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# Investigations on acceptance and size of piglet nests

The optimal size of piglet nests depends on the litter size, on physical development of the piglets, but also from the nest acceptance and on lying behaviour. Factors influencing piglet nests acceptance and appropriate size of piglet nests were examined in two different trials. Only about 50 % of piglets accept not optimally adjusted nests as laying area. For construction of piglet nests space requirement in the second nursing week of 0,065 m<sup>2</sup> per piglet should be used. The importance of the surface temperature of the piglet nest declines with age of the piglets. The optimum surface temperature of heating plates in the first nursing week is 38–39 °C. Optimum surface temperature of 33–36 °C for older piglets depends on the ambient temperature. For nest acceptance room temperature in the farrowing house is more important than the optimum surface temperature of the piglet nest.

## Keywords

Suckling pigs, laying area, surface temperature of piglet nests, piglet nest acceptance

## Abstract

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As the litter sizes of sows grow, the size of the piglet nests must be adapted. With regard to the space requirements, a distinction must be made between individual and social space requirements. Animals kept in groups need less space because the individuals rarely simultaneously exhibit the behavioural patterns which cause the space requirements [1]. In addition, the determination of space requirements not only depends on the body dimensions, but also on the body posture of the animals. Space requirement values for fattening pigs have been derived based on body weight [2; 3] using the formula: space requirements =  $k \cdot \text{body weight}^{0,67}$ . In this formula, “k” describes a constant factor which depends on the body

posture of the animals (ventral position, lateral position). The k-values for fattening pigs derived in the literature are shown in **Table 1** [2].

## Material and methods

The studies were carried out on the Instructional and Test Farm in Köllitsch during 26 farrowing periods with 16 to 20 sows per period during 21 non-consecutive trial months (January 2007 until October 2010). The farrowing pens common in practice arranged diagonally or in a straight position were equipped with piglet nests out of polymer concrete from the company Durofarm, measured 0.4 x 1.2 m (0.48 m<sup>2</sup>), and were connected in series (5 nests each). The floor temperatures of the slatted plastic floor and the piglet nest were measured at three points each with the aid of an infrared thermometer (company Raytek/Raynger MXTM) at a distance of ca. 20 cm from the floor (**Figure 1**). In order to avoid performance depression, the flow temperature of 45 °C was slightly varied (2–4 °C) in order to reach a slightly higher variation in the surface temperatures of the piglet nests. The measurements were taken during a nur-

Table 1

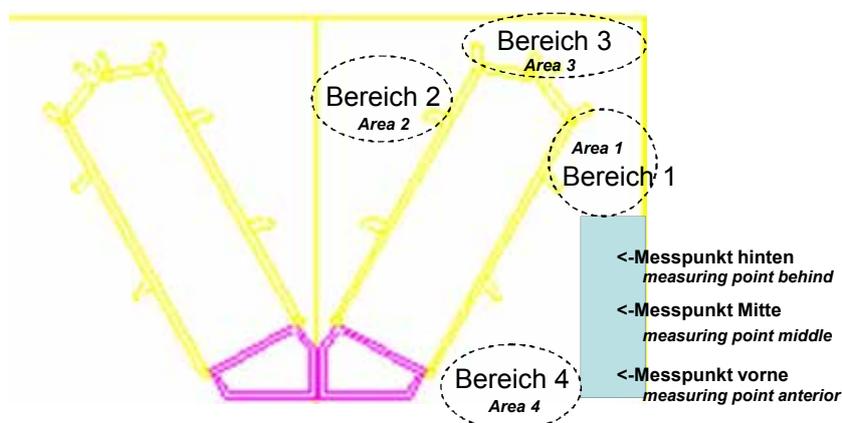
Space requirement of fattening pigs depending on body weight of the animals

	Liegeposition/Lying position		
	Gestreckte Seitenlage/Lying on side with legs stretched	Seitenlage/Lying on side	Bauchlage/Prone position
Formel/Formula	$0,047 \cdot \text{KGW}^{0,67 1)}$ $0,047 \cdot \text{BW}^{0,67 2)}$	$0,033 \cdot \text{KGW}^{0,67}$ $0,033 \cdot \text{BW}^{0,67}$	$0,019 \cdot \text{KGW}^{0,67}$ $0,019 \cdot \text{BW}^{0,67}$

<sup>1)</sup> KGW: Körpergewicht.

<sup>2)</sup> BW: Body weight.

Fig. 1



Measurement points and observation areas

sing period of 28 days on the 3<sup>rd</sup> and the 14<sup>th</sup> day after birth and on the day of weaning. Parallel to the temperature measurements, the percentage of piglets lying in defined floor sections or in the piglet nest was recorded. The time frame used for the measurements was always the same (9 a. m. until noon). For this purpose, all piglets of the litter had to be in a resting position, and the measured surface temperature had to be uninfluenced by the body heat of the piglets. The measuring points were chosen according to **Figure 1**. The three measuring points on the slatted plastic floor were varied based on the actually assumed lying positions of the piglets within the defined areas.

Altogether, the results of 1.079 pen evaluations and the connected temperature measurements of the nests and the floor were merged in the calculations. During two final trial runs, the body dimensions of the piglets were additionally measured weekly with the aid of a tape measure. Length was measured first from the tail head to the neck vertebra and, second, from the tail head to the snout tip in order to consider the changing body-head ratio during piglet development. Body height was measured from the claw root to the shoulder with the leg in

a straight and a bent position. Shoulder width was measured as the distance between the upper end of the right and the left front leg. The required lying surface was calculated based on the measurement values using a correction factor and compared with the actually necessary surface determined by means of animal observations and with literature values.

## Results and discussion

The space requirements are determined based on the development of the body dimensions and the lying behaviour of the piglets. In contrast to animal observation, theoretical determination does not consider lying and social behaviour. According to observations in practice, the piglets lie both in a ventral and a lateral position so that the observed area requirements realistically reflect the conditions (**Figure 2**).

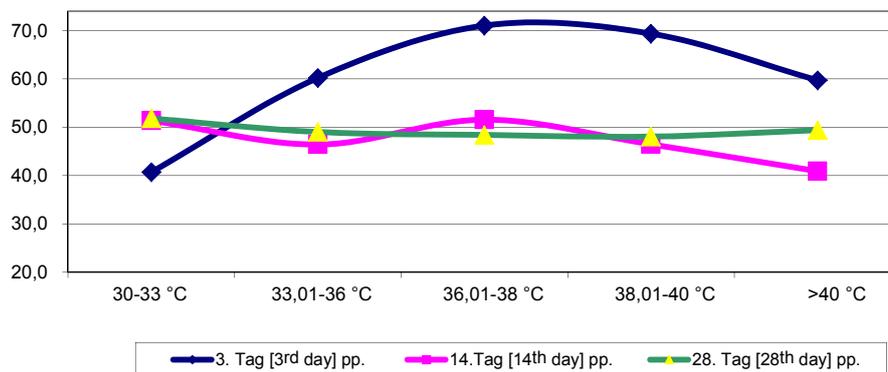
The measurements are based on the assumption of an exclusive lateral position in which the piglets pull their legs up to their bellies and put their heads half on the heads of other piglets. According to practical observations, this is a realistic posture, which, however, changes with age. As compared with

Table 2

Derivation of lying area using body weight, body size and lying behaviour

	Körpergewicht gemessen [kg] <i>body weight</i>	Berechnet (Seitenlage - 0.033) [m <sup>2</sup> /Ferkel] <i>Laying on side</i>	Berechnet (Bauchlage - 0.019) [m <sup>2</sup> /Ferkel] <i>Prone position</i>	Beobachtet [m <sup>2</sup> /Ferkel] <i>Observation</i>	Vermessen [m <sup>2</sup> /Ferkel] <i>measurement of body dimension</i>
Geburt/ <i>Birth</i>	1,3	0,04	0,02	0,04	0,03
1. Lebenswoche/ <i>1<sup>st</sup> nursery week</i>	2,7	0,06	0,04	0,05	0,05
2. Lebenswoche/ <i>2<sup>nd</sup> nursery week</i>	4,2	0,09	0,05	0,06	0,07
3. Lebenswoche/ <i>3<sup>rd</sup> nursery week</i>	5,9	0,11	0,06	0,07	0,08
4. Lebenswoche/ <i>4<sup>th</sup> nursery week</i>	7,7	0,13	0,08	0,08	0,09
Mittel/ <i>Middle</i>	4,3	0,09	0,05	0,06	0,064

Fig. 2



Acceptance of piglet nest depending on age of the piglets and surface temperature of the nest

the space requirements determined on the basis of the body dimensions, the space requirements derived from the actually observed lying behaviour of the piglets are slightly higher at the beginning of the nursing period (0.04 vs. 0.03 m<sup>2</sup>) and slightly lower at the end. According to practical observations, the piglets assume a rather non-uniform lying position at the beginning. Many of them, however, prefer the lateral position. Thus, the observed lying area requirements of 0.04 m<sup>2</sup> per nursing piglet correspond to the value which results from the body weight and the assumption of an exclusive lateral position. Towards the end of the nursing period, the piglets lie in a more uniform position with a preference for the ventral position. Therefore, the observed space requirements match the space requirements theoretically derived from the formula based on the assumption of a ventral position better. Over the average of all observation times, the observed space requirements and the space requirements derived from the body dimensions match the planned size of 0.065 m<sup>2</sup> per suckling piglet.

At the same time, the space requirements are inseparably connected to the acceptance of the piglet nest. If the piglet nests were not set optimally, only approximately 50 % of the suckling piglets chose the piglet nest as a lying area over the average of all measurement times. As expected, however, the importance of the surface temperature of the piglet nest decreased with

the age of the piglets. Due to the available space, in particular the front sides are chosen as an alternative in diagonal arrangements, whereas in straight arrangements also the longitudinal sides of the pen are chosen as lying areas. In order to gain results regarding the optimal surface temperature, the data were related to the straggling of the surface temperature in the middle of the piglet nest, i.e. at the warmest place, depending on the age.

The results showed that suckling piglets reacted sensitively to surface temperature fluctuations up to an age of one week. The maximum of acceptance of more than 70 % was observed at a range of 38–39 °C, whereas acceptance significantly diminished at 40 °C and more. More than 80 % of the piglets were observed on the heating plate when its temperature was 39.2 °C during the first week, 37.2 °C during the second week, and 36.5 °C during the third week. Thus, advantageous or optimal temperatures remain within a very narrow range and are on average rather lower than 39 °C. If the temperature is kept precisely, the conventional series arrangement principle (flow and return) of piglet nests with heating coils quickly reaches its limits. This is also proven by temperature variability. During the following weeks of the piglets' lives, nest acceptance is lower. During the second week of their lives, the piglets still often frequented the nests. During the

Table 3

Laying area of suckling piglets depending on temperature of farrowing compartment

	18–20 °C	20,01–22 °C	22,01–24 °C	> 24,01 °C	Signifikanz <sup>1)</sup>
% Ferkel im Ferkelnest / % piglets in the nest	68	62	49	35	aabc
% Ferkel im Bereich 4 / % piglets in area 4	20	25	31	36	aabc
% Ferkel im Bereich 2 / % piglets in area 2	12	11	15	21	aaab
% Ferkel im Bereich 1 / % piglets in area 1	1	2	5	8	aabc
% Ferkel im Bereich 3 / % piglets in area 3	0,0	0,1	0,4	0,0	ab,ab,b,a

<sup>1)</sup> Signifikanzniveau p < 5 % / Level of significance p < 5 %.

fourth week, the nests were no longer frequented because the heat requirements of the piglets decrease and other factors play a growing role. An equal part of the three-day old piglets which were not in the piglet nest were found at the teats on the other side of the piglet nest (area 2, **Figure 1**) and even more often between the head of the sow and the piglet nest (area 4, **Figure 1**). Older piglets preferred to withdraw into the area between the piglet nest and the sow trough (approximately  $\frac{1}{3}$  of the litter). While nest acceptance by the piglets can be influenced by means of an optimal piglet nest temperature ( $< 40$  °C) during the first nursing week, fluctuating room temperature correlating with outdoor temperature plays a bigger role for older piglets. With growing age and increasing room temperature, piglet nest acceptance decreased, and undesirable lying on the slatted floor was observed more often. The young piglets withdrew into the slightly warmer floor area 4 ( $+1$  °C), while the older animals preferred the cooler floor areas 2 and 1, where they were susceptible to injury (**Table 3**).

## Conclusions

Different factors influence the acceptance of piglet nests. Depending on the age, in particular low room temperature ( $< 23$  °C) influences acceptance by the piglets even more than an optimal (37 °C up to a maximum of 39 °C) surface temperature of the piglet nests. The sow as a social leader probably also influences the lying behaviour of the piglets. Thus, in particular the front area of the pen is used as an alternative lying area. In order to improve acceptance, piglet nests should be arranged in the visual or contact area of the sow's head. This is easier to achieve in a diagonal than in a straight arrangement. The question of how large the piglet nests are really intended to be depends on the litter size and the question of how long all piglets are supposed to find a heated lying place. If the piglet nest is intended to offer space until the end of the nursing period, between 0.06 and 0.09 m<sup>2</sup> per suckling piglet are required depending on the viewpoint. For litters of up to 12 piglets, this means a size of 0.72–1.1 m<sup>2</sup>. The piglet nests installed in new buildings, which are already relatively large given a size of 0.8 to 0.85 m<sup>2</sup>, meet the space requirements of piglets up to the 14<sup>th</sup> day of their lives in litters of up to 14 piglets. If the pens are intended to offer space for even larger piglet nests without causing heat stress for the sows, the lying area for older piglets should consist of actively heated and passive zones with good insulation characteristics.

## Literature

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