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Natural Ventilation in Pig Housing

The Important Points for North Germany

Natural ventilation in pig housing meets future requirements for sustainable livestock production in two important respects. In comparison with conventional closed housing, the former can require substantially lower investment and running costs and, with regard to production methods and housing climate, can be organised to be more in-line with welfare demands. The common aspect of all variations is the foregoing of full insulation and of forced ventilation as well as the structuring of the house compartments into separate climate areas. Natural ventilation houses are used for pregnant sows, pig rearing and for feeding pigs.

In the Weser-Ems region, as in other regions throughout the federal states of Germany, pig production now features an increased use of large-area lateral ventilation in association with so-called natural ventilation housing.

The motive is two-fold: improvement of the quality of air for the livestock and the reducing of investment and running costs. At the same time, lighting intensity, compared with that in classic housing, is considerably increased through natural light with seasonal day length variations.

In broiler, and particularly turkey feeding, enterprises manifold and long-year experience with the principle of lateral ventilation is available. Nearly all Louisiana housing for broilers and open-housing for feeding turkeys are fitted with roller-blinds, also described as jealousies or curtains, facilitating lateral ventilation system on the basis of natural air distribution. Like the whole housing concept, this ventilation system was introduced from the USA. In principle, it comprises a system that has been applied over more than 15 years and proved itself successful over that time.

The use of lateral ventilation for feeding and breeding pig housing is relatively new in the Weser-Ems region. Here, alongside the classic roller blind solution, other variants are available in association with windbreak nets. Lateral ventilation with space board walls originated in Ireland and has also proved successful in practice.

Application of lateral ventilation in pig feeding and piglet rearing

In contrast to poultry feeding enterprises, the introduction of lateral ventilation for pig production has considerable consequences for the housing system being used for weaner production, sows and feeding pigs. Lateral ventilation conditions in pig production has to be planned to include protection from cold and heat for the pigs because of the animals' limited thermo-neutral zone and the associated effects with regard to animal performance, health and welfare. The best way for securing optimal temperature conditions

and comfort is to offer the pigs the choice between different temperature conditions. Where surrounding temperature is low, pigs at rest – when body-heat production is at its lowest and heat-loss through contact with the ground at its greatest – require a freely-accessible draught-free and temperature-insulated loafing area where the animal can create a suitable microclimate with its own body-heat. Detailed solutions in this aspect are not to be covered here.

It's decisive that there can be a choice between a micro and macro climate and that temperatures in these climate areas can easily vary over a broad range, especially with regard to the minimum temperature. The alternating between cold and warm areas within natural ventilation housing is unproblematic for pigs. On the contrary, it can be assumed that this variation has a training effect on the metabolism, especially regarding thermo-regulation and the immunity system. The thermo-regulation potential in unhealthy animals can, however, be greatly impaired so that ill animals should have appropriate facilities such as a separate hospital pen with the possibility of additional heating.

In principle a combination of windbreak nets or perforated plastic gridwork nets with rolling facilities for regulating the inlet and exhaust air flow is almost always chosen for feeding pig housing. The systems are fitted on the long elevations of the buildings with openings of around 2 m height for windbreak nets and 1.5 m height for plastic gridwork nets with a solidly-built base wall 1 m in height. In all cases, only UV-stable material should be used, if possible with DLG-recognition. Extremely important for ensuring long working life of the equipment is the siting of the nets for friction-free operation and the solid mounting of the equipment with, e.g. eyelet skirting, tensile bracing and/or Klemm profiles. Various investigations show

that the individual types of net are very different in their ability to brake the wind speed. Decisive for the wind braking effect is firstly the form and the size of the individual openings and their number per area unit.

Measurements in various pighouses using the Nürtinger or the „Vechta Compost“ system conclusively confirm that ammonia concentration is very low at under 1 ppm up to a maximum 8 to 10 ppm, according to the time of year, position of blinds, speed of wind and its direction to the building.



The relative air moisture in the houses follows that of outdoors (maximum 10%, depending on the position of the blinds. Classic windbreak nets have a strong braking effect on the wind as it enters the housing from 1 m inside of the net. This has definite advantages and disadvantages:

Advantages are

- the question as to whether the blinds should be rolled from the top of the opening to the bottom or vice versa is of secondary importance
- the position of the blinds can remain unchanged over long periods of the season/day. Manual adjustment of blinds is therefore a viable and practical option
- the blinds on the lee side of buildings are fully opened for longer periods with adjustments only required on the windward side
- in principle, draught problems in the livestock areas cannot occur.

Disadvantages are

- the windnets becomes very dirty and must be regularly cleaned (in practice, after every feeding period)
- the air exchange can be greatly reduced during low wind velocity periods in summer
- where the wind flow in relation the building is not ideal (e.g. at an angle to building side elevation) an uneven through-ventilation of the building occurs during nearly all

seasons of the year.

Plastic grid nets do not have the disadvantages of the classic windbreak net, but nor do they have all the positive attributes. Here, it is basically always advisable to apply an automatic control of the blinds over a mini weather station. In fact, where buildings tend to be long, as with poultry feeding units, blind control should be split-up into shorter units along the length of the house. Opening of the blinds from top to bottom is absolutely necessary. In our opinion, foldable blinds should not be used in pig buildings. Roller blinds are to be advised here because of their longer working life.

Naturally-ventilated housing with lateral airflow for feeding pigs only offers completely satisfactory results in all seasons and all wind directions, independently of the detail development of inlet and exhaust air openings on building side elevations, when

- the building is open to the wind on all sides. If possible the distance to the next building or any group of higher trees should be over 20 m
- the breadth of the building is limited to 15 m
- eaves height is at least 3 m and roof slope over 20°
- roof overhang is 1 m in order to at least strongly reduce rain ingress in strong winds
- the building outside walls are of support-free construction with smooth (insulated) cladding
- an adjustable ridge opening with wind shield is fitted.

In most cases, no further specified calculations are established for the dimensioning of inlet and exhaust air openings.

On the basis of air volume flow determined up until now from multiple measurements under all conditions, the minimum air rate per animal according to DIN 18910 is exceeded to a great extent (factor of 10 and more). This means that all occurring substance and temperature problems are mostly better carried away than in a closed building. The respective consequence for air quality, at least from a substance point of view, can be regarded as very positive.

Lateral air flow in natural ventilation housing for pregnant sows

The developments for lateral ventilation for feeding pigs and piglet production are here analogous. The specific demands on the fitting and operation of blinds are appropriately less for breeding sows because of the greater cold-tolerance of breeding sows and the very small temperature influence on their reproductive performance. Here too, separate climate areas are identified as a basic require-

ment for strawless, naturally-ventilated, housing with lateral air flow. Only plastic gridwork nets, partly without supplementary blinds, are fitted for the inlet and exhaust air openings.

Housing system

For feeding pig and sow units, the housing system is strawless, with mainly dry feeding. In the piglet production units, straw bedding systems (deep straw) in association with large groups and dry feeding is used. Compost systems for feeding pigs are up until now only occasionally used and then in association with direct marketing schemes.

Emission characteristics

Because of their, in the main, lower inside temperatures and lower rate of air exchange, naturally-ventilated houses produce a lower intensity of smell compared with closed housing with forced ventilation. On open sites – and this is very often the case in Weser-Ems region – naturally-ventilated houses appear clearly more favourable with respect to emission effects than does force-ventilated housing. For this reason, no system-caused difficulties appear in the context of planning and building permission procedures. In built-up areas, or in the vicinity of housing, naturally-ventilated housing for pigs is only advised in conjunction with low-smell systems (e.g. compost system).

Conclusion

Natural-ventilation offers a range of possibilities for housing livestock according to behavioural requirements, reduction of investment requirements (15 to 45%) despite clearly higher space requirements, improvement of air quality inside housing and reduction of emissions.

Naturally-ventilated housing is in total more difficult to manage than closed, fully-slatted strawless housing with forced ventilation (cleaning, disinfecting, livestock care). According to the design, naturally-ventilated housing leads to a slightly to strongly increased labour input requirement per feeding place (in comparison with fully-slatted systems), represents higher demands from the site and is climatically controllable only as when buildings are open to wind movements on all sides. The livestock performance is in every way comparable to that within conventional, closed housing.

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