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SWINE
The Newsletter of Prairie Swine Centre Inc.

In This Edition

Summer 2002 Volume 9, Number 2

Optimizing the Production System

Ken Engele, BSA. P. Ag.,

PSC Elstow Farm Manager, Troy Donauer explaining the Practical Considerations for Group Housing of Sows

Three years ago, the industry asked us to provide a high-level technical conference (rotating between the prairie provinces) where they could have access to the scientists conducting the research. The result was the Focus on the Future Conference. The third annual Focus on the Future conference was recently held in Winnipeg, Manitoba on February 19-20, 2002, attracting over 130 people for the two-day event. People in attendance listened to leading-edge ideas in the areas of: PRRS eradication, in-barn management issues related to breeding herd productivity, nursery performance, sow housing, impact of water quality and environmental controls.

This year's hot topic was Dr. Harold Gonyou's presentation on the group housing of animals. Dr. Gonyou examined two aspects of group housing (1) specific to group size in grower-finisher pigs (2) group sow housing at Prairie Swine Centre.

Dr. Gonyou began by outlining why there is increased interest in large group sizes of grower-finisher pigs, and some of the concerns in implementing these large groups. Dr. Gonyou went further to explain the theories on social behaviour in large groups, and reported some preliminary research results on the level of aggression, social structure, and growth potential of pigs housed in large groups. The presentation was concluded by a brief, but detailed assessment of the group sow housing at PSCI. Dr. Gonyou identified some of the advantages, disadvantages and management issues associated with group sow housing relative to stalls, as well further research that is currently underway.

A related presentation that generated a great deal of interest was Practical Considerations for Group Housing of Sows (Troy Donauer, PSC Elstow Research Farm). Mr. Donauer covered the what's involved with the day-to-day operation with this type of system; as well some of the challenges that the staff faced during start up.

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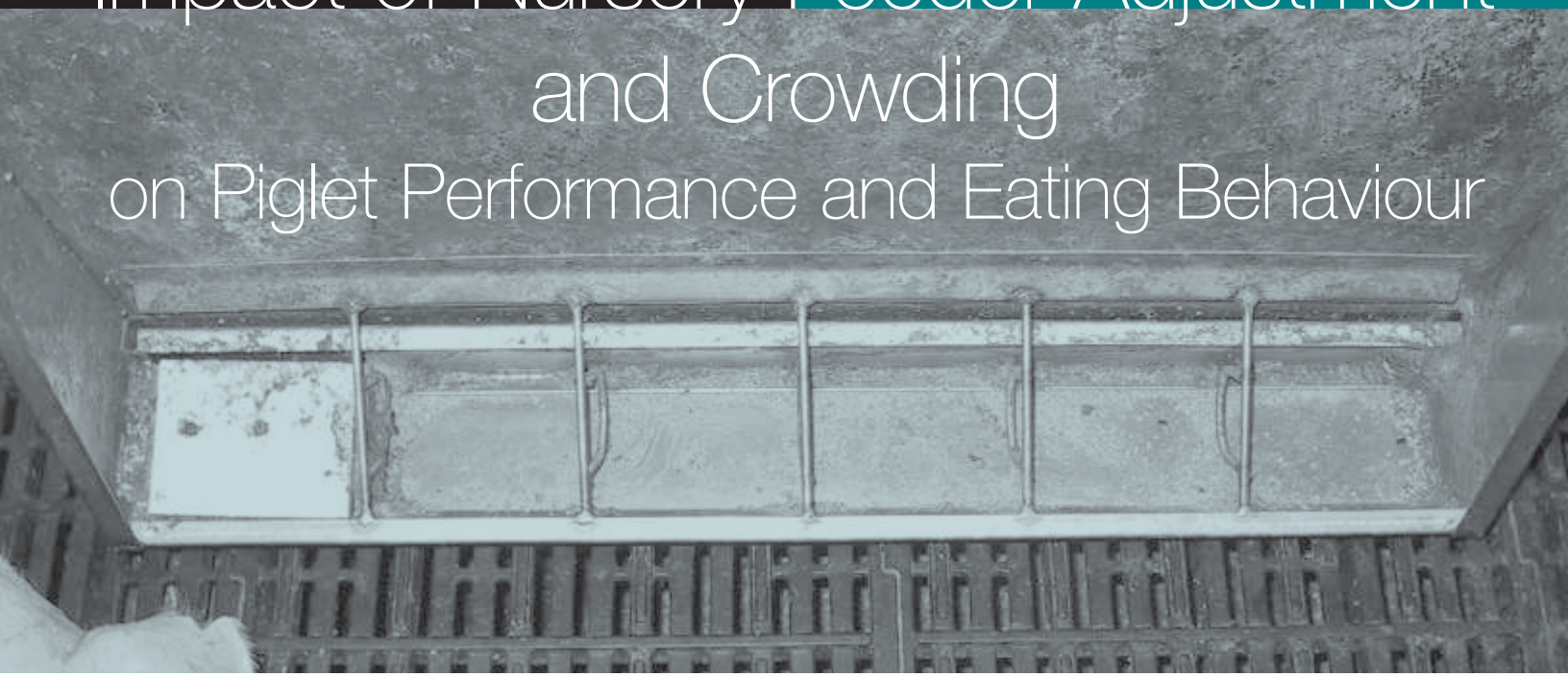
Saskatchewan Agriculture, Food and Rural Revitalization

Impact of Nursery Feeder Adjustment and Crowding on Piglet Performance and Eating Behaviour



L. Smith, J.F. Patience, Ph. D., H.W. Gonyou, Ph. D., A.D. Beaulieu, Ph. D. and R.D. Boyd, Ph. D.

It is widely accepted that increasing nursery exit weights will increase weights at marketing, in a time-based growout system, or reduce days to market, in a weight-based growout system. For example, previous research at the Prairie Swine Centre revealed that weights at 20 weeks of age increased by 2 kg for every 1 kg increase in nursery exit weights. As a consequence, more attention is being paid to nursery performance, to ensure that overall pig performance is optimized.

Feed access and stocking density are two factors that can affect the performance and eating behaviour of young pigs. Surprisingly, there is disagreement on the proper adjustment of nursery feeders. Some people recommend a full feeder trough, as a means of maximizing feed intake; others recommend a tighter adjustment, with only a bead of feed in the trough, to minimize feed wastage and thus minimize feed expenses.

To address this question, an experiment involving 716 pigs running from four to ten weeks of age was conducted at PSC Elstow Research Farm. Three different floor space allowances were also compared to determine if crowding would affect the response of pigs to different feeder adjustments.

The Staco® dry feeders were adjusted to five different gaps to achieve a wide range of feed access. Gap widths ranged from 9 to 32 mm, providing feed trough coverage from 6% to 92%.

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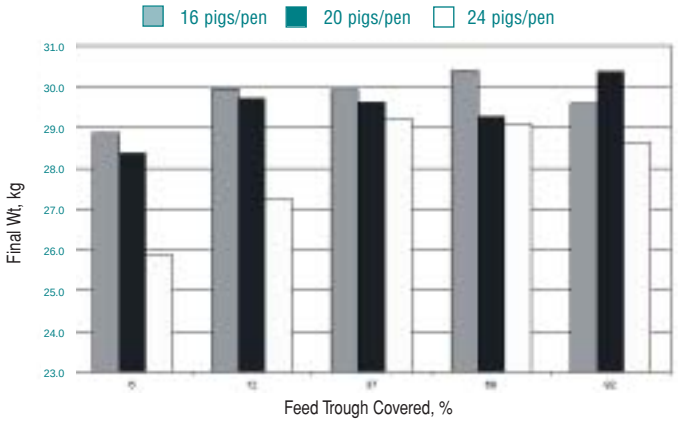
Figure 1

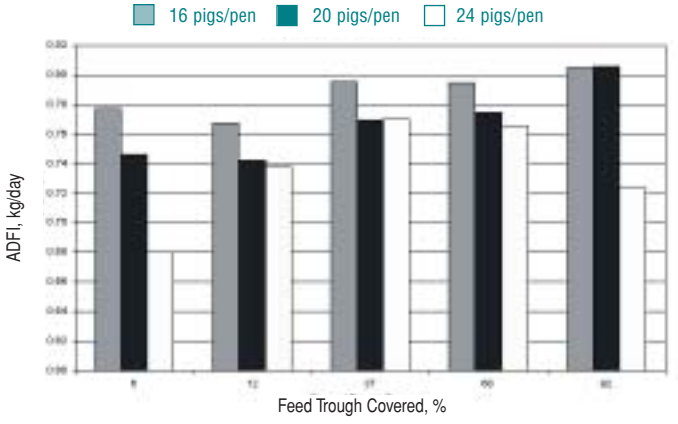
Impact of Feeder Adjustment and Group Size/Density on Final Weight of Pigs



The interaction of percent trough covered and pigs per pen is significant, P<0.05

Figure 2

Impact of Feeder Adjustment and Crowding on Avereage Daily Feed Intake



The interaction of percent trough covered and pigs per pen is significant, P<0.05

Figure 3

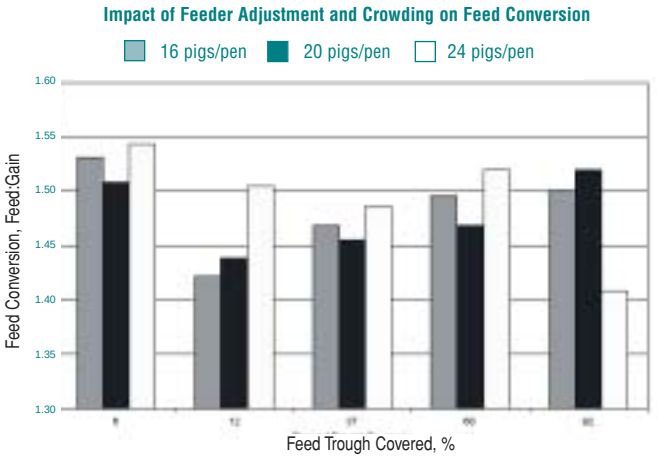
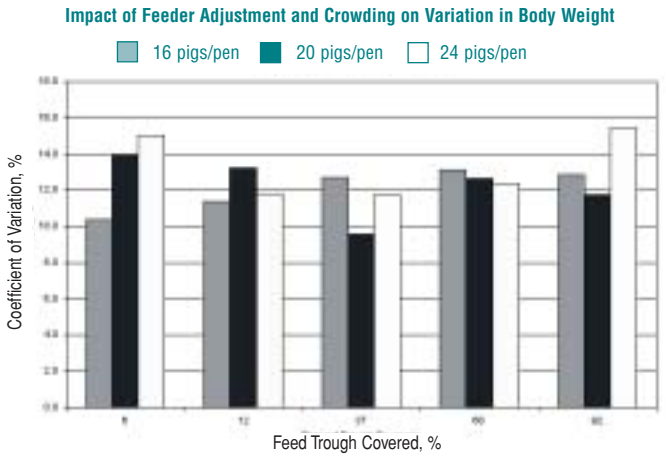


Figure 4



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While the experiment was conducted according to trough gap width, the results are presented as trough area covered with feed, as this can be more easily applied under commercial conditions.

"Nursery feeders should be adjusted to provide a minimum of 40% of the trough covered with feed"

The three floor space allowances were 2.5, 3.0 and 3.75 ft² per pig, corresponding to group sizes of 16, 20 and 24 pigs per pen. The number of feeding spaces was kept constant (4 pigs/space) across all treatments. Skin lesions were measured at the end of the experiment, to determine if reduced access to feed, or crowding, would result in increased aggressive behaviour.

By the end of the 6-week experimental period, pigs on the three widest feeder gaps weighed 5.8% more than pigs with the smallest feeder gap (Figure 1). The least crowded pigs were also 5.6% heavier than pigs with less space. Average daily gain was 10% higher for pigs with 3.75 ft² of floor space than for pigs with only 2.5 ft² of space. Feeder adjustment also affected average daily gain during the last week of the trial, when pigs with a feeder adjustment of 10 gained 23% more per day than pigs with a feeder adjustment of 3. Both feeder adjustment and pig group size/density affected average daily feed intake (Fig. 2). Pigs with more floor space and a larger feeder gap ate approximately 8% more than crowded pigs with a smaller feeder gap. There was no significant difference in feed conversion rates or skin lesion scores affected by feeder adjustment or pig group size/density (Fig. 3).

Younger pigs spent more time eating each day than older pigs. The total duration of eating time was affected by feeder adjustment and crowding in young pigs, but not in older pigs. Pigs with restricted feed access spent 18% more time eating than those with freer access. Since a longer eating time per pig means that fewer piglets have access to each eating space, the feeder adjustment affected feeder capacity. If we assume that feeder capacity is maximized when it is being used 90% of the time, then trough coverage of 6% would allow 9 pigs to use one feeder space, while the capacity of the feeder would increase to 11 pigs per space when the trough coverage was increased to 12% or greater.

Since the desired gap would change with different feed particle sizes and forms, the desired feeder gap is achieved when at least 40% of the feeder trough is covered with feed. Feeder space had no apparent impact on pig weight uniformity; however, uniformity increased slightly as floor space allowance increased (Fig. 4).

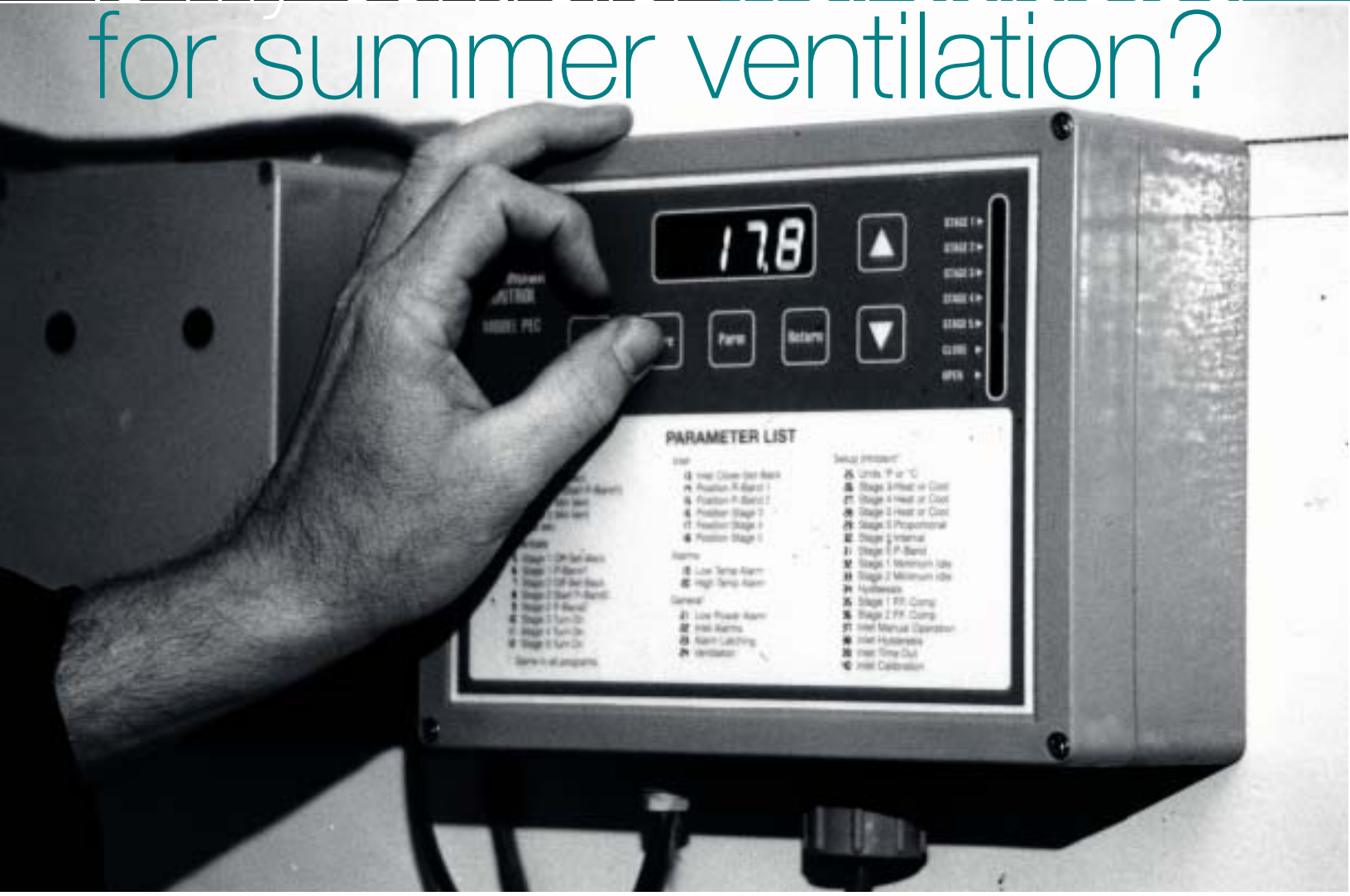
This experiment confirmed the importance of unrestricted feed access and ample space for young pigs. Because the consequences of crowding and feed restriction were most apparent as the pigs grew, one might speculate that the importance of feeder adjustment and floor space would be even greater as the pigs aged. This would be of particular importance in nurseries designed to house pigs for 8 weeks of age.

The Bottom Line

"Nursery feeders should be adjusted to provide a minimum of 40% of the trough covered with feed"

"Up to 30 kg bodyweight, 2.5 ft² of floor space per pig will result in unacceptable reductions in performance and increases in body weight variation"

Is my controller well adjusted for summer ventilation?



S.P. Lemay, Ph. D. and L. Chénard., MSC

It is always exciting to see summer coming after winter and spring conditions. After cold months, nobody complains when the outside thermometer is climbing up each day announcing really warm summer days. Pretty soon, the ventilation system of your barn will have to work at full capacity, and like any other piece of equipment, it will provide you with satisfaction only if it is set well and in really good working condition. Before we get to those warm days, now is the perfect time to verify the operation of all system components and to ensure that your controller is well adjusted.

The temperature setpoint for grower-finisher pigs can essentially stay the same over summer and winter periods. It is sometimes suggested that the summer temperature setpoint should be slightly increased compared to winter recommendations to reduce daily temperature fluctuations occurring during hot periods. Two experiments conducted at Prairie Swine Centre Inc. and recently published indicated that healthy pigs could adequately deal with a large daily temperature fluctuation (up to 15°C) as long as this fluctuation is progressively achieved. In other words, pigs are very sensitive to a rapid temperature change but they do fine if the temperature is slowly increased or decreased.

For most of the ventilation controllers, the first parameter to set is the room temperature setpoint. Elevated barn temperatures will reduce growth rate of pigs by decreasing feed intake. Looking at previous research, for every degree above 20°C, the average daily gain of finisher pigs decreases by 20 to 40 g/day. The ventilation system of a swine building is generally designed to maintain the indoor room temperature no more than 3°C above the outdoor temperature. As soon as the outdoor temperature rises close or above the room temperature setpoint, the room temperature starts to increase and the ventilation system gets to its maximum and cannot keep up. In the same way, if the room temperature setpoint is kept too hot already, the pig performance will be negatively affected. For pigs between 60 and 100 kg, the recommended temperature setpoints vary from 14 to 21°C but a typical setpoint recommendation would be 22°C for 25 kg pigs, with a gradual reduction to 15°C when pigs reach 75 kg.

Most controllers are what we call proportional controllers. For variable speed fans (generally the first two ventilation stages in grower-finisher rooms), it means that the fan rotation speed is progressively increased at the same time the

Continued on page 5

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room temperature increases. The temperature interval over which the variable speed fan goes from its minimum to its maximum rotation speed is generally called the Proportional band (P-band) temperature value. One P-band value needs to be defined for each variable ventilation stage.

The ventilation system performance is heavily dependant on P-band value settings. Two small P-band values (less than 1°C per stage) will make the whole system unstable (fan speed will increase and decrease too quickly) and can create undesirable air drafts at pig level. If the ventilation system is run with too large P-band values (more than 2°C per stage), fans react slowly and the average room temperature will be kept warmer, and can penalize pig performance. In practice and depending on the number of ventilation stages, the total temperature increment (TTI), starting from the room temperature setpoint and required to have all the fans running, should not exceed 3 to 4°C. As an example, for a room with two variable stages and two on/off stages, if P-band values for stages 1 and 2 are set at 1°C, those two stages will be running at full capacity when the room temperature is 2°C higher than the setpoint. If stages 3 and 4 are both set with a 1°C temperature offset (from the end of stages 2 and 3), it means that all fans will be running at maximum speed when the room temperature is 4°C above the setpoint. In this particular example, TTI would be equal to 4°C.

Figure 1 shows the indoor temperature of a grower-finisher room calculated for 80 kg pigs according to the outdoor temperature and for different setpoint and P-band setting combinations. This particular room used for the calculations is provided with four ventilation stages where stages 1 and 2 are variable speed fans and stages 3 and 4 are on/off fans. Theoretically, the ventilation system should be capable of maintaining the 15°C setpoint until the outdoor temperature reaches 12°C (Tdesign curve on Fig. 1). When the outdoor temperature exceeds 12°C, the room temperature should be 3°C warmer than the outdoor conditions. However, for a 15°C temperature setpoint and a 3°C TTI, the room temperature stays above the Tdesign curve when the outdoor temperature varies between –5 and 15°C (Fig. 1). This higher room temperature is the result of the controller settings, to accelerate the rotation speed of the first two ventilation stages, the room temperature should increase as well. Therefore, under spring and fall conditions, the room temperature will be, on average, warmer than the setpoint even if the ventilation system would have enough capacity to maintain room temperature at the setpoint. If a 7°C TTI is being used, the room temperature will be up to 4°C warmer than the Tdesign curve.

Obviously, an 18°C temperature setpoint with a 3°C TTI will further increase the average room temperature (Fig. 1). When a 7°C TTI is combined with an 18°C setpoint, the room temperature stays above 20°C as soon as the outdoor temperature exceeds 5°C. You should also keep in mind that the temperature sensor accuracy (typically ±1°C) of the controller will increase the variability of the actual room temperature. In this particular case, a 15°C temperature setpoint with a 3°C TTI provides a better temperature control than the other combinations presented on Figure 1.

> For every 1ºC above 20ºC the average daily gain of finisher pigs decreases by 20 - 40 grams per day.

Figure 1

Room temperature according to outdoor temperature and various controller settings.

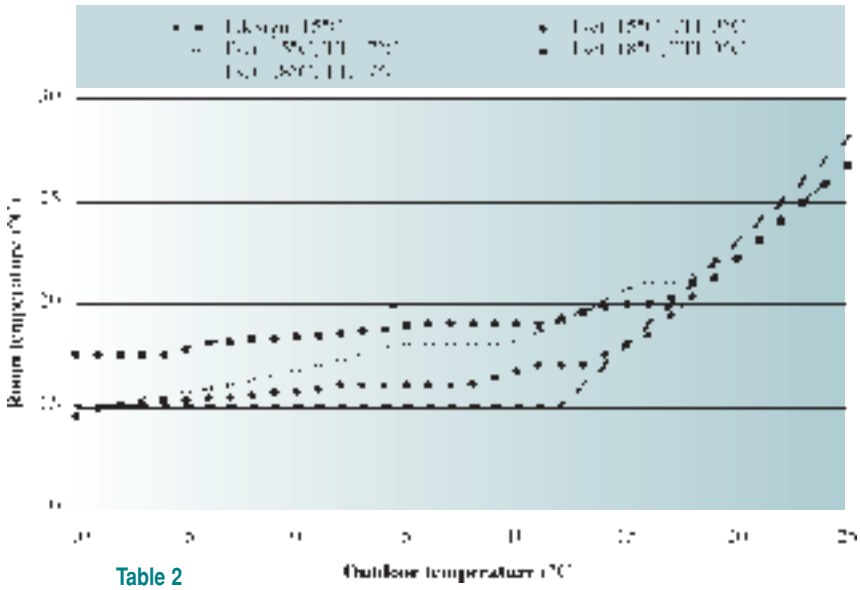


Table 2

The Bottom Line

To optimize performance over spring, summer and fall conditions check your ventilation settings.

- make sure set points are appropriate for the size of the pig
- P-band values of 1.5 offer a good compromise for acheiving stability in the ventilation system
- make sure temperature sensors are functioning and clean.

If you are looking for additional assistance in getting the best out of your ventilation equipment, contact an Agricultural Engineer that has the right expertise in livestock building ventilation. Hopefully, your pigs will grow under good temperature conditions so you can enjoy the nice and warm Prairie summer!

Space requirements for male and female grow-finish pigs

H. W. Gonyou, Ph. D.

Producers have moved towards split-sexed feeding regimes to improve nutritional management. If males and females are to be penned separately, then we should consider if other aspects of management should differ for the two sexes. In a previous study on the effects of crowding on performance and behaviour, it appeared that space restriction is more detrimental for males than for females. In the current study, we investigated this further to determine if the space requirements are different for males and females.

Four replications involving four treatment levels were conducted throughout the past year in a fully slatted room at the Floral site. The treatments consisted of different degrees of crowding, with the space allowance recommended by the Code of Practice used as a control. The degree of crowding was decreased from 0.035 $m^2BW^{0.667}$ (Code) to 0.032, 0.029, 0.026, which represent 94, 83 and 74% of code, respectively. For 110 kg pigs, this represents 0.80, 0.74, 0.67 and 0.60 m^2/pig, or 8.6, 8.0, 7.2, 6.5 $ft.^2$/pig respectively. Eight pens of 12 pigs per pen were used per replication (four pens of males and four pens of females). Pigs entered the study at 25 kg and for the first two weeks were allowed to adjust while in uncrowded conditions. The pigs were then crowded for two weeks. Following the first two weeks of crowding, the pens were adjusted for increased body size, and the pigs continued in crowded conditions for the next two weeks. At the end of the grower phase, pigs were regrouped and given two weeks of uncrowded conditions. The finisher phase consisted of the same routine. Pigs were weighed every two weeks and feed disappearance was determined.

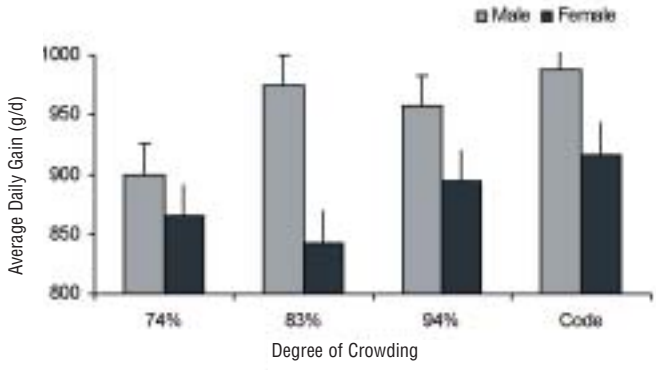
The results indicate that crowding decreases average daily gain and feed efficiency in the grower and finisher phases. The reduction in growth was about 25 g/day for each reduction in space allowance, for a total of 70 g/day between the Code and most crowded condition. There were no differences between males and females in their response to space restriction (Figure 1).

The Bottom Line

This indicates that there are no differences in the space requirements for male and female grow-finish pigs. However, crowding is detrimental to the growth and feed efficiency of grow-finish pigs.

Figure 1

Effect of crowding on growth response of male and female pigs.



Graduate Student Profile

Michel Payeur

Michel Payeur was born in Thetford Mines, Quebec, and raised on a dairy and maple farm. His interests for agriculture led him to earn a B.Sc. degree in Agricultural Engineering at Université Laval in Québec city. He then began a Master's degree in Agricultural & Bioresource Engineering under the guidance of Dr. Stéphane P. Lemay at Prairie Swine Centre in July 2000. For his M.Sc. research, Michel is studying the effect of canola oil sprinkling combined with a low-protein diet on odour and gas emissions of grower-finisher rooms.

One of the issues swine facilities have to deal with is the concerns raised by the neighbourhood and the general population about gas and odour emissions from the ventilation system of these buildings. Consequently, it is important to understand such emissions and find an easy way of reducing them for existing barns and also for future barns in order to allow pig production to develop.

The main objective of this project was to try to reduce odour and ammonia emissions of grower-finisher rooms with canola oil sprinkling on the floor combined with a low-protein diet including sugar beet pulp without affecting pig performance. The experiment was conducted using four rooms over three different growing-finishing cycles.

The Bottom Line

The results of the experiment showed a reduction by up to 50% of the ammonia concentration in the rooms fed the experimental diet without any impact of the oil sprinkling. The oil sprinkling, however, reduced the dust concentration by up to 80%. For the odours, none of the treatments had a consistent effect. The cost of applying oil at our recommended rates is approximately $0.80 to $1.00 per pig.

Shala Christianson

Shala Christianson was born in Prince Albert and raised in Weldon, Saskatchewan. She has always had an active interest in agriculture and the environment, and in 1999 she received her B.Sc. in Agricultural and Bioresource Engineering at the University of Saskatchewan. After working as a Research Engineer at PSCI, she decided to pursue her education under the guidance of Dr. Stéphane Lemay. She began her Masters degree in Environmental Engineering in the spring of 2000, and is studying the impact of dry and wet/dry feeders on the water balance of a grower-finisher room.

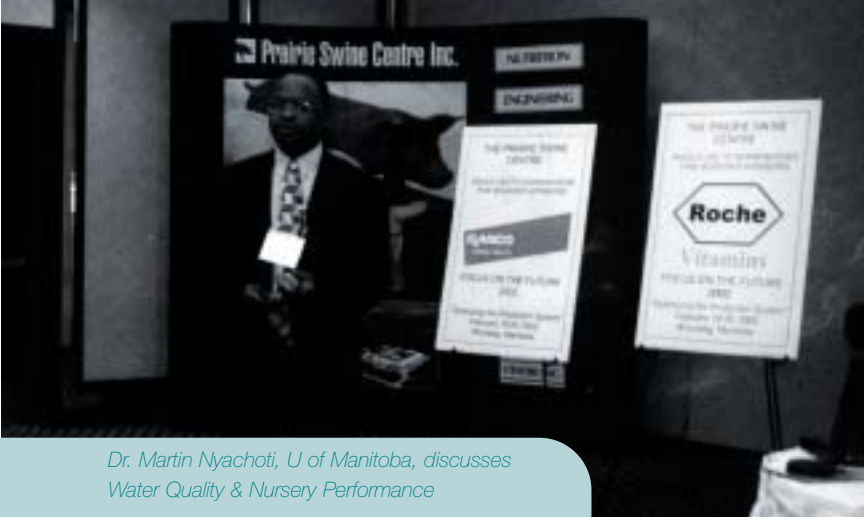
Intensive swine operations use large volumes of water and any wasted water increases the demand on the water source, as well as the cost of manure storage, handling and transportation. Environmental considerations arise when the manure is land applied; more manure increases the possibility of nutrient runoff into surface water and leaching into groundwater.

The water balance of a grower-finisher room includes all the water entering and leaving the room, including water from the drinkers, feed, ventilated air, water within the pig, water from oxidation of feed, and water in the slurry. Each source and sink of water was measured over three complete grower-finisher cycles. This water balance may be used to determine the significant sources and sinks of water in a grower-finisher room and is an indicator of where future research efforts should be focused to reduce water usage in swine barns. The water balances were also compared to determine the impact of dry and wet/dry feeders on the water balance. For both feeder types, the significant source of water was at the drinker and the significant sink of water was in the slurry. In the finisher phase using wet/dry feeders as compared to dry feeders reduced water disappearance from 9.4 to 6.1 kg water/day-pig, which is a 35% reduction in water disappearance. As well, at the finisher phase slurry volume was reduced from 10.7 to 6.7 kg water/day-pig, which is a 38% reduction.

The Bottom Line

Shala found that use of wet/dry feeders in grower-finisher rooms as compared to dry feeders saves a large amount of water. She is currently looking at relationships between different variables such as feed and water disappearance with manure production. From these relationships it may be possible to predict the amount of manure the producer may expect.

Shala is currently working on the final statistical analysis for her experiment and hopes to defend her thesis in the summer of 2002.



Dr. Martin Nyachoti, U of Manitoba, discusses Water Quality & Nursery Performance

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The Bottom Line:

Large groups of grower-finisher pigs tend to develop a "tolerant" social system. Producers can therefore incorporate large groups into their system without compromising growth rate or variation or increasing vices. Group sow housing can work; however not all group sow systems are the same. A new fact sheet on group housing accompanys this issue of Centred on Swine.

The conference also addressed big pictures issues. Dr. Camille Moore tackled the issue of PRRS Elimination, Needs and Feasibility. Dr. Moore provided a detailed description of the elimination concept including, different protocols available to the producer to remove PRRS from a positive herd. Feasibility was addressed through a checklist which helps producers make an informed decision based on their specific situation (with respect to location, herd size, biosecurity and others).

The Bottom Line:

PRRS elimination is feasible and desirable in several instances: (1) when replacement stock is PRRS negative (2) there is a low risk of recontamination (3) when you are the sole positive herd within a system (4) when you are challenged with other diseases, including PRRS, a depop-repop may be a viable alternative.

Other presentations included: Water Quality and Nursery Performance: Is it Important (Dr. Martin Nyachoti, Univ. of Manitoba), Understanding the Needs of the Individual (Mary Petersen, PSCI), and Design and Evaluation of a Manure management System (Dr. Claude Lagué). Dr. John Patience reported on some of his work in the area of nursery management and performance. This most recent study indicates that a 1 kg weight increase at weaning results in a 4 kg increase at market. The conference wrapped up with Liliane Chénard and her presentation on odour control and barn environment; outlining odour characteristics, detection techniques, sources, control and solutions to mitigate the odour generated from swine facilities.

Focus on the Future Conference is intended to change the way that we look at pork production. It focuses not only on new and leading-edge technologies, but provides new and innovative insight on existing production practices. It is designed to encourage pork producers and others within the industry to sensibly analyze their operation, and ask themselves: What can I implement today? What can I implement 6 months from now? One year from now?

Next year we hope to see you in Saskatoon in mid March 2003. Conference proceedings are available at a nominal charge (cost $10.00/copy) by contacting (306) 373-9922. A very special thank you to PIC Canada Ltd., this year's corporate sponsor.

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