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BEST PRACTICES

Environmental control in livestock buildings in Mediterranean area

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Summary

Explain your case in one or two sentences

This text aims to present practices that could be applied to monitor environmental conditions inside a livestock building in order to control indoor climate and air quality levels, so as to ensure animals' welfare. The practices can be applied to naturally and mechanically ventilated livestock buildings.

Background information: How was the situation previous to your actions?

The environmental conditions that prevail inside a livestock building induce various physiological and behavioural effects upon animals. Air quality and climate conditions are considered as major factors affecting them. Poor indoor air quality and climate conditions trigger adverse effects to animals related to their welfare, health, growth and production. The degradation of the indoor climate combined with poor ventilation and high pollution levels aggravates the above-mentioned effects. The increase in temperature that is expected to occur due to climate change may also induce various effects to livestock production.

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What were the needs you identified?

There is a need to improve the climate conditions and mitigate air pollution levels inside a livestock building. The control of climate in livestock buildings is mainly based on indoor temperature. However, relative humidity control is considered as one of the most important procedures so as to improve the climate in livestock buildings. Therefore, relative humidity control along with temperature control must be implemented. Additionally, particulate matter and ammonia are considered as important health hazards for animals.

What solution you found to cover those needs?

Continuous, near real time, temporal and spatial monitoring of climate and air quality parameters inside the livestock building

What actions did you take to reach the solution?

- Monitoring indoor climate parameters (temperature, relative humidity, wind speed, wind direction) at several points and heights
- Monitoring indoor air quality (ammonia and size fractionated particulate matter levels) at several points and heights
- An integrated telemetry system was used to collect and transfer the data recoded by some of the equipment indoors
- Monitoring outdoor meteorological parameters (temperature, relative humidity, wind speed, wind direction, solar radiation, precipitation)
- Wired and wireless sensors were installed.
- The farmer can have direct access to the data and to specific advice. Appropriate indices were used for the simplest presentation of the information.

If any, which partners or other organisations did you involve during the process?

- Institute for Bio-Economy and Agri-Technology, Greece
- Livestock farms

What were the main problems or difficulties you had to face?

- Air quality and climate parameters interact inside the livestock building, especially in a naturally ventilated building under hot weather.
- It is difficult to control humidity levels in a livestock building, as the moisture content doesn't remain constant, depending on several factors including feeding diet, feed intake, digestibility, ruminal pH, water intake, fecal and urinary characteristics, bedding material and floor type.
- Under hot weather conditions, natural ventilation alone is not an efficient method to reduce the temperature conditions inside a naturally ventilated livestock building, as outdoor hot air can

move indoors by ventilation, thus preventing cooling inside the barn. In this case, additional, active and passive, protective measures are recommended.

- Accurate determination of the ventilation rate requires more data, like monitoring the concentration levels of a representative gas (i.e. CO_2). Unlike the mechanically ventilated livestock buildings, it is more difficult to determine the naturally ventilation rates.
- Factors, such as ventilation, feeding practices, bedding materials, animal activity and manure management can affect directly or indirectly indoor air quality.

What is the situation now, after your actions?

- Thermal comfort conditions, air pollution levels, and ventilation rate can be adequately adjusted in almost real time taking into account the indoor environmental conditions, as well as the outdoor weather conditions.
- Measurements could be exploited to validate a CFD numerical model that could be applied to assess qualitatively and quantitatively the indoor thermal and pollution flows.

Main lessons learned along the way? *

Monitoring networks support decisively precision livestock farming approaches. They can provide almost real time measurements, informing the farmer about the climate and air quality that prevails inside the livestock building and provide her/him the opportunity to take immediate actions, if needed, e.g. ventilation control, to improve indoor microclimate, which is a major factor in production efficiency. However, a detailed accurate real time monitoring of environmental parameters requires expensive equipment. Additionally, there is still a knowledge gap for the proper and optimum design of ventilation systems in order to improve indoor microclimate and reduce air pollution levels.

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