Eva Gallmann, Wolfgang Bea and Eberhard Hartung, Hohenheim

Conversion solution for fully slatted floors

Sustainable fattening pig production requires the development and testing of various housing solutions, taking into account the investment and running costs. Equally, optimising and adapting existing housing systems must be examined as an alternative to new building. With this in mind, a conversion solution for a slatted floor piggery was developed and executed for comparative experiments to determine its environmental soundness and its suitability for meeting the animals' needs. The conversion solution includes a covered, plain-fixed resting area with two perforated loafing areas, one on each side. It also has a sensor-controlled liquid feeding system, occupation devices and gravity ventilation.

Dipl.-Ing. sc. agr. Eva Gallmann and Dipl.-Ing. sc. agr. Wolfgang Bea are members of the scientific staff, Dr. Eberhard Hartung is scientific assistant, in the Faculty of Process Engineering in Animal Production and Agricultural Buildings (Head: Prof. Dr. T. Jungbluth), Institute of Agricultural Engineering, Hohenheim University, Garbenstr. 9, 70599 Stuttgart; e-mail:gallmann@uni-hohenheim.de
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Feeding pig production, housing comparison

At the Institute of Agricultural Engineering, Hohenheim University the questions of whether a conversion solution for slatted floor housing can meet environmental and animal-physiological requirements and represent an alternative to new building is being examined. Starting with an existing fully slatted floor system in the experimental housing shed for fattening pigs in Hohenheim [1], a conversion solution was designed and executed which combines the advantages of the litter-less method with those of the latest housing systems with separate climate and functional areas.

The experimental housing is subdivided into two separate compartments, so that parallel experiments and system comparisons can be carried out. This makes it possible to check the functioning and assess the conversion solution. Of the formerly identical compartments, the one on the south was kept almost unchanged as a reference system with fully slatted floor, and the northern compartment was converted.

The conversion

The layout plan, main functional dimensions and characteristics of the conversion solution are shown in comparison with the slatted floor reference system in *table 1, figures 1 and 2*.

Layout

The former arrangement with three pens per compartment side was abandoned and each row of pens was converted into a single pen for 24 animals each.

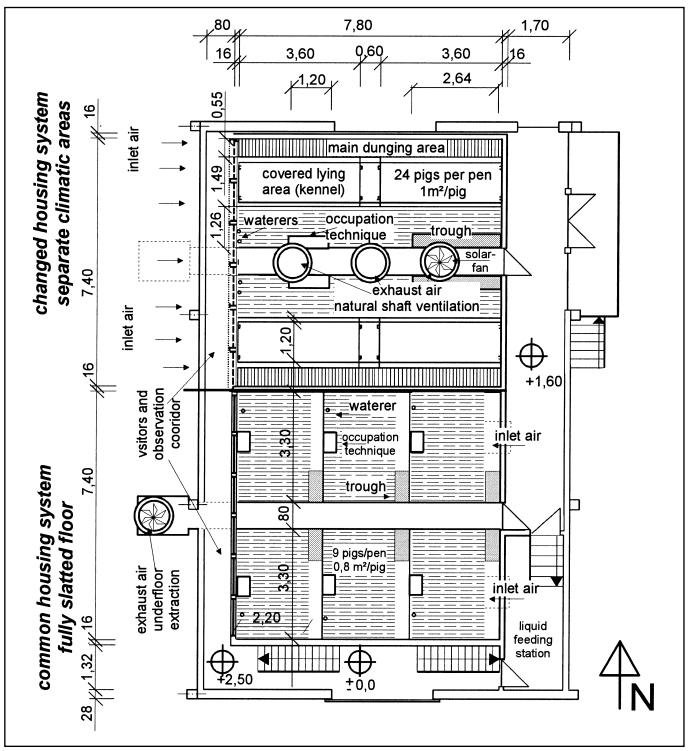

Fig. 1: Ground plan of the experimental housing

As before, the slurry cellar underneath the pens is used for manure removal. The pens are divided along the longitudinal axis into three areas. At the wall side there is a 55 cm wide slatted area which is above all intended as a dung passage and reserve loafing area. The existing concrete slatted floor was replaced by plastic gratings. This makes it easier for the dung to drop through this comparatively heavily dung-soiled, but less highly frequented, area so that the soiled area can be reduced. The 1.20-metre wide covered resting area, in the middle is adjacent to this. It then borders on broader concrete slatted area on the aisle side, where the trough, occupation devices and drinkers are placed. This can be described as the activity area.

Resting area design

The resting area consists of pre-fabricated, slightly arched concrete elements which are placed on the existing concrete slatted floor. The floor elements are equipped with an integrated tube system which allows heating or cooling with water. In this way, the resting area temperature can be adjusted to the animals' needs for heating or cooling and at the same time it serves as a control instrument to

	Reference system fully slatted floor	Redesign solution separate climate areas
Housing system		
pen layout	6 pens each with 9 animals	2 pens each with 24 animals
measurements		
without trough space	3,30 m • 2,20 m	7,80 m • 3.30 m
net area per animal	0,8 m^2	1 m^2
movement area	slatted floor	gangway concrete fully slatted with plastic on wall sides
loafing area	concrete fully slatted	covered (concrete elements) heatable and coolable 1.5 m wide and 0.4 m^2/animal
loafing area microclimate covers	not applied (heated housing)	hard foam plates 1.2 m wide, 1.1 m high, strip curtains on both sides
trough positioning	single transverse trough	longitudinal trough
occupation equipment	1 Hohenheim occupation automatic for every 9 animals	2 occupation automatics for every 24 animals
ventilation	forced ventilation underfloor extraction	natural ventilation shaft ventilation
air introduction	trickle ventilation canal above and in middle of every pen row	80 cm broad opening from 1.70 m over floor level over total western housing breadth (air introduction area 6 m^2) temperature regulated roller blinds
air emission	underfloor extraction under the entire feed passage 1 emission shaft D=63 cm	gravity shaft ventilation 3 over-passage ventilation shafts with D=63 cm eastern chimney for-support ventilation with temperature-regulated solar fan
feeding	liquid feeding with trough-fill control sensors animal/feeding place ratio 3:1 12 feeding times from 6.00 to 22.00 hrs	
manure handling	slurry system; with slurry cellars on both sides of feed passage with storage capacity for a feeding cycle pipeline slurry withdrawal with bucket fastenings	

Table 1:Description and comparison of the housing systems investigated (fully slatted floor with forced ventilation, separate climatic aereas with natural ventilation)

maintain the function areas. The resting area was covered with rigid foam panels and provided with an opaque curtain on the two long sides. This suspended cover can be lifted by means of a winding motor for better checking of the animals and for cleaning. For improved regulation of the air quality in the resting area, adjustable openings were provided so that used air can be emitted.

Ventilation

The forced ventilation system was converted to a free shaft-type ventilation system. The heat-insulated inner lining was retained, apart from the new air inflow and outflow openings. Three waste air chimneys were installed in the centre over the aisle. The eastern chimney is fitted with a battery/mains-buffered temperature-regulated solar ventilator. It provides support ventilation and maintains a minimum volume flow in weather conditions where the temperature difference and the wind pressure are not sufficient to activate the natural ventilation. The existing window area above the western side of the compartment, in the main wind direction and along the entire width of the compartment, is used for the air inflow. The air inflow cross-section is adjusted using a temperature-controlled winding roller.

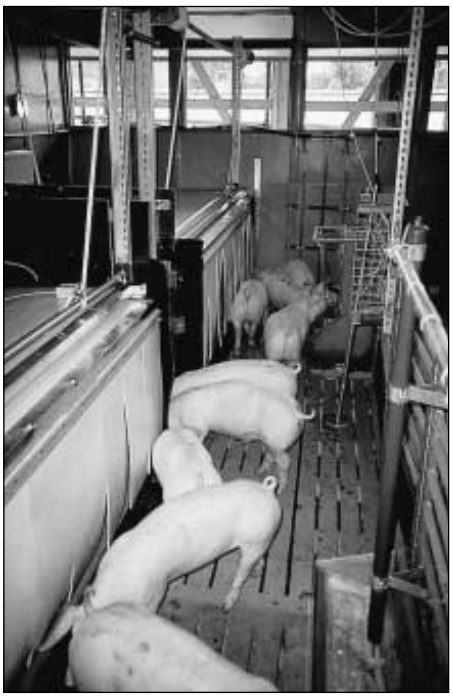

Fig. 2: Structural alternation solution for separate climatic areas

Initial findings

There have so far been two fattening cycles under summer and winter conditions in the experimental housing for fattening pigs in Hohenheim, and the basic concept of the conversion solution for fully slatted floor housing has proved successful. The intended separation into functional areas is largely accepted and observed by the animals. Due to the limited pen depth, the dung and retreat area next to the wall has proved useful in facilitating the animals' movements and keeping the resting area clean, even though this reduces the space available for the activity area. In summer 2000 it is planned to move the monitoring corridor which is currently in the centre of the pen to the western side below the air inflow openings. It has been observed that the animals establish their manure area along the entire width of the western side, thus partly soiling the resting area. The design of the free ventilation system as a shaft-type ventilation system offers several advantages. Only slight changes to the building are necessary, and already available ventilation openings can be used by ducting the waste air accordingly. Using supporting ventilators in extreme weather conditions increases the reliability of the system.

Current experiments comparing this system with the slatted floor reference system concentrate on its appropriateness for the environment and for the animals' well-being, as well as on its practicality. Initial findings from the fattening cycles carried out so far will be published at the end of the year in „Landtechnik".

Literature

Books are signified with •

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