



PROVIDING SOLUTIONS THROUGH ORIGINAL RESEARCH ENGINEERING

- A new (prototype) trailer design consisting of a mechanically ventilated air-filtered trailer where the major ventilation system components were located in a separate compartment at the front part of the trailer was assessed. Unique features of the (prototype) trailer included: a hydraulic loading platform, solid trailer side walls, and a removable deck and roof.
- Evaluation of the (prototype) air-filtered trailer showed:
 - a. Significant reductions of airborne pathogens inside the trailer. Concentrations of aerosolized bacteriophage (inside the trailer) were reduced by 96.9% compared to initial levels upstream of the filtration system.
 - b. Under typical winter conditions, supplemental heat is required to avoid temperatures (in the animal compartment) from dropping lower than 10°C.
 - c. Moisture (RH) level and air quality (CO₂) inside the trailer (during monitoring trips) were maintained at levels comparable to conditions found inside swine barns.
 - d. Ventilation controllers are able to compensate for temperature, RH and CO₂ inside the trailer, which enables faster recover to desired conditions associated with travel interruptions.
- Estimated payback associated with this trailer design is approximately two years, assuming a \$5 per head premium can be realized. Benefits may be greater, particularly for producers transporting high-value genetic stock.
- A novel monitoring system that combines infrared thermography and individual water consumption was installed at Prairie Swine Centre. Evaluation of this monitoring system indicates:
 - Grower pigs tend to consume more water when stressed.
 - Water consumption increased as the pig grew regardless of stress induction.
 - Aggression resulting from mixing unfamiliar pigs caused an increase in body temperature of pigs (captured by infrared thermography).
 - Pig's body temperature is affected by changes in room temperatures.
 - Inducing stress due to moving and mixing pigs had no significant negative impact on pig performance.
- Experiments in controlled-environment chambers indicate sows fed a high heat-increment diet maintained lower temperatures (11.9°C on average) than those fed with standard gestation diet (12.7°C). There was no significant effect on performance and physiological response between treatments.

- Combining an operant mechanism and high-heat increment diets in a gestation room have shown that group housed sows can tolerate temperatures as low as 8°C, without adversely impacting their growth performance and physiological response.
- Lower CO₂ levels were observed in the Sow-controlled room, compared to a Pre-set room (16.5°C), during the heating season, translating into relatively better air quality.
- Allowing group housed sows to control their own environmental temperature resulted in a 75% and 11% reduction in natural gas and electrical consumption, required for heat and ventilation during the heating period.
- No significant behavioral differences were observed between the sows in the Sow-controlled room and the Pre-set room, which implies that sow welfare was not adversely impacted by having the sows maintain relatively colder temperatures in the gestation room.
- Adoption of an operant mechanism along with high heat increment diets could lead to as much as 59% reduction in total heating and electricity cost, which can readily offset costs associated with installing and operating the system.

ETHOLOGY

- In controlled studies at Prairie Swine Centre comparing six different space allowances (above and below $k=0.0335$):
 - a. Space allowance had no clear effect on average daily gain (ADG) or feed efficiency (G:F)
 - b. Pigs spent more time sitting and less time lying laterally at lower space allowances. Sitting requires the least amount of space, and has been associated with poor welfare in pigs. Lateral lying requires the greatest amount of space, and is associated with comfort.
- In two commercial studies, comparing six different space allowances (above and below $k=0.0335$) in summer and winter:
 - a. Space allowances below $k=0.0335$ resulted in reduced growth. The behavioural differences on commercial farms were similar to those at PSC (described above).
 - b. Body injury, ear necrosis and tail biting scores were not significantly affected by space allowance. However, all three physical injuries were affected by age and season. As piglets approached nursery exit body weight, the injury, ear necrosis and tail biting scores increased significantly. Injury scores were also higher in summer than in winter.

- Overlying behaviour (pigs resting on top of each-other) is a common behaviour in piglets before and after weaning.
 - a. Overlying decreased significantly over time during the nursery period.
 - b. In weeks three and five (nursery), overlying was affected by space allowance - with more pigs overlying at lower space allowances, suggesting that older pigs overlie only when necessary as a space saving behaviour.
 - c. Temperature of the barn had no effect on overlying behaviour.
- The current NFAACC Code of Practice minimum space requirement for nursery pigs of $k=0.0335$ provides a reasonable balance between production costs and pig welfare. Weaned pigs housed at $k=0.0265$ (the 20% 'allowable decrease in floor space' provided in the Code) showed reduction in ADG.
- When considering barn renovations, assessing the existing barn structure is key to the decision making process. Depending on the soundness of the structure additional investment may be required and must be factored into planning and cost estimates for construction.
 - a. A significant renovation will cost approximately 50-75% of the cost of new.
 - b. Most new structures, whether for farrowing, dry sows or finishing, cost around \$32 ft² (Ontario prices).
 - c. It is estimated - major renovations cost between \$15 - \$24 ft². If estimated costs exceed these parameters, serious consideration should be given to building new. Most renovations include pit work, slats and interior walls. Exterior walls, ceiling, trusses and steel are generally not included or required.
- Three problems encountered in renovations for group sow housing include:
 - a. A lack of information on the importance of dedicated training areas for ESF feeders. This resulted in difficulties during the changeover period as many sows did not learn the system quickly. Both producers and animals experienced stress during the transition.
 - b. Electrical interference problems which caused sorting equipment to fail (ESF systems). Diagnosing the cause of interference problems was very challenging.
 - c. Staffing issues associated with competitive feeding systems. All pigs should be observed at the time of feeding in competitive systems - identifying sows that are lame or in poor health. This influences staff scheduling and daily feeding times.
- Many early adopters of group sow housing in Canada have implemented non-competitive feeding systems (ESF). These systems are more expensive to install and require greater technical knowledge (than competitive feeding systems), but have long term benefits in terms of reducing aggression, lower feed costs, and the use of new technologies such as automated data capture.
- Adoption of competitive feeding systems may be more common in later renovations due to the lower cost associated with these systems. However, these systems require more floor space due to use of small pens, more labor to sort and manage sows on a daily basis and higher feed costs to maintain appropriate body condition.
- Physical characteristics of rubberized mats and concrete overlay materials were evaluated. Tested materials were found to be:
 - a. Significantly softer than concrete
 - b. Greater surface friction - therefore were less slippery
 - c. Good durability and resistance to wear as well as being readily cleaned.
 - d. There is great potential for concrete overlay materials with these characteristics to improve sow comfort without compromising hygiene.
- Mixing sows into gestation groups immediately after weaning, post-insemination or at 35 days gestation can achieve similar levels of productivity and sow well-being when sows are individually fed and housed in static groups.
- Sows' use of environmental enrichments in group housing is encouraged by novelty of manipulable devices (rotating enrichment; fibrous materials, such as rope and straw tended to be preferred by sows), demonstrated by increased activity and interaction with these enrichments.

NUTRITION

- High fibre diets and stimulation of the immune system independently result in an increased threonine requirement for maximum nitrogen retention (lean gain).
- Estimates of threonine requirement with a high-fibre diet using nitrogen-balance and average daily gain appear to be higher than NRC (2012) recommendations. However, in the current diets a mix of soluble and insoluble fibre was included which may have different effects than soluble fibre alone.
- High dietary fibre appears to have a protective effect, reducing the threonine requirement during immune stimulation.
- Immune stimulation increases the variability in response to dietary nutrient content and estimates of nutrient requirements in growing pigs.
- Hydrothermal processing of oat, but not wheat straw improved energy available to gestating sows.
- Feeding sows processed oat, but not wheat straw, during late gestation improves feed intake in early lactation.
- Feeding weanling pigs acid-preserved grains provides the same benefits for growth and feed intake as directly adding organic acids to the diet
- Acid preservation of high moisture grains may be a viable tool to reduce feed costs, especially when harvesting conditions are sub-optimal
- Supplementing creep feed with a yeast extract has no effect on numbers of piglets in a litter consuming the creep feed.



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