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Litterless Housing Systems for the Farrowing Area I

Presentation of the Project and Housing Environment

Within the framework of two publications, an experiment is presented, which compared three keeping variants (conventional farrowing crate, farrowing crate to open, activity pen) for suckling sows over a period of several years. Furthermore, the effects of a temporally and quantitatively restricted straw supply are discussed. This first publication describes the project. Further, results from recording the animal house climate and assessing the pen dirtying are presented.

Three housing variants for nursing sows providing identical environmental conditions were compared in the present study over a period of several years. The systems compared were a conventional crate stall, an opening crate stall, and an activity pen.

The primary objective was the evaluation of alternatives to the conventional crate stall which could meet with acceptance in practice even without massive pressure from the legislator. Additionally, the effects of a temporally and quantitatively limited straw supply were studied.

This contribution will provide an overview of the project. Furthermore, the results of stall climate measurements and the evaluation of pen soiling will be presented. The following contribution will focus on ethological and pathological criteria as well as production data. Aspects of work management have already been described in reference [1].

Animals, Materials and Methods

Housing Technique and Examined Housing Variants

The studies were carried out on the experimental farm Relliehausen of the University of Göttingen. There, four compartments were newly constructed in an existing stall building at the end of 1998. Each compartment contained six farrowing pens (2000 • 2500 mm; *Fig. 1*). Each compartment featured separately controllable pore canal ventilation (Fancom company, Panningen, NL).

Standard parts from a stall equipment manufacturer (Laake company, Langen) were employed to equip the pens. The pens only differed with regard to the fixation of the mother animal and details immediately derived from this feature, i.e. the height of the pen partition and the installation of piglet protection bars. The farrowing pens were equipped with fully perforated floors (MIK company, Marienhausen). Each pen featured a water-heated piglet resting area from the same manufacturer, which measured 600 • 800 mm.

In detail, the housing variants were able to be characterised as follows:

In compartment 1, A_1, the pens were equipped with crate stalls common in practice. In this housing system, the sow was fixed from the day of stalling-in until the day of stalling-out.

Stalling-up in compartment 2, A_2, was largely identical to A_1. After the castration of the piglets (on ca. the 10th day of their lives),

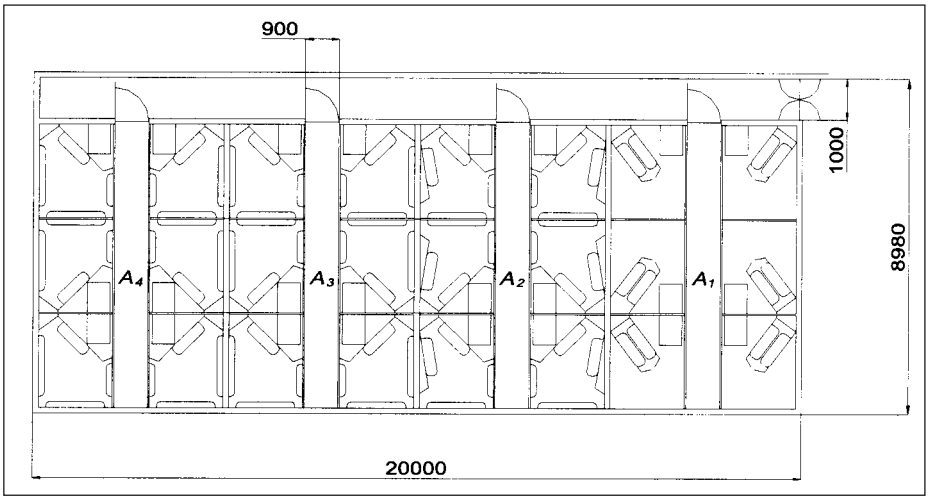

Fig. 1: Ground plan of the farrowing section (measures in mm); A_1 conventional farrowing crate; A_2 crate für opening; A_3, A_4, movable crates

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the crate was opened.

Stalling up in compartment 3, A_3, was an activity pen developed on the basis of a crate stall (*Fig. 2*). Of the original crate stall, a side wing was left, which was used to partition the piglet area off. By swivelling this grid and putting the rear bar in a different position, it was possible to fix the sow to the wall temporarily.

Stalling up in compartment 4, A_4, was similar to A_3. The only difference was that it was impossible to fix the sow.

Since the possibility of fixing a sow temporarily was not used in A_3 during the entire trial period, compartments A_3 and A_4 did not differ with regard to the housing system. A slight difference existed in the form of straw supply in the second phase of the trial, which will be discussed below.

Trial Period and Straw Supply

The trial began with work management studies in the period from 13 April 1999 until 14 October 1999 [1; 2]. All other trial questions were researched in the period from 20 April 2000 until 25 April 2002. This period was divided into two trial phases, VI and VII. Like in the work management studies, no straw was used during VI. In VII, the sows were offered straw for a limited period of time in order to allow them to exhibit nest building behaviour. In spring 2001, the changeover from VI to VII was carried out differently compartment-wise.

For straw supply, straw racks were attached to the crate stall in A_1 and A_2 and the grid adjacent to the piglet resting area in A_3 two days before the calculated farrowing date. Approximately two days after birth, these racks were removed from the pen. In A_4, metal sheets were fitted under the trough during the entire trial phase VII. On these sheets, straw was able to be offered on the floor.

Independent of the form of straw supply, each sow received 500 g of straw two days before the calculated farrowing date. Two days after birth, the straw which remained in the rack or on the metal sheet was removed and weighed back.

Stall Climate Measurements and Assessment of Pen Soiling

Relative humidity and air temperature in the stall were continuously measured at one point in each compartment at a height of 2000 mm.

The exhaust air volume flows of the individual compartments were calculated daily on the basis of the ventilation rate indicated by the ventilation computer. Ammonia concentration was measured three times a week with the aid of a PAC III E gas measuring instrument (Dräger company, Lübeck). The measurement was carried out at 12 points in each compartment.

The total suspended particulate matter in the air was measured in the middle of the compartments at a height of 1500 mm using a TEOM 1400 measurement device (Rupprecht & Patashnick Company, Albany, NY) as described previously [3].

For the assessment of pen soiling, the pens were divided into four main areas of the same size, which met in the middle of the pen. In each of these areas, four sub-areas were distinguished. Pen soiling was evaluated once per week. According to subjective discretion, the individual areas were divided into five classes ranging from clean to very heavily soiled. For clarity's sake, soiling was converted into percent. This parameter, which is termed soiling degree in the present study, was based on the soiled area and the subjective mark given to describe the soiling.

Results and Discussion

With regard to temperature and relative humidity, differences between the compartments were small. Over the average of the trial years, stall temperature was lowest in compartment A_1. Even there, however, temperature was within the performance-oriented optimal range according to reference [4].

With regard to airborne dust, there was no directed difference between the compartments as well (A_1, 318 µg m^{-3}; A_2, 330 µg m^{-3}; A_3, 262 µg m^{-3}; A_4, 392 µg m^{-3}). By means of analysis of variance, no significant influence of the trial compartments on dust concentration could be established.

Therefore, the present study does not provide any indication that more possibilities of activity for sows with piglets lead to increased dust formation in the stall compartment under the given housing conditions.

No directed difference could be distinguished between the trial phases with and without the provision of straw as nest construction material. The fact that offering straw to the sows did not influence dust concentration can be explained as a result of the extremely small quantity.

The ammonia concentrations in the stall air were low in each of the compartments (A_1, 6 ppm; A_2, 8 ppm; A_3, 7 ppm; A_4, 8 ppm). Even though the influence of the stall compartment on this parameter was highly significant, it does not express any directed differences between the housing variants.

Non-parametric analysis of variance showed the influence of the housing variant on pen soiling to be significant. However, differences between the individual compartments were small (A_1, 8.1 %; A_2, 7.7 %; A_3, 8.8 %; A_4, 9.0 %). The differentiation of the soiling of the entire pen area into the individual sub-areas shows that area 4 (the pen area adjacent to the feed passage) in the crate stall variants A_1 and A_2 and area 2 (the pen area adjacent to the wall) in the activity pens (A_3 and A_4) were worst affected.

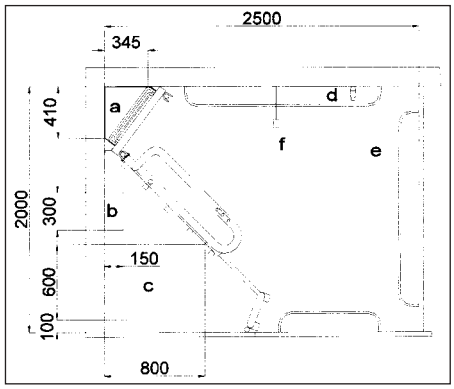

Fig. 2: Ground plan of a pen in section A_3, movable pen with the option of fixing the sow (measures in mm): a = feed trough with integrated waterer for the sow; b = piglet creep feeder; c = piglet lying area; d = waterer for piglets; e = piglet protection bow; f = bow for fixing the slewable separation of the farrowing section

Conclusions

The improved possibilities of activity for the mother animals did not result in measurable effects on the stall climate. Small straw quantities did not increase suspended dust concentration in the stall air.

The increased mobility of the sows in the activity pens led to the soiling of otherwise clean pen areas (e.g. the trough area), which, however, was of little importance at least under quantitative aspects.

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