Best Practice Guide on Housing

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The volatility that has characterised the world dairy industry recently is likely to be a permanent feature and to have a sustainable industry, enterprises must embrace modern technology.

Sustainability in this definition is financial and is closely linked to efficiency of production but the industry must continue to be alert to the health and welfare of animals both from a customer perspective and their impact upon financial sustainability – replacement rate, disease levels and vet bills etc.

Remote sensing and particularly the management decisions informed by this remote sensing will play an increasing role in this strive for efficiency and sustainability.

<u>What does this mean for housing?</u>

The use of sensors can be split into two levels, operational and strategic decisions – the use in daily management decisions and their use in long term policy decisions respectively. The use of sensors in both scenarios, operational and strategic management must ensure that the housing is cow centric allied to cost effective delivery of the daily tasks of dairy production.

Housing design and its use must have positive effects on the health of the animal and welfare of its keeping through the provision of appropriate levels of ventilation, shade, light, air movement, cow comfort and social interaction to ensure the optimum conditions are maintained throughput the housing period i.e. provide optimum conditions to allow full genetic potential realisation,

The experience of one unit moving to new housing showed a 2.5 ppl improvement in profitability with the same cows and same diet, a result solely due to more optimal conditions within the housing.

The main types of sensors utilised in this area are:

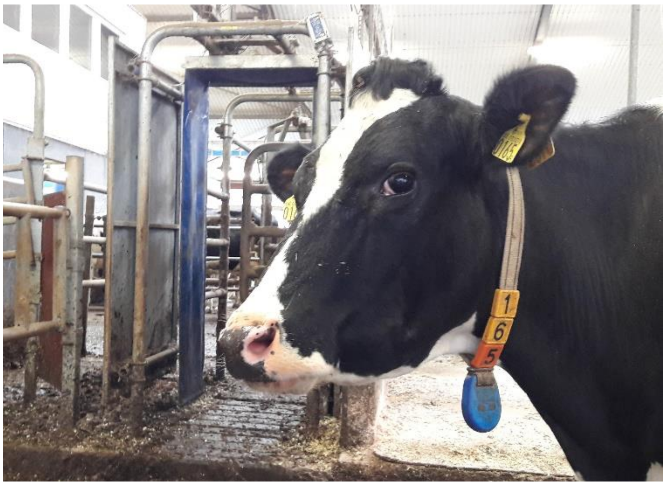
- Position monitors
- Activity monitors
- Environmental sensors

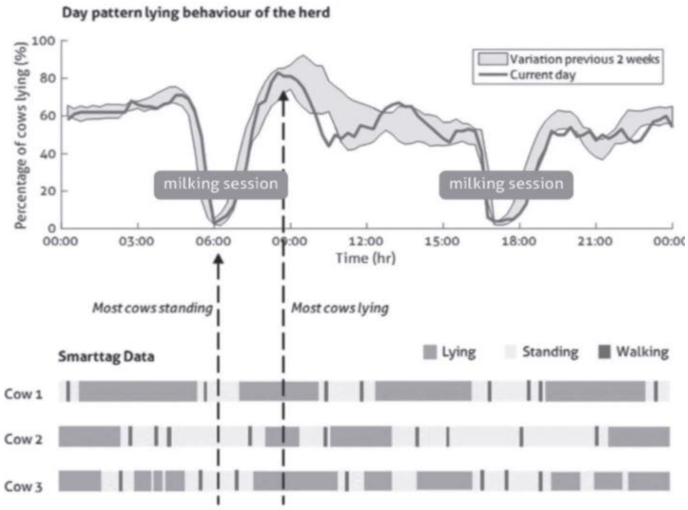
The practical aspects of the first two types is effectively described in other parts of this website (see Reproduction BPG) data transfer, attachment location, battery life etc.

The onging management of all sensors particularly environmental sensors appropriate positioning routine cleaning and annual calibration is required to ensure accurate readings and resultant actions are effective.

Positional monitors

Cow location sensors, GPS driven, such as Nedap Cow Positioning can be extremely useful in finding individual animals for treatment/movement, however the data is valuable in other ways. Other systems exist giving such positional data Faire: iBo Real Time Positioning, Smart Bow: Ear TagLife and Noldus:Tracklab.





It is the amalgamation of this data to show the movement and position of the entire herd/group over time that may illuminate issues of preference or the reduced performance in specific areas within the dairy barn. Fundamentally if the animals monitored behave in a specific way and favour locations is it because this area is more optimal or conversely the other areas are suboptimal.
Once abnormal behaviour or favouring of specific areas are identified, the management must be changed to alleviate the situation, this may range from simply changing the group dynamics/size to non-invasive reorganisation of the cow barn to improvement of the environment in the barn, as described below, to increase the percentage of the barn that is optimal - checked through continual monitoring of cow positional data from the sensors over an appropriate period and conditions.

There is a continual need to assess this scenario as the dynamics of the herd constantly changes throughout the year as does the external ambient conditions.

Activity Sensors

The GPS type of data delivered by the positioning sensors can be linked with activity monitor type of sensor and the concept of daily time budgets to monitor the cows in a specific barn; % lying time, rumination time, feeding time etc (see Activity and Behaviour BPG). The recognition of a deviation from the norm for a specific unit/cows and the ability to respond to said changes is the very essence of decisions driven by remote sensor data.

In one example the farmer who was using sensors to monitor the rumination rate of the cows saw a consistent significant reduction of the rate followed by an extensive period of recovery when the cows were passed through a cow race and crush, a redesign of this area led to an end of this reduction – more consistent rumination and more efficient digestion of feed.

Environmental sensors and control systems

The real-time monitoring of humidity, light, air movement and temperature is the basis for environmental control.

The technology of such sensors is well proven, with the adoption of sensors used widely in human situations to operational level cow housing management.

The requirement for 16 hours of 160+ lux light per 24 hrs is optimum for milk production (6-13% production improvement) – simple light sensors within the buildings linked to the lighting, especially energy efficient LED lighting can give a very quick payback – increased intake leading to increased production.

Work is currently being undertaken to ascertain whether specific wavelength light is more effective in increasing yield but as yet no firm answers.

Heat stress and associated yield depression and health problems can start at temperature as low as 20 C. – and as such can be relatively common in European situation – even in the higher latitudes during the summer.

Temperature is only one part of the issue, humidity is a significant contributing factor and a combined measure the Temperature Humidity Index should be used to ensure that the conditions are effectively assessed.

To install temperature and humidity sensors throughout the housing is simple and cost effective. With accurate measures and parameters set, the automatic control of conditions possible.

Such sensors can be used in natural ventilation systems through the control, activation of air inlet and outlet vents, however, forced or artificial ventilation maybe required with the use of fans, and in such systems the linkage of these to sensors to the activation of fans, misters and sprinklers and outlet vents ensures that the internal climate is maintained as optimum without the intervention of cow keepers – reducing the pressure on staff and ensuring decisions are made objectively related to known cow characteristics and not subjectively. Such integration of humidity monitoring using the [THI (Temperature Humidity Index)] by is an example of this methodology.

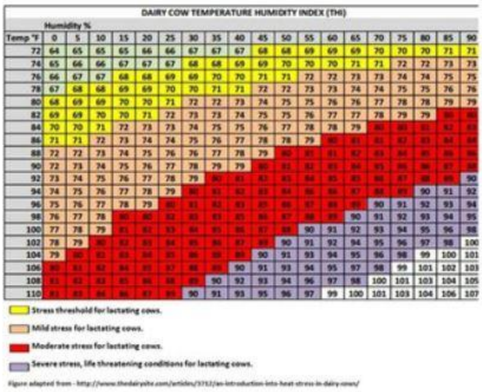


Figure 1. Dairy cows begin to experience heat stress when the Temperature Humidity Index (THI) exceeds 68.

Internal environmental sensing as described above also can be linked to the control of muck scrappers - the viscosity and flow charachteristics of slurry changes with temperature and humidity and to ensure that passages are kept as clean as possible the frequency of activation can be intergarted into the complete internal environmental managment system of the unit.

Sensors are also used to ensure that robotic scrappers cover the entire area and that the surfaces are manitained in optimal condition

Smart Housing

The design of smart cow housing takes the learnings from remote sensors to inform the design of new housing and linked with the usage of new (to agriculture) building techniques and materials has led to a variety of systems that enable cows to be housed in facilities with the full range of sensors incorporated within the structure of the building that react automatically to both internal and external ambient conditions and ensure continual optimum conditions.

Such designs can include both automatically deployed walls and roofs – to achieve optimum conditions.

For such flexibility to be built in - new construction techniques and materials are required -such as fabric/composite materials which are suitable in terms of density and ability to be moved but in transmission of light thus reducing the cost of lighting within the buildings.

Currently the cost of such buildings is comparable to traditional building techniques but have significant beneficial attributes which allow conditions to be optimised and thus production maximised whilst reducing running costs.

However, the differing legislative frameworks within Europe and differing priorities given by different countries will greatly affects the final system adopted.

The capture and processing of ammonia and methane produced by dairy units will mitigate against the use of open structure and deployable walls but nevertheless the use of sensors and the automatic management of fans, extractors etc is central to the successful delivery of optimum cow conditions in systems when external venting of air is not permissible

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