

# High animal comfort and low emissions in a new housing system for pigs - conceptual study and first results from pilot farms and laboratory experiments

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## Abstract

The objective of the DBU-funded project "Pig farming without FYM and slurry" is the development of a pig farming system which, on the one hand, significantly reduces environmentally and climate-relevant emissions and, on the other hand, meets the socio-political requirements for animal-friendly livestock farming. The newly developed system is based on the separation of faeces and urine right in the barn using an optimised and automated underfloor manure removal system. The separated urine is quickly removed from the pen and, in addition, is already stabilised in the pen with urease inhibitors (hydrated lime, sulphuric acid, synthetic substances), so that the emission of ammonia is prevented to a great extent.

Keywords: animal comfort, urease inhibition, low emission pig house, urine-faeces-segregation, manure nutrient recovery

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## 1. Objectives and working hypothesis

The objective of the DBU-funded project is the development of a pig production system that drastically reduces environmentally and climate-relevant emissions, optimises N-efficiency and at the same time meets the socio-political requirements for animal-friendly farming. The working hypothesis is that these requirements cannot be met with the current technologies for pig housing systems based on liquid or farmyard manure systems.

## 2. Concept of housing system and removal system

Within the scope of an interdisciplinary cooperation, existing components of a naturally ventilated housing system already tested in practice were further developed by several

structural-technical components. The housing system is characterised by a symmetrical structure of 23-25 m width (Fig. 1) and an interior comfort zone that offers heating and cooling. Faeces and urine are separated in the barn with a scraping or robot system. The separated urine is stabilised in the barn with either acids, leaches or synthetic urease inhibitors and is quickly removed from the barn. Practical observations show that the housing system is very well adapted to provide the fattening pigs with an animal-friendly environment and to support the animals in their inborn cleanliness behaviour. The reversal of the functional areas, which can be observed in most cases by creating defecation wallows in the comfort zone, can be avoided.

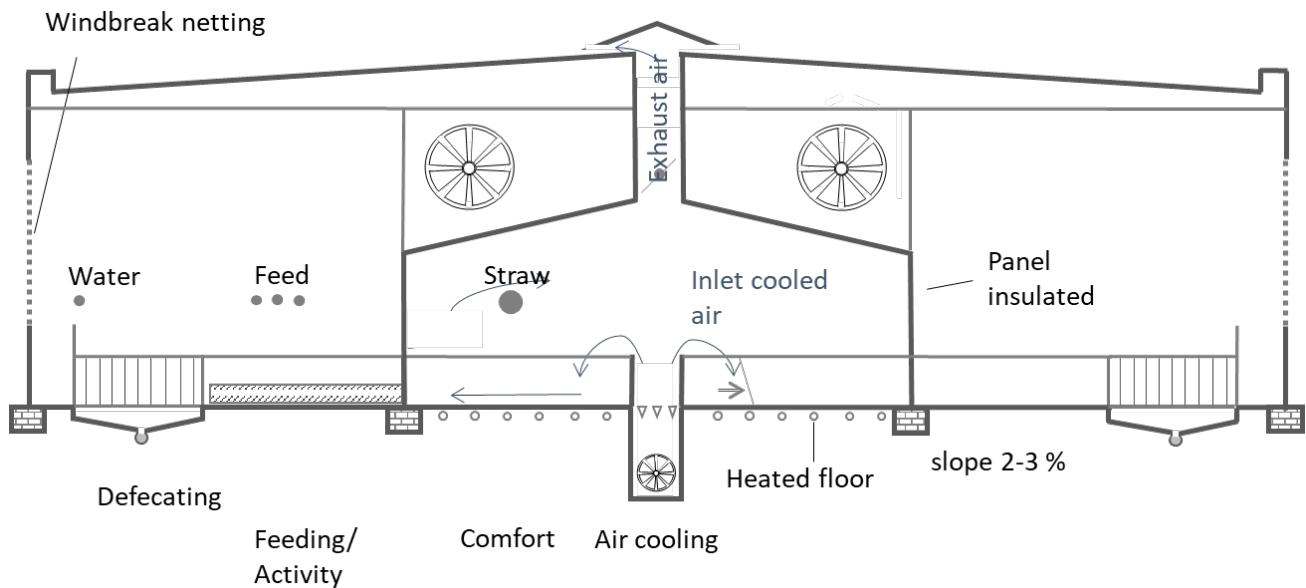


Fig. 1: Finishing pig house with flat roof construction and encapsulated comfort zone

### 3. Laboratory tests on stabilization of urea and precipitation of nutrients in urine

A prerequisite for the low-emission and environmentally sound collecting, storage and further treatment of urine is the inhibition of urea hydrolysis immediately after urination. Further treatment of the urine should result in nutrient concentrates which can then be used as fertiliser in an environmentally sound manner.

Laboratory tests have shown that the addition of acid (up to a pH of 2.5 with  $\text{H}_2\text{SO}_4$ ) or leach (pH 12.3 with  $\text{Ca}(\text{OH})_2$ ) completely suppresses urea hydrolysis over the entire 30-day experimental period (Harder, 2019).

The alkalisation of native urine resulted in precipitation rates of 100 % for calcium, 68 % for phosphorus and 73 % for magnesium. When acidified, all nutrients remain dissolved.

### 4. Emission abatement

The inhibition of urease as well as the induction of nutritional element precipitation reactions can be controlled very effectively. The production of a low nutrient effluent is feasible. Accordingly, it can be expected that ammonia emissions can be reduced by 70 % with this integrated manure management compared to fully perforated housing systems. By largely preventing fouling processes, methane emissions will presumably be reduced by 90 % and odour emissions by 50-70 %.

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