Bolus set to improve rumen health and drive production

Vet and nutrition specialist Richard Vecqueray is employing a new tool which is helping high yielding cattle to 'walk the tightrope' of early lactation.

At a time when the balance between starch and fibre intake has to be carefully managed to avoid acidosis while at the same time optimising milk production, he is using a pH-monitoring bolus to help indicate whether that balance is right.

"The key to high milk yields is starch intake as this drives blood glucose which fuels milk production," he said. "But too much starch will lead to a high concentration of acid in the rumen which will reduce pH and kill off the beneficial fibre-digesting bacteria."

This process initially leads to sub-clinical acidosis and then on to more extreme clinical cases, although the situation can be avoided by feeding more fibre. This will stimulate cudding, increase the production of saliva and raise the rumen pH.

Richard Vecqueray: tightrope.

However, additional fibre will reduce dry matter intake, may compromise milk production and, in the worst cases, will cause the high genetic merit cow to fall into negative energy balance and suffer ketosis.

"By using a pH bolus, we are able to walk that tightrope between these two situations," said Mr Vecqueray.

Designed

Demonstrating the bolus on Mike and Chris King's high-yielding Kingspool herd near Bristol, he said it was designed for use in just a few cows within a group.

These cows would effectively act as sentinel animals that were considered to be representative of the whole group, with just three or four animals regarded as adequate in a group of about 70.

"The boluses have told us a fascinating story," said Mr Vacqueray, remarking peaks in intake and drinking behaviour were also monitored by the device, whose results were displayed on a smart phone.

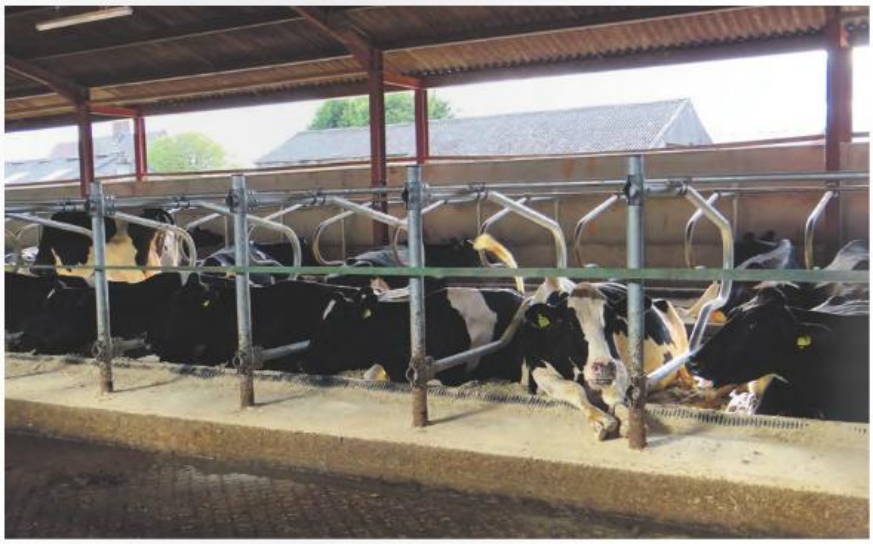
The ideal, he said, was to keep the rumen pH close to but no lower than 5.6 and to reduce fluctuations. This would be a sign of efficient fermentation and reduced methane emissions, both of which were associated with more efficient milk production.

More starch

But a high pH was the signal more starch could potentially be fed, also offering the scope for yields to increase.

On the King family's farm, he said the payback of their three boluses, which each cost £450 plus VAT, had been made many times over, with more precision rationing, better feed efficiency and improved milk production.

"Big economic responses can certainly be expected," he said. "The bolus enables you to feed more starch and to walk the line between acidosis and ketosis."



Monitoring rumen pH at the herd of Mike and Chris King has allowed precise rationing and improved yields.

The eCow pH bolus

▸▸The pH bolus has been developed by Prof Toby Mottram through eCow, his small family company in Devon. The device measures the pH of the cow's reticulum (and effectively its rumen), and transmits a signal to a mobile phone which provides displays and summaries of pH changes.

Used extensively for trial work at universities around the world, the bolus is now being increasingly used on commercial dairy farms. With a lifespan of around five months inside the cow, it is generally used in small numbers of early lactation animals which act as sentinels. The device enables rations to be fine-tuned to maximise starch intake while avoiding acidosis, although it also has a role in optimising the timing of feeds.

Prof Mottram believes with such precision in feeding and nutrition from this and other devices, dairy farmers should realistically be aspiring to produce yields of 20,000 litres.

The UK herd may be genetically capable of 20,000 litres but falls far short of that figure. **Prof Toby Mottram** of the Royal Agricultural University outlines the case for higher yields and how we may have to rethink our approach to keeping dairy cows.

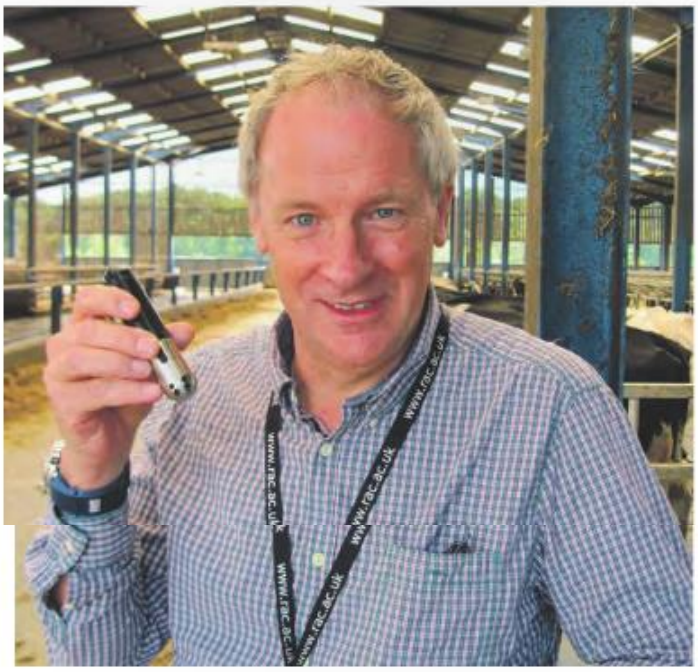
Beyond Boutflour to the 20,000-litre cow

In the immediate post war period Robert Boutflour established a high yield and high margin system at the Steadings where the 22 cows were pampered and fed to achieve high performance.

By 1953 the herd was averaging 1987 gallons (9040 litres). The cows were a mixed bunch bought at the Saturday market in Gloucester and many were elderly by modern standards, so it was no mean achievement.

In the autumn of that year Boutflour gave a conference paper 'Towards the 2000 gallon cow'. This was something quite startling as it translates to 9100 litres.

Now, a mere 60 years later, we are almost there. Our national average is close to 8700 litres but the big difference is somehow we have allowed the assumption to creep in that high yields equate to short lives. I believe we should aim to increase both the yield and the longevity of cows to emulate Smurf – a Canadian cow who retired recently at the age of 15 having given 216k litres in 10 lactations, over 20,000 litres for 10 years.



Prof Toby Mottram: use sensors to monitor and optimise cow functions so that we can get towards the 20k litre cow.

Less methane

But before I get into the how, let's talk about the why of high milk yields. To reduce methane emissions, at yields of 20,000 litres we could meet the current market with a million fewer cows. This alone will reduce our agricultural methane emissions by 30%. By extending longevity we will decrease the number of heifers we need to raise from probably 600,000 a year now to under 140,000 per year.

In addition, by intensifying we can release land for extensive systems which can lock up carbon and nitrogen.

On the animal welfare front, by reducing the number of animals which may suffer poor management, we reduce the sum of suffering, and I would also reverse that dismal Singerish calculation and state we can give animals joy in their daily lives while still achieving high yields.

Three things we need to improve to get to the 20,000-litre, long-lived cow are cow health and nutrition; the living environment of cows; and conserved forage.

In 1976 the first results of measuring progesterone in milk to manage fertility were announced. Most (96%) of cows have viable ovaries and we could cut calving index to under 400 days at a stroke but no-one (save for a prototype system I demonstrated in 2003 and the Herd Navigator system in Denmark) has attempted the engineering approach. We slaughter 500,000 cows per year which have viable ovaries saying we cannot get them pregnant.

The investment required is a few million and the pay back would be in billions.

Nutrient analysis, particularly of silage, is very unreliable and we do not know what cows will do with a diet until we feed it to them. The rumen pH bolus allows us to assess the energy intake of cows and adjust diets to encourage cows to

eat frequently. With new sensors we could look at the nitrogen balance and VFA levels in the rumen and move from a model-based open loop control to sensor-based closed loop systems.

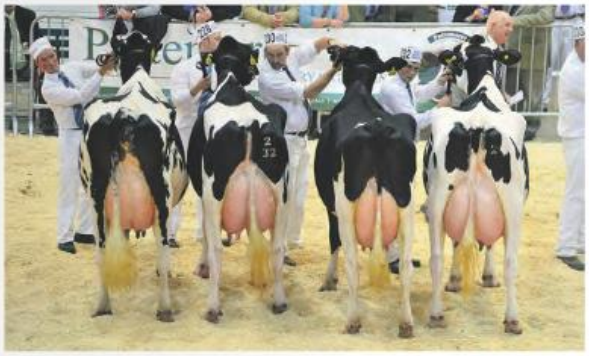
The principal difference between moderate milkers and high yielders is food intake, and cows have an appetite for feed if it is kept fresh and available. Many cows spend hours a day shut in yards where they cannot lie down or eat properly.

Robotic milking allows cows to eat and be milked at times of their own choosing, around 2.7 times a day, and milk yields climb as a result. The most stable rumen pHs we have seen are from a farm in West Devon with two robots milking 120 cows.

Environment

The perfect environment for cows might be characterised as a place where a supply of digestible food is always available, there is a surface to walk on which is non-slip and causes no damage to the feet, there are plentiful dry places to lie in family and friend groups, and where the air is clean.

For about 10 days a year, pasture meets all these criteria but for much of the year there is insufficient nutrients in grass, the ground is either too wet or too stony for comfortable walking, and the weather is inclement. I believe we should include a grazing period for all cattle, and for autumn calving cows a spell at summer pasture is certainly beneficial.



Genetic potential is there for yields of 20,000 litres.

Perhaps the main housing challenge is concrete. This is a hard surface and it quickly becomes slippery. It is also impervious which means urine and faeces mix together increasing emissions of ammonia. What we need is a surface that is non-slip, which separates urine and faeces, that is soft to walk on and is easy and cheap to lay and maintain.

The diets used by Bobby Boutflour at the Steadings herd were based on hay and concentrates with some summer grazing. He said he liked his cows to take in plenty of water by drinking it, so I am not sure what he would have made of the revolution to silage.

We need to improve silage analysis and perhaps one simple way would be to pay contractors for quality rather than speed of operation.

So where does that take us? My crstal ball thoughts for the next 50 years are shown in the table and include 20k litres and cows lasting 12 years.

We need to recognise high yields and happy cows with long lives are compatible, and not mutually exclusive as seems to be the case currently.

Crystal ball gazing for the next 50 years

- ▸▸Legislation or supply chain insistence that cows spend two to five months outside averaged over a lifetime
- ▸▸Supermarkets integrate welfare and health measures into their supply contracts
- ▸▸Milk and grain prices rise
- ▸▸Silage made at 50% DM
- ▸▸Feed prices do not track cereal prices due to increased availability of products
- ▸▸Meat and bone meal becomes available again
- ▸▸Average milk yields rise above 20,000 litres
- ▸▸Average cow life of 12 years.