Novel Supplemental Heat Source Evaluation for Swine Farrowing Stalls

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Benjamin C. Smith, Graduate Research Assistant;
Brett C. Ramirez, Assistant Professor, Department of Agricultural and Biosystems Engineering, Iowa State University

Summary and Implications

The objectives of this study were to evaluate the impact of a novel supplemental heat source (NSHS) on piglet performance and energy usage compared to an industry standard heat lamp (HL) in farrowing stalls. The NSHS evaluated has a parabolic shaped cover (provides heat to two creep areas) with clear curtains and an infrared heat source with proportional heat output control. Six farrowing turns in two farrowing rooms (24 farrowing stalls per room) were utilized in this study. The six NSHS (12 stall coverage) were randomly assigned to a farrowing stall for the duration of the study and HL assigned to the other 12 stalls in each room. Piglets were weighed at 3 days and at 18 days of lactation using a litter scale; pre-weaning mortality was tracked using farm records. Energy usage was monitored by current sensors on each NSHS and HL; energy was verified using a power meter. Data were collected on 113 NSHS and 101 HL litters and analyzed using a Mixed model in JMP 14. There was no statistical difference between the two treatments on ADG $P>0.10$, but there was a tendency for significance for pre-wean mortality $P=0.08$; NSHS 9.67% (SE=0.82) and HL 12.04% (SE 0.87). A significant difference was noted in the rate of laid-on mortalities $P< 0.05$; NSHS 4.05% and HL 6.04%. There was a significant difference, $P< 0.01$, in the energy usage (NSHS 3.25 kWh d^{-1}, HL6 kWh d^{-1}). Overall the NSHS tended to reduce pre-wean mortality with a significant reduction in laid-on mortalities and reduced energy usage, though no impact was noted on ADG of the piglets.

Introduction

Pre-wean mortality (PWM) is a major production challenge facing the swine industry. There are multiple influential factors that impact PWM rates, including health, starvation, sow behavior, and thermal environment. The thermal environment is a unique influencer as modern farrowing rooms are built to provide the sow's environment at 66°F (19°C) while the piglet's ideal temperature range is 89-95°F (32-35°C). The industry standard is to provide supplemental heat to create a warmer microclimate in the piglet creep area to meet the piglet's thermal environment needs; typically, a heat lamp or heat mat is used for this purpose. While these two common methods do provide the piglet with adequate supplemental heat in ideal conditions, it leaves piglets exposed to unnecessary air drafts and cooler surfaces. These two pitfalls commonly occur in farrowing rooms and compromise the quality of the piglet's microclimate. The objectives of this study were to evaluate the impact of a novel supplemental heat source (NSHS) on piglet performance and energy usage compared to an industry standard heat lamp (HL) in farrowing stalls.

Materials and Methods

All procedures were approved by the Iowa State University Institutional Animal Care and Use Committee. This study was conducted at a cooperator's commercial 1,000 head sow farm near Ogden, Iowa. Two farrowing rooms were utilized, each consisting of 24 farrowing stalls. The NSHS (Haven, Farrpro, Iowa City, Iowa) consisted of a parabolic shaped cover which heated two adjacent creep areas (1 ft by 4 ft); clear plastic curtains provided 3 inches of clearance from the flooring. The NSHS had an infrared heat element with proportional heat output control based on the dry-bulb temperature under the cover. Setpoint temperature was lowered based on animal age on a custom curve developed for the study. Six NSHS were randomly assigned to stall locations in each farrowing room (12 stalls) with HL assigned to the other stalls in each room. Six farrowing turns (January to July) were utilized in the study, max litters per treatment were 144 for the study. Sows were randomly loaded in each room at day 112 of gestation. Piglet weight was measured at day 3 following cross fostering and at day 18 of lactation. Mortalities (PWM) were weighed and recorded as needed. PWM records were obtained from the production record software and verified with the mortality weight records. A Mixed model was utilized to analyze the production results with fixed effects of sow parity group (young, prime, and geriatric), heat source, number of piglets post cross fostering, and starting average weight for ADG. P values <0.05 were considered significant and P values between 0.05 and 0.10 were considered tendency for significance.

Energy usage of the NSHS was measured by monitoring the amperage draw of each unit with a current clamp reading into a commercially available data acquisition system. A custom voltage and power factor curve based on the control percentage were generated using a power meter (1730 Fluke meter, Everett, WA). The HL energy usage was verified using the power meter and assumed to be constant. Energy usage from farrowing to weaning was considered in the calculations of the average daily energy usage.

Results and Discussion

In total 113 litters of data from NSHSs were utilized representing 1,357 piglets weaned; and 101 litters from HL were utilized representing 1,187 piglets weaned. The use of the NSHS had no impact on the overall ADG of the litters ($P > 0.05$; NSHS 252 g hd^{-1} d^{-1} and HL 260 g hd^{-1} d^{-1}; figure 1). Overall PWM (figure 2) tended ($P=0.08$) to favor NSHS (9.67%; SE=0.82) compared to HL (12.04%; SE=0.87). The percentage of the mortalities attributed to laid-ons was reduced ($P<0.05$) with the NSHS 4.05%; SE=0.76) compared with the HL (6.04%:SE=0.78). Average daily energy usage of the NSHS (3.25 kWh d^{-1}) was significantly less ($P<0.01$) than the HL (6 kWh d^{-1}). This reduction in energy usage represents a 59% reduction in comparison to the HL. Based on the results of this study the NSHS did not have an impact on piglet growth, but did reduce the occurrence of laid-on mortalities. The implication of this study on a full-scale production system are limited as the randomized experimental design created unique management challenges for the cooperating producer and this study only focused on the piglet productivity. The impact of the supplemental heat source on a sow's feed intake and body weight change were not measured as a part of this study, but could have an impact on the sow's next litter and lactation performance.

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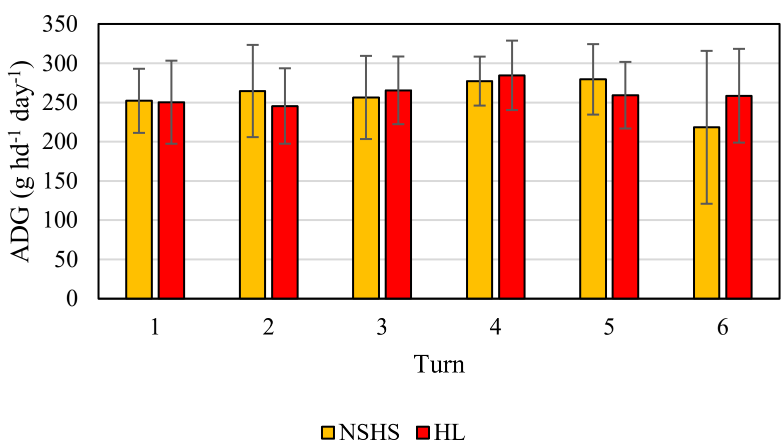

Figure 1. ADG by treatment and turn for the study. The error bars represent 1 standard error of the mean.

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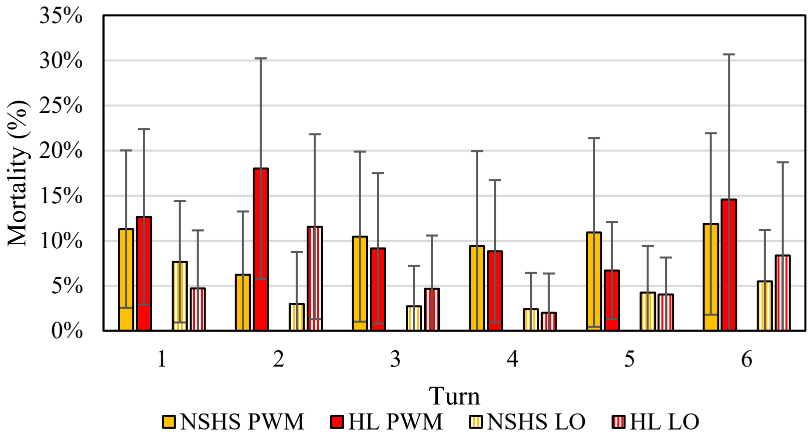

Figure 2 PWM and laid-on (LO) mortality percentages for all six turs in the study. The error bars represent 1 standard error of the mean.