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## House Climate for Calves and Heifers

### Lessons from the Federal Competition Agricultural Construction 2004

*Air-temperature, lying floor heat insulation, the concentration of noxious gases and air movement influence the health and therefore the wellbeing of calves. The winners of the Federal Competition Agricultural Construction 2004 have houses with a temperate outdoor climate. They all have a well insulated lying floor, and despite the different construction modes, they have a good to excellent air-quality and a low germ-pressure. These results are encouraging and future oriented.*

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#### Keywords

Calves rearing, heifer rearing, house climate, ammonia, germ pressure, non-insulated house

#### Literature

- [1] Richter, Th. und D. Burgmayer: Vergleich von zwei Vollspaltenboden- und drei Tretmistställen für die Bullenmast hinsichtlich des Staubgehaltes, des Ammoniak- und Kohlendioxidgehaltes der Luft. Tagung der Internationalen Gesellschaft für Nutztierhaltung, Veterinärmedizinische Universität Wien, 1999, Tagungsband
- [2] Richter, Th., P. Rietzler und M. Karrer: Gruppenhaltung von Kälbern in Außenklimaställen. Arbeitsblatt Landwirtschaftliches Bauwesen, ALB Bayern, Grub, 1997

The subject of the Federal Competition Agricultural Construction 2004 was calf- and heifer houses for dairy-cattle. In the following, the aspect of animal welfare, especially of microclimate (-house-climate), will be discussed.

#### Definition of animal welfare

In the following by animal welfare<sup>1)</sup> the protection from pain, harm and suffering shall be mend.

Contrary to a frequently published opinion, the main animal-welfare-problems in reality are diseases and just on the second hand deficits in ethological possibilities or in housing offers. Hence the main focus had to be on animal health and hygiene. Beside these aspects, housing-details were dealt with. For the health-care of the calves and heifers, the house microclimate has an important influence.

#### Change in the point of view

In veterinary medicine and the animal-welfare associated science a change in the point of view has taken place, not recognised by many scientists till now. Were the causes of livestock diseases traced back formerly to the influence of microbes, nowadays the scientists realise that most of the diseases, which are of economic importance, are accompanied by microbes, but the microbes just become pathogen, when the animal is harmed in it's defence resistance (so called factoris diseases). For calves the economically most important diseases, the enzootic pneumonia (icrowding disease<sup>1)</sup>, the omphalitis and the main part of diarrhoeas, are to be included in these categories. A main reason for the damage of the defence resistance is the microclimate in the house.

<sup>1)</sup> German animal welfare act § 1: The purpose of this act is to protect, regarding the responsibility of humans for the animal as co-creature, the animals life and wellbeing. Nobody is allowed to cause pain, damage or suffering of an animal without reasonable reason.

#### Microclimate

By „microclimate“ mostly the physical and chemical conditions of the air are summarised. Of interest for this paper are the temperature, the air-movement and the gases. Additionally there is a focus on microbes, which cause the „germ-pressure“. They have a negative impact on the animals and their reproduction is closely related to climate-factors.

#### The winners and their competitors

Three houses for calves were awarded (Wipertaler Agrar GmbH and the family farms Wiewer-Rellmann and Fischer) and the house for heifers of the Sedlmair family farm (little calves are housed in igloos at the Sedlmair farm). All of the four winners realised solutions, which take the needs of the animals, concerning the microclimate, to a very high level into account. This was not the case with some of the competitors. A negative example had a quite nice house for heifers, but the calves during the colostrum-period just had a tiny room, which hardly could be ventilated, and the calves during the milk-feeding-period were housed in a totally insufficiently ventilated corner with a badly emitting deep-litter mattress. As you could expect, the calves showed signs of respiratory disease.

#### Temperature

Concerning the temperature it must be differentiated between the air-temperature and the heat conductivity of the lying-floor. Homiothermic animals are able and interested to keep their body-temperature constant under different temperatures of the surrounding. The sector of the surrounding temperature, in which they can do this, without the need of additional energy, is called thermo-neutral zone. For newly born calves this zone is in the positive sector (of the centigrade-scale). As the growth rate is correlated to a lot of „waste-heat“ (calorigenic energy) it moves to the negative part of the scale soon. Surviving is possible in any case even



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The degree of emission depends additionally on the size of the emitting-surface. Cubicles houses have a smaller emitting-surface than those with deep-litter. The size of the surface of a straw-deep-litter-mattress is

for newly born calves under all of the temperatures you can expect (in Germany), on the condition that the calves are dry, the lying-floor is insulated sufficiently and there is no excessive air-motion that chills the calves. The microbiological production of damaging gases and the reproduction of pathogen micro organisms is related to higher temperatures. By this housing calves in temperate outdoor-climate takes better care for the health than housing in the traditional insulated houses.

All of the winners consequently have outdoor-climate, non-insulated houses. The most important insulation of the lying-floor is guaranteed at all farms. The houses of Wiewer-Rellmann and the Wippertaler Agrar GmbH have deep-litter-mattresses, the house of the Sedlmair-farm is supplied with smooth mattresses and the Fischer-farm has cubicles littered with straw.

### Gases, air-motion and ventilation

High amounts of (damaging)gases cause disease of the respiratory system. The most important damaging gas is ammonia. The limit for recognising ammonia by humans is about 8 to 10 ppm, at 20 ppm<sup>2</sup> human eyes begin to water. Ammonia should not be recognised in animal houses by humans.

The damaging gases can be reduced by ventilation. More important than removing gases from the air in the house would be to prevent the production. Ammonia is produced by micro-organisms from urea and from amino acids in the faeces. The activity of the microbes depends on substrate, temperature, moisture and time. Removing the excrements quickly from the house, e.g. by scrapers, reduces the ammonia production as well as a low temperature of the slurry.

<sup>2</sup>) Threshold value of the German animal welfare decree

especially big, because of the irregular surface and the capillary effect of the wet straw. The temperature inside the straw-mattress is even higher, so more emission of ammonia can be expected, compared to houses with slurry or daily change of bedding [1]. So ventilation is even more important.

The air-motion in the house is feared as draught by a lot of farmers. On the other hand a frequent air-change to remove damaging gases, dust and humidity is preferable. Draught means an air-jet that hitting the body partially and is about 4 centigrade (or more) colder than the house-temperature. Small apertures for inlet air that force a distinct air-jet, make the situation even worse. Besides appropriately designed, can a big house-volume lead to a high air-change-rate and avoid draught as well. Up to 17 m<sup>2</sup> per calf are recommended. One, who does not like mighty buildings, can build tiny buildings with direct access to the air outside, which incorporates the atmosphere into the house-volume. This is the principle of igloos and multi-house-barns [2]. Here it must be ensured that - especially in summer - the gases are really removed from the animals' area, this is not always done well, especially by some group-igloos.

The houses of Wiewer-Rellmann and Wippertaler Agrar GmbH are constructed with an open front and three walls closed. The lying-floor is very short in addition, so the gas-molecules have a short way to the surrounding air. The house of Wiewer-Rellmann has some apertures at the back wall, which can be opened and closed when needed. The farmers Sedlmair and Fischer trust in wind-shielding-nets, Fischer's house has an open front as well. The houses of the Wippertaler Agrar GmbH and the „three-bay house“ of the Sedlmair family include an open barn-yard between lying-floor and feeding table. The principle of the „three-

bay house“ - cubicles, wind-shielding-net and integrated open-yard - was awarded with the model of the „Nuertinger Open-Air-Barn“ of the Bäumler family in the competition in 2000.

### Germ-pressure

By the term germ- the entity of the pathogen micro organisms is meant, having an influence on the animals. Methods to avoid damage by gases, especially a quick separation of excrements from the animals, dryness and fresh and cool air, reduce the germ-pressure. Most important is the stocking density. Open-yards reduce the stocking density considerably.

For practical purposes it is important to distinguish between micro organisms, which can reproduce just in the animal and others that can reproduce even in the environment. If they just reproduce inside the host excretion cannot be reduced directly, By just by removing the excrements and by ventilation. To this category belong all of the viruses and some bacteria, e.g. *Mycobacterium spp.* (that causes tuberculosis), or *Brucella spp.* and *Bordetella spp.*, which are important with pneumonia, and most of the parasites. But if they reproduce outside the host in the close environment, the animal owner can effect the number of germs. The most important pathogens, which can reproduce in the environment, are bacteria but some fungi, too. Especially the all-day-bad-guys, like *Escherichia coli*, *Staphylococcus aureus*, *Salmonella spp.*, *Klebsiella etc.* can survive and reproduce in a dead substrate.

Most of these bacteria have a temperature requirement, which is comparable with the body temperature of the hosts, the livestock. Lowering the barn-temperature below 10°C reduces the reproduction of the pathogens enormously. The substrates outside of the body are mainly the excrements. The faster the excrements are separated, the better for the animals.

Using non-insulated houses with low temperatures in average, all of the prize-winners have a low germ-pressure from the beginning. Especially the house of the Fischer family has to mentioned. Cubicles with straw bedding, and daily removing of excrements off the running alleys reduces the reproduction of pathogens successfully.