Evaluation of piglet heating system by water heated panels in farrowing house

Ľubomír Botto[1], Jana Lendelová[2]

[1]Animal Production Research Centre Nitra, Hlohovecká 2, 951 41 Lužianky, Slovak Republic

[2]Slovak University of Agricultural in Nitra, Trieda A. Hlinku 2, 949 76 Nitra, Slovak Republic

Introduction

Piglets do not have the ability of thermoregulation at birth (Blecha, 2001). Piglet upon its birth experiences a sudden 15-20°C decrease in ambient temperature (Herpin et al., 2002). At birth, the new born pig leaves a draft free environment, 38.9ºC which is the sow's womb. Even a temperature of 35ºC is cold to the piglet in its first few hours. The piglet needs heat immediately to survive and grow. Temperatures less than 37.8ºC will result in the piglet using the sow milk to warm itself. For new born pigs in its resting place the temperature should be from 32°C (Lean, 1994; Curtis, 1995,) to 35°C (Xin, Zhang, 2000), which is gradually decreased till 22-24 °C when weaned (Herpin et al., 2002).

In Slovakia is recommended the air temperature for piglets 22-32°C as optimum and for sows 16-22°C at relative humidity 50-75 % (Botto et al., 1995). To keep minimum ambient temperature of 20°C till piglets' age of 1 month it is necessary to use local heating of their area. Electric or warm-water heated panels for bottom local heating are used. Warmth transmission to piglets occurs by their body contact with the surface of the heated panel. From the viewpoint of comfort zone for piglets, correct regulation of temperature, either optimum or advantageous surface temperatures of heated panels are important factors.

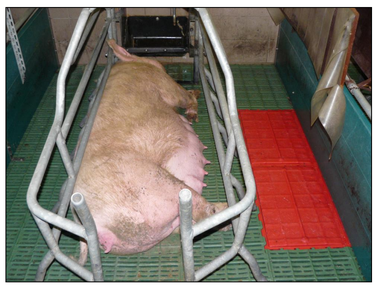
Aim

The objective of this work was to evaluate piglet heating system in strawless farrowing house on the basis of surface temperature of water heated panels.

Material and methods

In farrowing house were 5 sections with 3 rows and 8 pens in each row. Farrowing pens with crate for sow were situated across the alley in sections.

Two water heated panels with total area 0.48 m^2 were installed for piglet heating in each pen. Panels in first pens in all rows were situated at the enclosure wall adjacent to marginal lengthwise passage in stable and panels of last (8^{th}) pens at external enclosure wall.



Surface temperature of 72 panels in 3 sections was measured by infrared thermometer (AMIR 7811-50B) in February 2011. At data evaluation we analyzed average surface temperature of panels from first to eighth pens in rows, including frequency distribution of temperatures (in the range from 34°C to 42°C with step of 1°C). The data were analyzed using the Descriptive Statistics procedure and a General Linear Model ANOVA by the statistical package STATISTIX 9.0. Significance of differences between heated panels in pens was determined by Tukey HSD test. Internal and external temperature and relative humidity of air was registered during the measuring day.

Results

Average indoor temperature of air in the farrowing sections was 18.7 ± 0.49°C during the measuring day and outdoor average air temperature was 3.5 ± 0.93°C (Tab. 1). Average indoor relative humidity of air was 56.2 ± 3.19 % and in external environment 77.1 ± 4.85 %. Measured internal temperatures of air were lower than the bottom limit of the presented optimum for piglets.

Table 1. Temperature and relative humidity of air during measuring day

Parameter	Air temperature, °C		Relative humidity, %	
	Indoor	Outdoor	Indoor	Outdoor
Average ± SD	18.7 ± 0.49	3.5 ± 0.93	56.2 ± 3.19	77.1 ± 4.85
Minimum - Maximum	17.6 - 19.6	1.0 - 4.6	49.6 - 62.6	68.6 - 86.2

Water heated panels of 5^{th} pens had the highest average surface temperature 40.62 ± 0.70°C (Tab. 2); the panels of 8^{th} pens had the lowest temperature 37.16 ± 2.15°C ($p<0.001$). Water heated panels of 2^{nd} pens had the highest average surface temperature 40.65 ±1.10°C (tab. 2) adjacent to lengthwise passage in stable.

Table 2. Surface temperatures of panels in pens according to their order in rows

Parameter	Pens order in a row in individual sections							
	1^{st}	2^{nd}	3^{rd}	4^{th}	5^{th}	6^{th}	7^{th}	8^{th}
Average*	39.86^{a}	40.31^{a}	37.79^{a}	39.54^{a}	40.62^{a}	39.79^{a}	38.91^{ab}	37.16^{b}
SD	1.52	0.97	1.05	0.63	0.70	0.98	1.59	2.15
Minimum	36.6	38.5	38.7	38.5	38.9	38.6	35.6	34.6
Maximum	41.4	41.6	41.2	40.2	41.9	41.6	40.4	41.1

* Significance of differences at $p<0.001$, $^{a-b}$ Data with an equal superscript are not significantly different from one another (Tukey HSD test at $\alpha=0.001$).

From frequency distribution of the average surface temperatures of water heated panels results (Tab. 3) that 65 from 72 evaluated panels (90.4 %) had suitable temperature (37-43°C) and 42 heated panels (58.4 %) had optimum temperature (39-41°C).

Table 3. Frequency distribution of surface temperatures of warm-water panels

Parameter	Range of surface temperatures of heated panels in °C							
	34-35*	35-36	36-37	37-38	38-39	39-40	40-41	41-42
Number	1	3	3	2	10	20	22	11
%	1.4	4.2	4.2	2.8	13.9	27.8	30.6	15.3

* The lower limit of range includes the value and the upper limit is less than the value.

52 panels (72.3 %) had average surface temperature in range 38-41°C. It is the temperature to which the water heated panels should be set after farrowing.

Conclusion

The lowest temperature had panels of 8^{th} (last) pens in rows, which were situated at external enclosure wall without thermal insulation. As far as the average surface temperature is concerned, from 72 panels 90.4 % water heated panels had suitable and 58.4 % optimum temperature. It is possible to get improvement of temperature conditions by additional insulation of the external enclosure wall in the area of pens as well as by optimal heat regulation of panels according to the position of lying piglets.

This work was written during realization of the project "CEGEZ No. 26220120042" supported by the Operational Programme Research and Development funded from the European Regional Development Fund.

Contact e-mail address: Ľubomír Botto, botto@cvzv.sk