

ETHOLOGY

- Prolonged transport duration of weaner pigs did not result in higher DOA risk or rates of mortality when compared to short or medium transport durations. Factors such as space allowance and ambient conditions impact transport outcomes for piglets.
 - Mortality records from weaner pig transports in Eastern and Western Canada showed significant but different effects of season in both regions. In the east, pigs had a greater risk of mortality during transport in summer, whereas in the west, mortality risk was greater in winter.
 - Large fluctuations in interior trailer temperatures were found in both potbelly and hydraulic-type trailers during summer and winter. Large variations within microenvironments were seen in compartments within and across trailer decks. Understanding the compartment microenvironment is an important area of opportunity for improving piglet comfort during transport.
 - Decreasing space allowance during transport is associated with a higher probability of mortality. This effect is most pronounced during summer transport conditions (June-August) in Eastern Canada.
 - Results demonstrate that increased loading time is associated with a higher probability of mortality. Transport mortality can be decreased by reducing loading times during summer transports (June-August), particularly in Eastern Canada where higher temperature and humidity levels pose a greater challenge.
 - Under good management conditions, sows in dynamic groups with early mixing performed better (higher farrowing rate) and experienced less aggression at mixing than those in static groups.
 - Dynamic groups had higher lameness and average lesion scores (a measure of aggression) throughout gestation, indicating that sows experienced more ongoing social stress.
 - Individual sow factors during gestation significantly impacted piglet development and behaviour with social structure and parity having the greatest impact. Sow social status (within the group) and parity affected piglet development more than housing treatment; while housing treatment significantly affected piglets' behavioural responses at tail docking and showed multiple interactions with social status and parity.
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- The provision of point-source enrichment increased mortality in fully-slatted pens when exposed to a natural disease challenge, as the enrichment may act as vector for disease transmission or increased pig stress.
 - Season is the largest risk factor when transporting pigs 8-28 hours. Mortality rates were approximately five times greater in winter compared to summer.
 - The concentration of cortisol in the hair of healthy piglets is a heritable molecular phenotype (0.26 ± 0.08) and is genetically correlated with back-test responses. Back-test responses are moderately heritable ranging from 0.34 ± 0.08 (vocalisation intensity) to 0.58 ± 0.08 (number of vocalisations). Completion of this work will determine the potential of these traits to select for disease resilience in swine.
 - Pigs reared with manipulation of the early life environment in the pre-weaning and nursery stage had greater average daily gain, and a tendency for a greater lifetime average daily gain compared to pigs reared in standard conditions (control) or pigs reared with manipulation of the early life rearing environment in either the pre-weaning or nursery environment only.

ENGINEERING

- A trailer's ancillary system was able to maintain acceptable environmental conditions in the animal compartment during a 6-hour transport with pigs on-board the trailer. On average, the temperatures in the animal compartment occupied by pigs were above 10 °C despite the near-zero temperature in the trailer air inlet. Carbon dioxide and moisture levels ranged from 837-974 ppm and 3.7-5.1 g/kg dry air indicating good air quality during transport.
- Disease-challenge tests showed that the air filtration system (MERV 8 pre-filter and MERV 16 glass fiber V-bank filter) installed in the trailer was capable of preventing entry of airborne transmissible diseases such as Swine Influenza A virus (IAV) to the animal compartment. Pigs in the trailer without an air filtration system started getting sick five days after trailer exposure to exhaust air from a barn with confirmed IAV infection.
- Cost analysis for a 120-pig capacity mechanically ventilated trailer fitted with an air filtration system indicated reasonable financial viability. The estimated payback period of 2.8 years is based on \$5/pig premium for every pig transported in the air-filtered trailer.
- Electro-spray modules developed to generate engineered water nanostructures (EWNS), which are highly charged nano-sized water droplets, to inactivate microbes. Inactivation efficacy was assessed at different bioaerosol concentrations, and results revealed that the highest reduction of 61% was achieved at the highest concentration of 1.3×10^5 CFU m⁻³ after an hour of treatment.
- Decontamination of various surfaces (i.e., metal, plastic, wood, and concrete) exposed to the pig barn using an electro-nanospray setup for surface treatment showed the highest inactivation on metal and plastic material, with 71% and 64%, respectively. In comparison, inactivation on wood and concrete surfaces were 59% and 51%, respectively.
- An electro-nanospray system installed in pilot-scale rooms with grower/finisher pigs showed that using only one electro-nanospray system is not sufficient to reduce the culturable bacteria concentrations in the pig room. However, reduced dust and ammonia concentrations by 28% and 80%, respectively.
- Pilot-scale trials with 2 electro-nanospray systems showed effectiveness in decontaminating air and surfaces in the barn resulted an average of 31%, 42%, and 40% reduction in culturable bacteria, dust, and ammonia concentrations compared to untreated pig room. Surface decontamination of in-barn surfaces for concrete, metal, wood and plastic, respectively, which were higher compared to trials with only one electro-spray system.
- Sampling with size-fractionating bioaerosol sampler showed that the electro-nanospray system inactivated respirable and non-respirable bioaerosols in the barn (at the same rate) with an average of 21%. Hydrogen sulphide experienced a 6% reduction; and no ozone detected.

NUTRITION

- Diets formulated to meet essential amino acid requirements but to be low in total dietary nitrogen (as indicated by an essential amino acid-nitrogen:total dietary nitrogen [EAAN:TN] ratio of 0.33) are limiting in total nitrogen for protein retention, resulting in a reduced lysine requirement. Addition of ammonium phosphate, as a source of non-protein nitrogen (EAAN:TN ratio of 0.30) resulted in an increase in nitrogen retention and lysine requirement.
- Non-protein nitrogen (ammonium phosphate) inclusion did not affect growth performance, but improved with increasing levels of lysine. The addition of non-protein nitrogen resulted in increased feed efficiency and lean gain.
- Non-protein nitrogen inclusion did not affect nitrogen digestibility, but increased nitrogen excretion.
- Non-protein nitrogen inclusion did not affect nitrogen use for lean gain, indicating that ammonium phosphate is an appropriate source of nitrogen in swine diets.
- Meta-analysis validated an indigestible protein index showing that negative outcomes (i.e., performance) was more highly correlated to dietary indigestible protein vs. total protein content. Performance was reduced in newly-weaned pigs with increased indigestible protein content, but only in the first 2 weeks post-weaning.
- Negative effects of protein may be greater in plant-based diets. Indigestible protein content was correlated with inclusion of plant-based but not animal-based ingredients or synthetic amino acid use in nursery pigs.
- The meta-analysis on indigestible protein content highlighted a lack of information on biomarkers for gut health, especially in the lower gut, with respect to dietary protein content.



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