



# Optimization of the stable micro-barn climate to improve the animal health of veal calves

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## Key words

Calf health, Antibiotics, Barn ventilation, Air quality, Microclimate, Animal Welfare, Livestock husbandry, Barn climate

## Aim of the study

This study was performed to: (i) develop and validate a new measurement method with stationary and mobile ammonia sensors and compare the measurements of both sensor types; (ii) evaluate the effect of a ventilation system on the ammonia concentrations under closed conditions; (iii) apply and validate the developed measurement method under practice conditions to record data on barn climate of different Swiss calf fattening barns.

## Material and methods

In the first study, the developed measurement method was applied in a single two-compartment calf fattening barn (experimental barn). In total 6 stationary sensors were installed at animal level and 4 mobile sensors were installed with the aid of a halter at the calf's heads. The sensors were equally distributed among the two compartments. Measurements with stationary and mobile sensors were performed over 14 weeks, to generate long-term data in the micro- and macroclimate range. The collected data was statistically analyzed; we compared measurements of stationary sensors with measurements of mobile sensors.

In the second study, the new measurement method was applied under forced ventilation. Therefore, the two compartments of the experimental barn were separated and equipped with a ceiling ventilation system, that was manually adjustable for each compartment. In addition, a system to locate calves' position in the barn was installed in both compartments. Again, measurements lasted for 14 weeks, and data was analyzed statistically. The third study was conducted on different commercial calf fattening barns in Switzerland, to collect data under practice conditions. Therefore, the developed measurement method was applied in different calf fattening barns in a comparable manner as in the experimental barn, but partwise adapted to the conditions on site. Measurements on commercial farms each lasted at least one month and were analyzed separately for each farm.

## Results and significance

The first long-term measurements of the macro- and microclimate conditions in the experimental calf fattening barn were successfully conducted. We found a significant difference between measurements of stationary and mobile sensors. Based on the results, we conclude that climate in the microclimatic range is more variable than in the macroclimatic range. Furthermore, we could get a detailed and realistic picture of the barn climate in the investigated experimental barn. We found daily patterns and strong fluctuations over time. Furthermore, these first results showed that a non-negligible part of the measured ammonia concentrations is above the recommended limit value of 10 ppm. Especially measurements from the direct environment (mobile sensors) of the calves showed high peak values and strong fluctuations. The publication of these results is finished and will be submitted to *Livestock science*, an international journal on Agriculture, Dairy, and Animal Science.

For the second experiment, data on the barn climate under forced ventilation could be successfully recorded over several weeks. Additionally, we installed a system to record the calves' position in the barn. This system was evaluated and unfortunately, the system did not prove to be reliable enough to include these data in further evaluations. Various systems on the market are comparable with the one used in our study, often such systems are developed for cattle/cows but not for calves. Therefore, we have not pursued this further. The evaluation of the barn climate data from the ventilation study is currently in progress. We plan to submit the publication of the second study to the Journal of Dairy Science, one of the leading journals in Agriculture, Dairy, and Animal Science category.

For the third study, we collected extensive data from different commercial production sites. We can conclude that the measurement method can also be applied in practice. These data were evaluated in separate student papers (per farm) and are still to be analyzed as a whole. This evaluation is still pending, the publication is planned to be submitted to the Schweizer Archiv für Tierheilkunde, a Swiss journal on Agriculture, Biology, and Environmental Sciences.

The results provide information on a suitable measurement method for the barn climate in macro- and microclimatic range. In the future, such measurements should help to evaluate barn climate properly, develop suitable ventilation systems, and allow optimization in the management. Further research in this area is necessary and could improve animal production systems in the future and therefore, might contribute to animal welfare and potentially also to the reduction of antibiotic consumption.

### **Publications, posters and presentations**

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| 08.09.2021 | Climat d'étable dans la détention de veaux – Méthodes de mesure actuelles, Journée santé animale Proconseil (Poster & Presentation)                                     |
| 26.09.2021 | Ammoniak im Kälberstall, Einweihung Milchviehstall Grangeneuve (Presentation)   |
| 27.10.2021 | Validation of a new method for ammonia measurement in calf barns, AgroVet Strickhof (Poster and Presentation)   |
| 02.11.2021 | Luftqualität in Schweizer Kälbermastbetrieben, Weiterbildungskurs für Baufachleute (Presentation)   |
| 27.01.2022 | Implementation of a New Measurement Method for the Barn Climate in the Macro - and Micro-climate Range of Calf Fattening Barns, GCB Symposium (Poster and Poster Flash) |

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