that week ($P = 0.04$). Growth and G:F were unaffected by the

Pigs raised in a clean, high health facility do not require antibiotics into Phase 1 diets post-weaning.

Table 1: Reproductive performance of sows fed diets with or without n-3 FA's and weaned at 3 or 4 weeks of age

	Sow Lactation Diets		Statistics	
	Control (- n-3)	Omega (+ n-3)	SEM	P Value
3 Week Wean[1]				
Parity	2.50	2.20	0.394	0.560
Lactation length, d	19.35	19.36	0.368	0.979
ADFI, kg/d	6.01	5.81	0.262	0.589
Born alive, n	14.81	14.72	0.662	0.925
Born total, n	15.62	15.92	0.666	0.746
Weaned, n	11.15	11.24	0.310	0.844
Total litter gain, kg	54.17	52.89	2.255	0.685
Piglet ADG, kg/d	0.25	0.24	0.007	0.468
4 Week Wean[1]				
Parity	2.11	2.12	0.279	0.982
Lactation length, d	26.22	26.56	0.393	0.538
ADFI, kg/d	7.55	7.66	0.249	0.747
Born alive, n	14.70	14.64	0.576	0.937
Born total, n	15.96	16.12	0.670	0.867
Weaned, n	11.56	11.88	0.267	0.386
Total litter gain, kg	77.21	77.94	2.151	0.795
Piglet ADG, kg/d	0.26	0.25	0.006	0.402

[1]Litters were standardized to ~12 pigs each within the first 24 hr post-farrowing

inclusion of Ab's from weeks 2 to 4 in the nursery. Feed intake tended to be higher in Ab fed piglets during week 3 ($P = 0.08$), and was significantly higher in week 4 ($P = 0.03$) relative to piglets who received no Ab's in the first week post-weaning (930 g/d vs. 900 g/d); however this did not impact G:F. We observed no dietary effects (sow diet or nursery diet) on the final body weight of piglets at nursery exit; however, regardless of dietary treatment, piglets weaned at 3 weeks of age were ~1.5 kg heavier than those weaned at 4 weeks ($P < 0.05$).

No effects were found in sow or phase 1 diet on any of the blood measures taken when piglets were weaned at 3 weeks of age. When piglets were weaned at 4 weeks of age, piglets weaned from sows fed diets containing n-3 FA's had lower white blood cell counts relative to those weaned from sows fed the control diet ($P < 0.05$). White cell counts were unaffected by phase 1 diet, and neither sow nor phase 1 diet affected any of the other blood parameters measured.

Regardless of diet, piglets weaned at 3 weeks of age had lower creatine kinase (CK), aspartate aminotransferase (AST) and white blood cell (WBC) counts relative to those weaned at 4 weeks. CK and AST are enzymes involved in muscle catabolism.

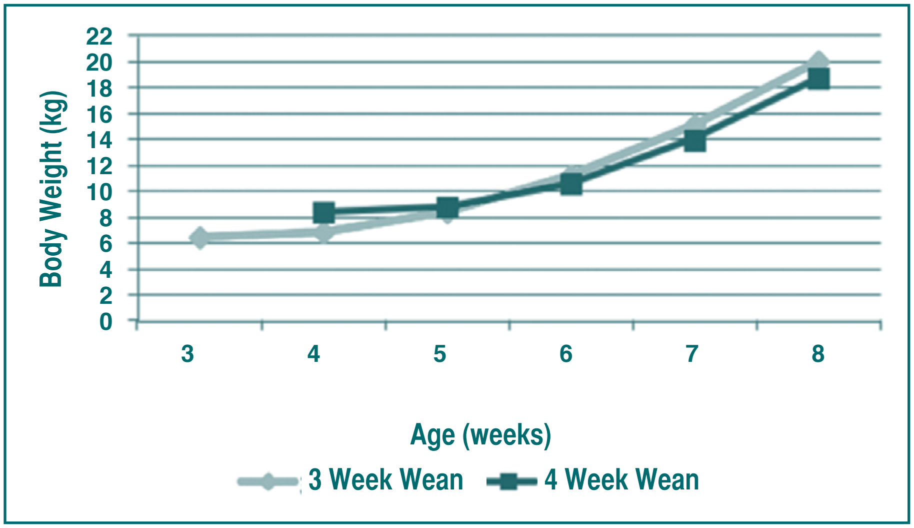

Figure 1: Average body weight of piglets weaned at 3 or 4 weeks of age during the nursery phase of the experiment

Conclusion

Results from this trial clearly showed that in a high health situation, the use of in feed Ab's post-weaning had no benefit, regardless of weaning age. This experiment has also shown that, at nursery exit (8 weeks old), piglets weaned at 3 weeks of age had heavier body weights than those weaned at 4 weeks of age, which in part may be due to the fact that piglets weaned at 3 weeks had lower WBC, CK and AST counts relative to those weaned at 4 weeks.

Managing Sows in Groups from Weaning: Are there Advantages?

Yolande Seddon, Ph.D. Jennifer Brown Ph.D.

As farmers in many parts of the world adapt to meeting requirements for housing gestating sows in groups, pressure continues to reduce stall use. In most cases, stall use is permitted during breeding and for the first 4 to 5 weeks of gestation. Will further limitations on stall use impact sow fertility and production, or are there advantages to be gained from managing sows in loose housing from weaning?

Stall housing has received ongoing criticism for being behaviourally and physically restrictive. Scientific research has demonstrated that sows housed in groups can perform as well those in stalls, this combined with increasing consumer and retailer pressure to limit use of confinement systems has led to the banning of gestation stalls in many parts of the world.

The majority of requirements for group housing requires sows in groups from five weeks gestation. Housing sows in breeding stalls after weaning until confirmation of pregnancy at around 28 days post breeding is permitted for producers to manage individual feed intake of sows and eliminate mixing aggression disrupting critical periods during estrous and embryo implantation. However, pressure may continue for the total elimination of close confinement and thus not housing sows in stalls for any period of gestation. Already, a number of EU members require reduced stall use, with the Netherlands requiring sows to be out of stalls from five days post-insemination. Grouping sows post-insemination works well, providing the aggression at mixing is not acute and does not occur during embryo implantation. Producing totally stall-free pork would require a different approach to sow management around breeding, and it has its potential benefits and risks. Mixing sows at weaning will prevent any stress influencing sow conception rate, but we need to consider how mixing aggression may disrupt onset of estrus in sows. Conversely, there is research to suggest that the mixing stress could stimulate a quicker return to estrus in sows, and through allowing sows to display group estrus behaviour, there is the potential to have a better synchronization of estrus in a breeding group. Management options need to be researched to determine what is best for the sow, her welfare and productivity, and in turn whether there are any advantages to be gained.

Is grouping sows at weaning viable?

A study was conducted at the Prairie Swine Centre (PSC), in collaboration with Yuzhi Li from the University of Minnesota, to investigate the effects of mixing sows at weaning, in comparison to when sows are mixed at five weeks gestation, to evaluate effects on sow aggression, welfare and productivity. Three treatments were compared:

1) Early Mixing (EM): Sows mixed into groups directly from weaning
2) Late Mixing (LM): Sows stall housed at weaning and mixed at five weeks gestation
3) Pre-socialisation (PS): Sows mixed for two days after weaning, then continually stall housed for breeding and up to five weeks gestation, after which sows were mixed back to groups (same groups).

The PS provided an intermediate treatment to examine if early formation of the social group would reduce the aggression in the second mixing.

Table 1. Production characteristics of sows in three mixing treatments: Early Mixing (EM); Pre-Socialization (PS); and Late Mixing (LM).

	Treatments			
Variable	*EM*	*PS*	*LM*	*P*
Conception rate (%)	*98*	*94*	*87*	*<0.05*
Wean to Service Interval (days)	*4.06*	*4.51*	*4.31*	*NS*
Total born	*15.16*	*15.63*	*15.47*	*NS*
Born Alive	*13.66*	*13.27*	*13.18*	*NS*
Still born	*0.95a*	*1.54b*	*1.58b*	*<0.005*
Mummies	*0.47*	*0.44*	*0.53*	*NS*

NS = not significant

For all treatments, sows were housed in fully slatted group pens from weaning, with the free-access stalls used to house sows during feeding, heat checks and breeding. When the treatment required sows loose in a group, sows were fed each morning in the free-access stalls, after which they were locked out of the stalls, ensuring sows socialized for up to 22 hours per day in the communal loafing area. Where treatments required sows in stalls, sows were locked in the free-access stalls.

Sow aggression, welfare and reproductive performance (wean-to-service interval, conception rate, and farrowing performance) were measured, along with salivary cortisol as a physiological measure of stress. Additionally, estrus behavior was measured in the EM groups, to determine if keeping sows loose from weaning can help to stimulate group estrus behaviour.

Results: Each system can work!

Aggressive interactions observed in the two days post mixing, were no different between treatments, and the overall levels of aggression were low. Similarly, no differences were found between sow cortisol levels and lameness. Skin injury scores were lower in PS sows compared to EM and LM sows after the first mixing. When remixed, sows in the PS treatment had significant increase in injuries than following the first mixing. However, injury scores on all sows were very low. This data suggests sow welfare was not significantly affected by the mixing treatments.

Loose in a group from weaning, and despite being on a slatted floor, expression of estrus behaviour was observed in EM groups of sows with increased frequency from days 3 to 4 post weaning. The average percentage of the pen group involved in estrus behaviour increased from 30% to 48% from days 3 to 4.

> Under good conditions of management, grouping sows at weaning does not negatively impact sow performance or welfare.

Sows managed with EM had the highest conception rate, the LM the lowest, and the PS treatment in between (Table 1). It is not clear why the LM treatment, which is the standard practice for managing sows around breeding and early gestation had the lowest conception in this trial. It may reflect comparatively sub-optimal stimulation of estrus in the stall housing, compared to in the EM and PS groups, which received mixing stress immediately at weaning. There is evidence that correct timing of stress post weaning can bring on estrus, and thus may have stimulated follicular growth and clearer estrus expression.

The EM treatment showed a significant reduction in the number of stillborn piglets. This appears to indicate a beneficial effect of allowing sows free movement during the early stages of pregnancy. This may be an effect of improved sow fitness, or may have links to an effect of sow movement on embryo placement along the uterine horns, and subsequent placental attachment, of which research in humans has shown to be influenced by maternal activity.

What can be concluded?

There may be production advantages to mixing sows into groups at weaning, as indicated by improved conception rates and reduced stillborns, as found in this trial, and these effects should be explored further. The same results may not be true in a group feeding system in which sows have to cope with a higher levels of competition, such as a heavily stocked ESF pens, or if they cannot access their daily requirement for food, as is a risk with competitive feeding systems (e.g. floor feeding). While no effect on sow lameness was found in this trial, pens in which sows are mixed should have very good quality flooring to reduce injury, and is a requirement if expression of estrus behaviour is to be encouraged. In conclusion, grouping sows at weaning is a viable option under the correct conditions of management. With forethought on the pressure to reduce stall use, some producers changing to group housing may wish to consider design considerations to allow sows to be managed in groups from weaning.

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Using Exploratory Behaviour to Increase Pre-Weaning Creep Consumption

Jennifer Brown Ph.D. *Yolande Seddon, Ph.D.*

Work at Prairie Swine Centre investigated whether feed consumption before and after weaning can be increased through stimulating exploratory behaviour in piglets, and whether this is best achieved through provision of enrichment (E), or through presentation of creep feed in a large tray feeder (TF) so as to facilitate synchronized feeding among littermates.

Enrichment consisted of cotton ropes hung in the farrowing pen. Piglets provided with enrichment were observed to contact the enrichment on average 11 times per day. Feeder type, but not enrichment, resulted in a greater frequency of piglet visits to the feeder on day 12 with more piglets using the tray feeder. On day 26 there was a tendency for a greater frequency of visits to the tray feeder. Litters supplied with a tray feeder also had a greater daily creep disappearance with no effect of enrichment. However, litters provided with the Standard Feeder (SF) had a greater piglet birth to wean average daily gain. Provision of a larger feeder that encourages social feeding, appears to have a greater influence on attracting piglets to creep feed. The increased creep disappearance and more frequent feeder visits in the tray feeder treatment indicate that this treatment may be effective at improving feed consumption and reduce weaning stress.

Introduction

Piglet weaning is a stressful experience, as shown by high levels of aggression, weight loss and increased salivary cortisol concentrations. Inadequate food intake in the first two days after weaning, in combination with the stress of weaning, has been shown to decrease piglet performance, resulting in increased disease susceptibility and mortality through changes in metabolic and immune systems. Promoting feed intake in piglets before weaning by providing creep feed familiarizes piglets with solid food, and has been shown to increase feed intake and improve growth rate in the critical two days post-weaning. Pre-weaning creep feed consumption by piglets has also been shown to correlate with increased weight gain in the week prior to weaning in addition to improving post-weaning performance. However, the overall consumption of creep by a litter can be low (with only 10-50% of piglets eating creep feed), and varies greatly among littermates. Considering this, the provision of creep does not generate the desired effect for producers, resulting in higher production costs without significant benefits.

It is important to identify convenient, effective and economical ways to increase the quantity and consistency of creep feed consumption by piglets within litters. Previous research has determined that the amount of creep consumed by piglets can be increased through provision of a specially designed feeder that encourages exploratory interaction around the feeder. It is known that piglets born outdoors are quick to consume starter feed and are often ingesting soil and plant material before weaning while exploring their environment. However, piglets born into indoor farrowing pens do not have the same opportunity for exploration in standard practice. This study builds upon current knowledge to investigate the effect of increasing the exploratory behaviour of piglets through provision of environmental enrichment in the farrowing pen and nursery. If simple enrichment can increase creep feed consumption in piglets this could transfer to piglets consuming starter feed earlier and having less of a growth check in the immediate post-weaning period.

Table 1. Average total frequency of visits made to the creep over 8 hours (8am – 4pm) when presented in a Standard Feeder (SF) or Tray feeder (TF).

Day	*Feeder type*		*Pooled SEM*	*P*
	SF	*TF*		
12	*1.3*	*6.0*	*1.2*	*<0.06*
19	*3.8*	*15.0*	*3.6*	*0.052*
26	*5.3*	*16.4*	*4.1*	*0.086*

Table 2. Growth rate (ADG, kg) per piglet across treatments.

Treatment	*Standard Feeder*	*Standard Enrichment*	*Tray Feeder*	*Tray Feeder + Enrichment*	*Pooled SEM*	*P*
Birth to Wean (Day 0 to 28)	*0.26*	*0.23*	*0.21*	*0.22*	*0.014*	*NS*
Wean to day 42	*0.22*	*0.16*	*0.24*	*0.25*	*0.03*	*NS*
ADG day 1 nursery	*-0.04ac*	*-0.22c*	*0.16ab*	*0.18ab*	*0.11*	*0.06*
ADG day 35	*0.22*	*0.23*	*0.16*	*0.16*	*0.02*	*NS*
ADG day 42	*0.35*	*0.34*	*0.34*	*0.38*	*0.02*	*NS*

Specific objectives of this project were to determine:

1) If providing enrichment, and/or a large shallow tray feeder in the **farrowing crate** results in increased exploration of creep feeders or increased creep feed consumption by the piglets, and any improvements in pre-weaning growth rate.
2) If the provision of enrichment in the **nursery** and having a larger tray feeder in the farrowing room results in increased consumption or any improvements in piglet growth during the first 2 weeks in nursery.

T1: Creep provided in a standard feeder
T2: Creep provided in standard feeder, with cotton rope as pen enrichment (SFE);
T3: Creep provided in a large tray feeder (9" x 13") (TF);
T4: Creep provided in tray feeder with enrichment provided

Creep feed was offered to all litters from 10 days after birth until weaning at 28 days. Strips of cotton rope were attached in two locations in the farrowing crate (front and back) for the enrichment treatment, from 5 days after birth until weaning. Piglets were weighed on days 0 (birth), 3, 7, 10 17, the day of weaning (day 26), day 35, and 42 in the nursery. Creep consumption was calculated weekly by total weight per litter. Behaviour was recorded on four litters per treatment for 8 hours (8am to 4pm), on days 12, 19, and 26. The frequency and the average number of piglets observed at the feeder or enrichment was calculated on each observation day. Average daily gain and creep consumption were calculated.

Results and Discussion

Piglet behavior

Piglets interacted with the enrichment, on average 11 visits per day in the farrowing crate. However, provision of a tray feeder, rather than enrichment resulted in a greater frequency of piglet visits to the creep (Table 1). This continued from day 12, with a tendency for a greater number of visits to the feeder on days 19 and 28 pre-weaning. There was a tendency for a greater number of piglets per visit at the tray feeder on day 12 pre-weaning, but no differences thereafter among the treatments.

Creep intake and growth rate

Rope enrichment had no effect on the creep disappearance or average daily gain in the pre-weaning period. Litters supplied with the TF had greater daily creep disappearance (In g/pig/day: SF: 5.4; TF: 13.2, SEM 1.33, $P<0.001$), with no effect of enrichment. No treatment differences in average daily gain values were observed between day 0 and 28, and day 28 to 42. Pre-weaning growth rate did not differ across treatments, however, piglets using a TF pre-weaning, showed no weight loss in the first days post weaning. On day 29 (day after weaning), T2 piglets had a significantly greater growth check within the first 24 hours of moving into the nursery, while the ADG of piglets in T1, T3 and T4 did not differ (Table 2).

The provision of enrichment in the farrowing pen elicited exploratory behaviour in the piglets, as demonstrated through rope interactions. However, provision of a larger feeder that could encourage social feeding and rooting appears to have a greater influence on attracting piglets to creep feed. This was demonstrated by the increased frequency of visits to the feeder when litters were provided with tray feeders. This feeder was a rectangular shape, allowing more piglets to investigate the feeder simultaneously. Pigs are social feeders, and will synchronize feeding. The accessibility of the tray feeder may help facilitate this behaviour. The increased creep disappearance found in the tray feeder suggests piglets were interacting with the creep.

In the period immediately following weaning, piglets using the tray feeder performed better, having no negative growth check, and maintained a positive average daily gain compared to piglets that had been given standard feeders. There was no effect of enrichment on the piglet performance post weaning. Piglets that received the standard feeder and rope enrichment had a significantly greater growth check at day 29 post-weaning than did piglets provided with the tray feeder, with or without enrichment.

Conclusion

A large tray feeder that encourages social feeding and foraging is more effective at attracting piglets to creep than a standard feeder, or the provision of rope enrichment. Providing a tray feeder before weaning also had a positive effect on piglet growth immediately after weaning. Growth benefits may have arisen from piglets more readily taking to solid feed post weaning, having had increased exploration of solid feed pre-weaning. These results are favorable for producers as a reduced growth check post weaning could also mean that piglets are better prepared for immune challenges and other stressors associated with weaning.

(What Does Being Sustainable...Cont'd from pg. 1)

Western College of Veterinary Medicine, and our Dr. Yolande Seddon, Research Associate in Ethology, was the successful candidate. Yolande will be moving her office to WCVM and working with PSC and the College to build the National Chair in Swine Welfare. This collaboration makes it possible to bring many new resources, including program eligibility to matching the over $800,000 to date in new pork industry support research to address the changing landscape in animal care.

In March Dr. Denise Beaulieu will move to the position of Monogastric Nutritionist at the University of Saskatchewan, College of Agriculture. After 14 years with PSC, Denise has become a recognized resource in swine nutrition, especially in the area of sow and piglet nutrition. Denise will continue her contribution as an active researcher and a regular contributor to this and other PSC publications but will assume a much greater role for teaching undergraduate and graduate students.

We are pleased that PSC has provided an environment for attracting and allowing researchers to grow and compete for internationally advertised positions. These scientists 'cut their teeth' in the commercial pig industry in Canada through the readers of this publication. We thank all our funders and supporters for nurturing young professionals to build a career that can be stimulating, rewarding and makes a difference. Perhaps the best case that can be made for sustainability is the continual development of people who seek SUSTAINABILITY as embracing change and staying ahead of the curve.

Compounding Iron Dextran with NSAIDs at processing

Ron Johnson, DVM.
Ontario Veterinary College

The objective of this project was to evaluate whether the mixing (compounding) of NSAIDs (anti-inflammatory/analgesic agents), such as meloxicam or flunixin meglumine, with iron dextran for administration to piglets at the time of processing has any effects on the availability of the NSAID. In a series of experiments, we evaluated the stability and systemic availability of both NSAIDs when mixed with iron dextran in the same bottle for administration to piglets at the time of processing. We also evaluated the effects of this practice on iron dextran's ability to increase piglet hemoglobin concentrations. We found that the amount of NSAID recovered from the bottle was reduced beginning shortly after mixing. We also found that blood drug levels measured in piglets for each NSAID when compounded with iron dextran was significantly lower than when each NSAID was administered alone to piglets. We did not find any significant effects of mixing NSAIDs with iron dextran on iron dextran's ability to increase hemoglobin following administration to piglets. The overall conclusion from these experiments is that the mixing of NSAIDs with iron dextran in the same bottle for administration to piglets at the time of processing results in a suspected drug interaction that reduces the shelf-life of the formulation and the amount of NSAID available for therapeutic effects.

Introduction

When NSAIDs (anti-inflammatory/analgesic agents) such as meloxicam or flunixin meglumine are administered to piglets at the time of processing, it is tempting to mix or compound the NSAID with iron dextran to be delivered in a single injection, thereby reducing the number of injections to the piglet. Technically the practice of mixing two different products in the same syringe/bottle is not allowed under the Canadian Quality Assurance program, nor is the compounding of drugs for food animal use acceptable to the Canadian Global Food Animal Residue Avoidance Databank, but we are aware that this practice does occur and therefore it seems prudent to evaluate possible drug interactions that could affect the absorption and availability of either the NSAID or iron. The study was carried out using three separate experiments and performed at the University of Guelph, with the following objectives i) to evaluate the bioavailability of meloxicam (Metacam® 20 mg/mL Solution for Injection, Boehringer Ingelheim Canada LTD) and flunixin meglumine (Banamine®, Merck Animal Health) when compounded with iron dextran (Dexafer-200®, Vetoquinol) and administered to newborn piglets of approximately 5 days of age, ii) to evaluate the effect of compounding these agents on iron dextran's ability to increase piglet hemoglobin concentrations, and iii) to evaluate the storage life by measuring concentrations of the NSAIDs at various times after mixing with iron dextran.

Results and Discussion

Measurement of recoverable flunixin meglumine and meloxicam when compounded in iron dextran was accomplished using high performance liquid chromatography. Our results showed that recoverable levels of either NSAID were reduced, beginning as early as 2 hours post-mixing, and with over 30% reduction in recoverable flunixin meglumine concentrations and over 10% reduction in meloxicam concentrations by 24 hours post-mixing. These findings suggested a probable drug interaction that could result in reduced NSAID being available for systemic absorption when administered to piglets. In the first of our two live animal experiments, we found no significant effects of compounding either NSAID with iron dextran on measured blood hemoglobin levels, indicating no significant effects on the iron status of the pig. The results of our bioavailability study (n= 8 piglets per group) comparing blood NSAID levels for flunixin meglumine and meloxicam when administered to piglets alone versus compounded in iron dextran did show notable findings. Piglets receiving flunixin meglumine were dosed intramuscularly at 2.2 mg/kg either as the NSAID alone or when compounded with iron dextran. Piglets receiving meloxicam were also dosed intramuscularly at 0.4 mg/kg as the NSAID alone or when compounded with iron dextran. Multiple blood samples collected shortly after dosing to 72 hours post-dosing were analyzed for meloxicam or flunixin meglumine using validated mass spectroscopy methods. Results showed significantly reduced concentrations of both NSAIDs when compounded with iron dextran compared to levels noted when NSAID was given alone rendering the compounding of NSAIDs with iron dextran not bioequivalent to NSAIDs administered alone.

Conclusion

The results of our study show that the mixing of meloxicam or flunixin meglumine with iron dextran likely produces a drug interaction, which does not appear to affect iron dextran's ability to maintain adequate hemoglobin concentrations, but does reduce the availability of the NSAID for absorption into the systemic circulation. The Clinical ramifications of the reduced blood NSAID levels when compounding with iron dextran require additional efficacy studies to evaluate whether adequate analgesia is being provided at the current NSAID concentrations in the compounded formulation. Importantly, if flunixin meglumine or meloxicam is mixed with iron dextran for administration to piglets at the time of castration and processing the compounded product needs to be used right away.

Managing Winter Ventilation

I was asked to write an article on how does Prairie Swine Centre prepare for winter ventilation. In thinking about this, I came to the realization that we really do nothing different than at any other time of the year assuring that proper ventilation parameters are being monitored in all rooms on site and that daily maintenance and repair is performed. One small difference when it comes to winter ventilation, is that for a period of time, in late fall and also in early spring, staff need to be more vigilant on a day to day basis to ensure room temperature fluctuations are kept to a minimum. This usually means daily vigilance monitoring first and second stage ventilation fans and either installing or removing fan covers until the temperature stabilizes late fall and late spring.

I have found that it was very beneficial to set up routing procedures for production technicians in all areas of the operation. Staff work with laminated "daily" work schedules for each day of the week that dictate what they are required to do, depending on that day. We have one work sheet for grow-finish technicians and as well, sheet for breeding/gestation/lactation and nursery staff. There is also room for "other" jobs that we all know comes up and staff or I will add this to the list for that day. Jobs are checked off when completed. Minor maintenance and repairs on grow-finish equipment is daily, by technicians from 10:30-11:00. Major maintenance is scheduled for production technicians to assist our maintenance man, if required, Thursday afternoon from 12:30 to 4:00.

What these sheets do is ensure that every single day staff is reminded of priority job functions that have to be dealt with. If someone is sick, the staff person moving into this position has a record of all job functions completed so far this week and what his priorities are today, with little instruction required.

Daily technician responsibilities:

- Room checks which involve monitoring the controller to see if fan's, heaters, and inlets are doing what the controller is indicating. This is the responsibilities of technicians in all rooms where animals are housed.
- If there are major problems the manager is notified and a request is put into maintenance for immediate repair. Technicians will deal with minor issues that same day.

Weekly technician responsibilities:

- Every Monday morning set point temperatures are changed depending on the room and the average weight of the animal particularly in nursery and grow finish. Set point temperature indicator sheets are kept on a bulletin board by each room. The appropriate time sheet is used in grow-finish vs nursery room set points for fall-winter and spring-summer ventilation.
- Farrowing rooms are set up with a standard curve that is initiated when the majority of sows have farrowed in that particular room.

Seasonal technician and maintenance responsibilities:

- As Manger I will determine temperature room changes in breeding, gestation, and gilt-development and these rooms are changed seasonally.
- As part of our maintenance program all second and third stage fans, louvers and covers in non all-in-all-out rooms are washed late fall so that they are clean when they are shut down for the winter.
- All heaters are blown out in the fall as a regular maintenance procedure.
- Appropriate fresh air inlets to the attics in all barns are closed late fall and again opened in the spring.

Personal Profiles

Dan Columbus

Dan Columbus joined the Prairie Swine Centre in June 2015 as a Research Associate in Nutrition.

Originally from Sarnia, Ontario, Dan completed his undergraduate degree from the University of Guelph in Animal Biology in 2004. Dan went on to complete his graduate training at Guelph under the mentorship of Kees de Lange. His M.Sc. research focused on the use of liquid feeding technology and phytase to improve availability of phosphorus in high-moisture corn based diets for newly-weaned pigs. His doctoral studies, completed in 2012, examined the impact of dietary ingredients on availability of amino acids and nitrogen and the efficiency of utilization of non-protein nitrogen sources, such as ammonia and urea, for growth.

After completing his graduate training, Dan moved to Houston, Texas to complete post-doctoral training at the USDA/ARS Children's Nutrition Research Centre, Baylor College of Medicine where his research focused on examining nutrient regulation of muscle growth and development of nutritional therapies to improve growth of low-birth weight infants, using the pig as a model for the human infant.

Dan's current research focuses on grower-finisher nutrition and on development of research studies utilizing the pig as a model for human nutrition and health. The goal of this research program is to develop feeding programs which emphasize economic efficiency, meat quality, and market value and reduce the environmental footprint of pork production through increased nutrient utilization efficiency.

Coming Events

Manitoba Swine Seminar
February 3-4, 2016
Victoria Inn
Winnipeg, Manitoba

Cramer Livestock Nutrition Expo
February 18, 2016
Kinetic Park
Swift Current, Saskatchewan

World Pork Expo
June 8-10, 2016
Des Moines, Iowa

Alberta Pork Congress
June 15-16, 2016
The Westerner
Red Deer, Alberta

Ontario Pork Congress
June 22-23, 206
Stratford, Ontario

"This would be one of the reasons we do all five stages of cleaning inside during winter."

But Seriously Folks...

Weather and seasonal temperatures can often make it challenging to follow biosecurity proceedures. Protocols should be made to ensure biosecurity and herd health can be maintained year round.

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