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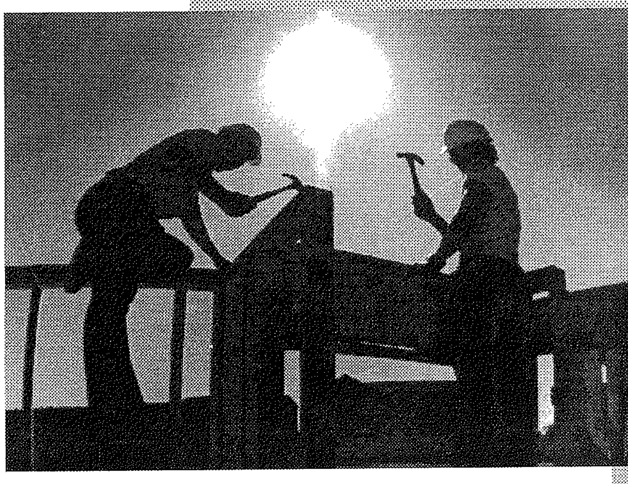

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Reducing Heat Stress in Gilts and Sows

Background.[1]

Appropriate environmental management is an important factor in animal management practices, in terms of welfare as well as productivity. Mammals have means of thermo regulation which allow them to maintain a homeostatic body temperature. They may utilize behavioral and/or physical thermo regulation. Animals will respond to heat stress with functional changes in an attempt to increase heat loss in relation to heat load. Adjustments will be implemented beginning with those that require lower energy expense, such as altering cardiovascular output that will increase the animals surface temperature, and behavioral thermo regulation. Due to the inability of pigs to sweat they must depend on panting for evaporative heat loss, which is metabolically more expensive than evaporative heat loss from the body surface that occur with sweating. If a conductive heat sink is available to pigs in a hot environment then conduction from the animals surface may serve the same purpose as evaporation in sweating animals.

Behavioral thermo regulation can be observed when environmental temperatures approach either extreme of the thermo neutral zone. Heat stress is of greater concern than cold stress, as heat stress can be extremely detrimental to welfare and economic production over a narrower range of temperatures. Heat stress begins at a point where environmental conditions and temperature become high enough to induce one or more thermoregulatory processes in an attempt to retain the homeostatic condition. The results of heat stress may range from decreased feed intake and efficiency of growth, reproduction and general unthriftiness to hyperthermic death. It appears that acute and scattered heat periods, with intersperced periods of thermoneutrality provides an opportunity for the detrimental effects of heat stress to be physiologically compensated for; however, extended periods of heat stress can quickly lead to exhaustion and death.

Selection of a more appropriate thermal micro-environment and changes in posture and body position to adjust body surface area in contact with environmental temperatures represent two common methods to behavioral thermo regulation. One method of achieving optimum welfare and production in environmental management is to allow the animal to choose its own micro-environment and evaluate the appropriateness of those choices. By evaluating these choices, it may be possible to provide effective choices to animals in confinement situations that would otherwise restrict their ability to behaviorally thermoregulate.

In order to determine if a pig will make a choice between cooling systems and if that choice is of physiological benefit to the animal, two experiments with farrowing sows and breeding gilts respectively were conducted.

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Procedures.

In experiment 1, a "thermal pillow" was attached to the elevated plastic coated flooring in farrowing crates at one side of the centrally located feeder allowing the sow to lie with her head and ear on the pillow or on the opposite side of the feeder directly on the plastic coated floor. The "thermal pillow" was constructed of galvanized iron pipes (1.3 cm in diameter) and elbows to form a 0.31 X 0.31 m square pad. Tap water continuously was circulated through the pillow at a temperature between 19 and 23 degree C (64-73 F). Control animals also had access to the pillow but no water was circulated through it, and the temperature, therefore, remained in equilibrium with room temperatures which was held between 32 and 35 degree C (90-95 F). Rectal temperatures as well as temperatures of the eye, ear and mammary area were measured, and respiratory rate was determined in control sows as well as experimental sows.

In experiment 2, 42 breeding gilts (130-150 kg) were used to evaluate the voluntary use of three different cooling systems when environmental temperatures ranged from 32-37 Degree C (90-99 F) during a 10 hour day period. The three cooling systems used were conductive cool pads, snout coolers, and drip coolers. The effectiveness of each system in dissipating heat load, was determined by rectal temperatures and respiration rate taken at three different times during the day. Animal behavior was recorded during videotaping.

The drip cooler used was a commercially available 3 mm tubing drip cooler. It was installed to drip continuously at an average rate of 56 ml/minute. Average water temperature during the heat stress period was 35 degree C (95 F)

Snout coolers were constructed of a 61 cm section of a PVC pipe with a 90 degree elbow at the bottom to direct cooled air into the stall at a height of 30 cm. off the floor. 30 cfm cooled air (30 degree C) was delivered to each gilt. The gilts could position themselves to have the snout cooler blowing on them from standing, sitting, and lying positions.

The conductive cool pads were constructed of 6 mm galvanized pipe and elbows to form a pad with the dimensions of 89 by 46 cm. Hose fittings on input and output pipes allowed for the delivery and exit of cooled (18-22 C) water from the pad.

Results

Data from experiment 1 indicated that the conductive cooling pillow is behaviorally preferred in the hot environment. The respiration rate in experimental sows was only 89 % of that observed in control sows indicating that the cool pad was of some thermoregulatory benefit during the first ten days of hot environment exposure. However, body temperatures remained elevated in experimental sows kept in the hot thermoenvironment, indicating that the cool exposure from the pillow was not enough to decrease temperatures in these sows. Milk production and litter weight gain was unaffected of the experimental procedures.

In experiment 2, it was revealed that the behavioral preference of the gilts was strongly for the use of cooling systems. Among the three systems, the cooling pad was the preferred one, this system was chosen 58 % of the times pigs chose to use a cooling system. The snout cooler was the least preferred among the systems (13.5%), with the drip cooler being the intermediate preference (28.6%).

Rectal temperatures in non-cooled pigs were 39.6 degree C. Only in pigs using the cooling pad was rectal temperatures decreased, whereas no reduction was observed in pigs using either the snout cooler or the drip cooler. The respiration rate of pigs using the cooling pad

was reduced compared to non-cooled pigs (72.7 and 103.2 rpm respectively). No decrease in respiration rate was observed upon the use of snout coolers or drip coolers.
These observations indicate that pigs will choose to use the cooling pad when given the opportunity and that the cooling pad is the only system that can efficiently decrease rectal temperature and respiration rate in heat stressed pigs.

Conclusion.

Results from the experiments suggest that the smaller (31 by 31 cm) cool pillow does not provide detectable physiological benefits during heat stress conditions, although the sows will use the pillow. The use of the pillow may indicate that the sows do derive some comfort from its use. A larger surface area of the pillow may improve its effectiveness.
The behavioral preference experiment was conducted using a larger (89 by 46 cm) cooling pad. Results from that experiment showed that pigs do prefer the use of a cooling system under heat stress. Animals will use the cooling pad as their first preference, the drip cooler as their second and the snout cooler as their third preference. Physiological measurements during heat stress strongly suggests that the cooling pad provides physiological advantages in combating the detrimental effects of heat stress.
Incorporating conductive cool pads into production environments may increase the animals ability to maintain a normal body temperature and respiration rate in heat stress conditions and thus maintain optimum production via maintained feed intake, reproductive efficiency and growth potential. Additionally, these experiments suggest that the use of cooling systems may increase animal welfare since gilts will voluntarily choose to use these systems.
In conclusion, the conductive cool pad provides a relatively inexpensive, environmentally safe and potentially low maintenance method of providing zone cooling that has been shown to be the choice of pigs while keeping rectal temperatures and respiration rates in a normal range so that the animals can partition energy to more profitable growth and reproductive processes.