



PROVIDING SOLUTIONS THROUGH ORIGINAL RESEARCH

ENGINEERING

- Geothermal systems installed in a finishing room showed about 36% reduction in energy consumption for heating and ventilation (during the heating season) compared to a room with conventional forced-convection heater. At current utility prices **geothermal rooms would save producers approximately \$1.70/hog.**
- Mean air temperature, relative humidity, and air quality within the two rooms were relatively similar, indicating that during winter season the geothermal system was able to maintain the same room conditions similar to that provided by a forced-convection heater system.
- During the cooling season, the geothermal room had higher total energy for heating and ventilation (1475 kWh higher) than that in the conventional room (mainly for the operation of the heat pump). **Average room air temperature was cooler in the geothermal room compared to the conventional room**, however the difference was not sufficient to lead to an advantage in feed intake.
- A **significant reduction (about 30%) in methane and carbon dioxide concentration** (during heating and cooling trials) was observed in the room with the geothermal system relative to a conventional gas-fired heater.
- In both rooms, no measurable levels of carbon monoxide and hydrogen sulphide were detected while very low levels of nitrous oxide (<0.40 ppm) were measured. **Ammonia levels tended to be higher in the conventional room** (about 4 ppm higher) than in the geothermal room, which could be attributed to the overall cooler air temperature in the geothermal room.
- **Decision-support software can be a useful tool for examining current energy use** and greenhouse gas emission patterns in existing barns and for conducting preliminary assessments that will help in making management decisions when considering the installation of a geothermal system for a swine production facility.
- Specific types of commercially-available **nanoparticles** such as zinc oxide (ZnO) nanoparticles **were found to be effective in controlling growth of selected pathogens** that can be encountered in swine production environments.
- Deploying the **nanoparticles** in filter systems can **effectively reduce the levels of airborne bioaerosols in a pig barn**. The set-up can be made more effective with better capture of air in the room to pass through the filter system.
- Sanitation procedures involving the application of **nanoparticles** in solution on pig barn surfaces can effectively inhibit the growth of microorganisms and **can be used as an alternative to conventional chemical disinfectants**.

- Biodegradation treatment (removal) of organic and nitrogenous compounds with concomitant generation of energy can be achieved successfully in microbial fuel cell (MFC) type bioreactors.
- Laboratory-scale experiments designed to treat (target) compounds commonly encountered in municipal and agricultural wastewaters (such as swine manure slurry) showed that the initial concentration of the target compound to be treated (loading rate), mode of operation (batch vs. continuous), microbial media configuration (immobilized vs. freely-suspended), and type of electrode (single-rod vs. granular) had significant impact on the biodegradation rate of the target compounds. Each of these parameters needs to be optimized depending on the properties of the influent to be treated in order to achieve maximum biodegradation efficiency of the bioreactor.
- Biodegradation of selected target organic compounds in the influent was accompanied by rise in open circuit potential (OCP) and electrical current generation, with the extent of generated power being influenced by biodegradability of the organic compound. **Maximum power achieved from small-scale laboratory experiments was 0.39 mW at a current of 1.41 mA**; further work is needed to establish the parameters for potential scale-up of the system.
- Current trials showed that sows fed with a high energy, low crude protein diet were **less affected by exposure to colder temperatures** (as low as 9 °C) compared to those fed with standard gestation diet.
- During winter season, maintaining gestation rooms at lower environmental temperature could result in an **estimated 78% reduction in energy consumption for heating and ventilation** compared to a conventional gestation room maintained continuously at a typical set-point of 16.5 °C. This reduction in heating costs would save producers \$1.25/hog throughout the year and \$5.00/hog during the heating season.

In a recent analysis of Prairie Swine Centre research projects conducted between 2001 and 2015, applying the research recommendations improved net income on average by \$4.15 per pig *every year* over this period.

NUTRITION

- At least 30% cull lentils can be included into the diets of growing and finishing pigs with no adverse effects on ADG, ADFI or feed conversion. Reducing finishing diet by \$10/mt would save producers \$2.20/hog.
- Proximate analysis (crude fibre, ether extract and crude protein) can be used to estimate NE and amino acid digestibility of cull lentils.
- In a high health herd, neither omega-3 fatty acids fed to sows during lactation, nor antibiotics in the nursery starter diet, improve performance of piglets, regardless of weaning age
- The interaction between nursery exit weight and weaning age is complex and requires more research. In a high health herd, piglets weaned at 19 days of age were heavier at nursery exit (54 days) than piglets weaned at 26 days of age.
- Piglets weaned at 3 weeks of age had lower concentrations of an enzyme involved in muscle catabolism and white blood cells post-weaning. Research is required to investigate if this is related to resources available to piglets prior to weaning.
- Alternate protein by-products (canola, sunflower, high-protein soymeal) can replace soymeal in the diet of growing-finishing pigs, if diets are formulated using net energy and ileal digestible amino acids. Reducing finishing diet cost by \$5-10/mt would save producers \$1.00-2.20/hog. Respectively.
- Moderate changes in Ca and P intake (plus or minus 15%) by young, gestating sows, does not negatively affect the growth or skeletal development of their piglets.
- Liquid whey is worth approximately \$400 per tonne when included in the water source for nursery piglets at approximately 8%. This value cannot be extrapolated to grow finish pigs.
- Liquid whey containing approximately 5% organic acids (from soft cheese production) provides no additional benefit when compared to normal whey.
- Regardless of dietary energy content, increased stocking density will result in increased visits to the feeder and aggressive incidents at the feeder.
- The proportion of piglets with evidence of creep feed consumption at approximately 20 days of age varies from 4 to 40% in different commercial facilities. If management could increase consumption of creep feed so that 100% consume creep, producers would see a next benefit of \$.50/hog.

ETHOLOGY

- Effects of oral sucrose on piglet pain following castration showed that pain responses after castration in a handling chute were reduced during the first hour after castration with sucrose treatment compared to pigs with no pain control.
- Three different mixing treatments were studied in group-housed gestating sows: mixing at 5 weeks gestation, and mixing at weaning for 2 days, followed by stall breeding and remixing at 5 weeks gestation. Sow conception rates were poorest when sows were mixed at 5 weeks gestation, while sows mixed at weaning had the lowest stillborn numbers.
- Overall, similar productivity measures were found for all three mixing treatments (identified in #2), indicating that with good management various mixing protocols can be used successfully

Observations from the National Sow Housing Conversion Project

- Various industry working groups have shown producers in Quebec are leading the country in adopting group housing for gestating sows. A variety of systems have been adopted in Quebec, including floor feeding, shoulder stalls, ESF and JYGA Technologies' new free-access ESF system.
- Majority of producers adopting group sow housing in Ontario and western Canada are implementing ESF feeding systems, and require additional information in training sows.
- Producers require additional information and support when converting to ESF systems to facilitate the transition, avoiding costly mistakes and maintaining sow welfare during the transition.
- For group housed sows, mixing sows within 5 days of insemination appears to be becoming a common practice. When renovating barns, this practice can be beneficial as it reduces the amount of space required for breeding stalls, leaving more area available for sow groups.
- Many producers in western Canada considering the transition to group sow housing have determined that construction of new buildings will be a better investment than renovating an older barn site.
- Renovations are costly, and typically do not result in an optimal floor plan or pen layout. Older barns may suffer from dry rot and pits may not be well constructed, resulting in additional costs or ongoing problems after renovation.



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