Thermal Stress Levels of Sows inVarious Gestation Housing Systems

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Methods

At the ISU L. Christian Swine Research and Demonstration Farm, Atlantic,IA, during July and early August, four first-parity gestating sows from each of three gestation housing systems were randomly selected. The sows were 1/2 Yorkshire, 1/4 Hampshire, and 1/4 Landrace, weighing an average of 317 lb with .5 in. of backfat. During the observations the sows were an average of 33 days post-breeding. They had been moved to their assigned gestation housing from a central breeding barn after breeding. The three gestation housing systems were 1) individual gestation crates on partial concrete slats with mechanical ventilation (CRATE); 2) group-housing deep-bedded hoop structure (30 ft × 108 ft) oriented north-south with elevated feeding stalls (HOOP); and 3) group-housing partially slatted floor, curtain-sided, naturally ventilated, modified open-front confinement building oriented east-west (32 ft × 64 ft) with feeding stalls, the curtain on the south side and vent doors on the north (MOF).

Each housing system was equipped with sow cooling devices. The CRATE system had drippers over the gestation crates. The HOOP system had drippers over the feeding stalls. The MOF system had water misters on timers.

The sows were marked with paint for easy identification. In mid- to late afternoon of each observation day the following data were recorded: 1) temperature in the building at sow level (about 3 ft above the floor), 2) air speed in the building at sow level, 3) relative humidity at sow level, and 4) sow respiration rate. The respiration rate was determined by counting sow flank movements for 30 seconds. Four consecutive counts were made, averaged, and then doubled for the respiration rate per minute for each sow for the observation day. Also outdoor temperature, relative humidity, and wind speed and direction were recorded in shade at 3 ft above a mowed grass lawn. Observations began on July 14 and concluded on August 9, 1999.

Temperature and relative humidity were measured with a digital instrument and air speed was measured with a hand-held anemometer.

Results and Discussion

The average temperature during the observation time was 85.7 ± .9°F. Relative humidity was constant at 62 ± .8% during the study period. A positive correlation existed between respiration rate and temperature ($r = .47$, $P = .0001$). Overall, there were no differences in respiration rate (Figure 1) between sows in any treatment (HOOP, 44.2 ± 3.1; CRATE, 36.5 ± 2.4; and MOF, 43.7 ± 4.1 breaths/min, respectively). Respiration rates paralleled the increase and decrease in ambient temperature (Figure 1). Relative humidity was fairly constant and elevated during the study period. Thus, the impact of humidity on respiration rate could not be elucidated during this study.

To test the efficacy of the cooling system sows in the CRATE and HOOP treatments were monitored for one day in which the cooling systems were rendered inoperable. During this day the respiration rate of sows in the CRATE treatment averaged 84 ± 13 breaths/minute and 129 ± 17 breaths/minute for sows in the HOOP treatment. The elevated levels were 2–3 times the respiration rate on the other days with similar temperatures. These data emphasize the importance of a cooling system for confined sows and indicate that sows housed in hoop structures may be more susceptible to heat stress.

Summary and Implications

The similar respiration rates of sows in all three housing systems indicate that housing systems have a minimal effect on respiration rate. The most dramatic observation was when sows were not provided with a drip cooler mechanism, respiration rates exceeded acceptable levels for normal physiological function and production.

These data suggest that all three systems of sow housing are comparable in relation to thermal environment by the sow. The systems challenged the sow's ability to cope with thermal stress when an acceptable system of cooling was not provided. Therefore, all three systems evaluated in this study provide adequate sow thermal comfort, but the data suggest that if heat stress is challenging sows, then those housed in hoop structures need to be carefully monitored to ensure that an excessive heat load does not negatively affect their production and welfare. These data further support the importance of an adequate mechanism by which to cool sows in all housing environments.

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Figure 1. Respiration rates of gestating sows in various housing systems at L. Christian Swine Research and Demonstration Farm.