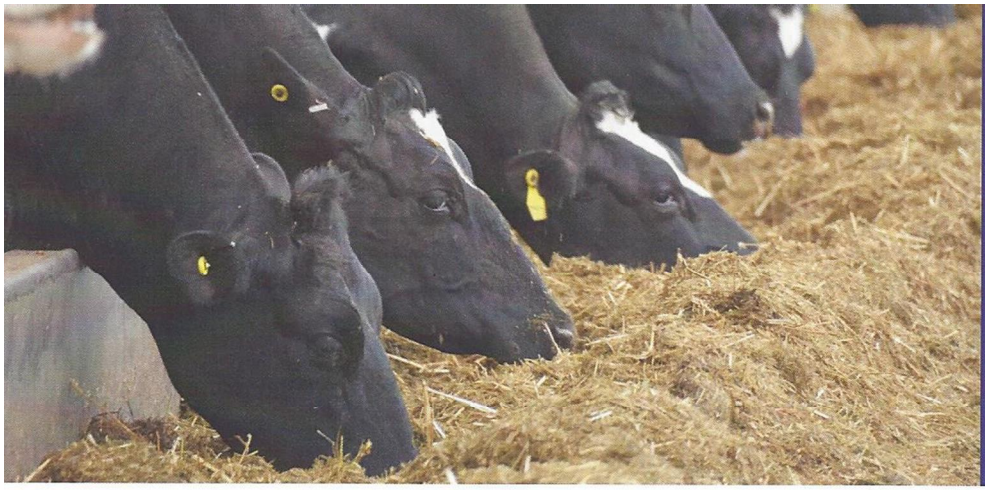


Three Counties Feeds Ltd

Ruminant Nutrition
Through Quality Feeds

Tel 01884 256256

The eCow pH Bolus

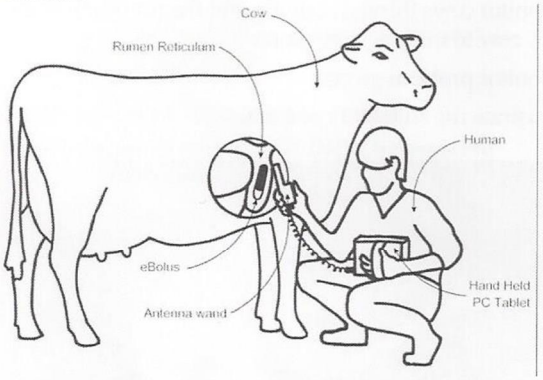
The pH bolus has been developed by eCow (www.ecow.co.uk), a family run company based in Exeter. eCow was founded by Professor Toby Mottram of the Royal Agricultural University, Cirencester.

The pH bolus has been designed and built to enhance modern dairy farming and is the result of a project that started in 2003 that has undergone multiple design iterations and improvements to maximise life and durability all culminating in the product we have today.

About the bolus:

- Administered orally
- No larger than a worming bolus
- Sits within the reticulum
- Records pH and temperature every 15 minutes
- Downloaded by handheld device in 2-3 minutes
- Transferred to laptop for analysis

We are sometimes asked about the positioning of the bolus. It is weighted to sink into the reticulum, but as it is actually rumen pH that we want to monitor and we know from research that rumen pH is 0.25 units lower than the reticulum this is corrected for. Therefore the rumen acidosis threshold of 5.55 is translated to 5.8 in the reticulum and this is the threshold represented by a red line on graphs produced by eCow. A total time under this line is also produced on the graphs to indicate whether or not there is likely to be an underlying problem with Sub-Acute Ruminal Acidosis (SARA) - a little time below the line is often insignificant, more sustained periods are the serious problems.



Feed the Rumen, Feed the Cow

Ensuring that the rumen is functioning well is pivotal for efficient milk production.

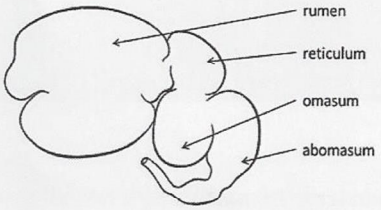
Good rumen digestion will support:

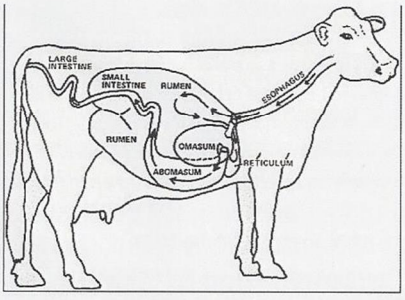
- Milk output
- Milk from forage
- Milk quality
- Fertility

all through excellent feed conversion.

The rumen is one of four compartments in the cow's stomach. It is in the rumen that a continuous, dynamic anaerobic environment supports a range of microbes that digests feeds, but specifically the fibre that other species cannot digest. The rumen has a volume of about 200 litres and each ml of rumen fluid contains billions of microbes, which include bacteria, protozoa and fungi. These bacteria are made of numerous species, but can be simply divided into fibre digesting and starch/sugar digesting bacteria.

The starch digesting species, especially *Streptococcus bovis*, are prevalent in high starch rations and thrive in more acidic rumen conditions. These process a lot of energy quickly. Conversely, the fibre digesters that are crucial for forage digestion, are more susceptible to acid levels and process feed more slowly. **Feeding dairy cows is about getting the balance between these bacteria just right. We need efficient forage digestion and high energy turnover.** This is why pH monitoring through indwelling boluses is such a breakthrough – we can now measure when the balance is just right, rather than just predicting it. This not only helps fine tune rations, but is proving invaluable for problem solving on farms in the South West.





Key benefits of the eCow pH bolus:

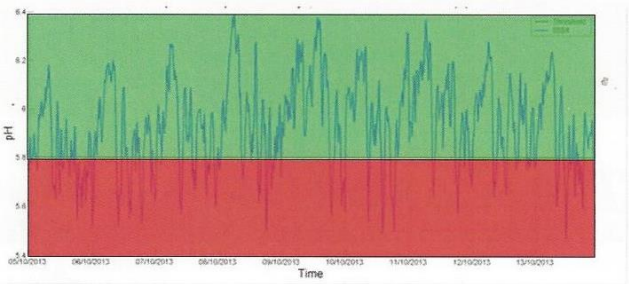
- Longest life bolus available with reliable data for up to 5 months
- 28 days of data storage on the bolus
- Smallest bolus available to measure rumen pH and temperature
- Accurate, stable pH sensor providing data quality
- Real time monitoring of changes in diet and condition

Changes in pH and temperature can be cross referenced with the existing records to measure the effect of diet and management on rumen function. This information directs whether changes need to be made to raise the pH for cow health and efficient fibre digestion, or alternatively when the pH is high if more high energy feeds can be fed resulting in more milk and better fertility. Management and dietary options can then be constantly considered to either prevent pH depression or increase milk yield.

The bolus can be used to:

- Avoid onset of acidosis through early warning
- Keep high yielders performing and identify any potential for more litres through diet
- Help identify management issues which may lock up yield potential through irregular routine
- Justify the use and cost of rumen buffers and yeasts
- Monitor cows through calving and the transition from dry cow to milking cow ration
- Monitor problem groups
- Illustrate the suitability of feeds

Below is a graph of an example pH reading using the bolus. The green area is classed as the safe zone with regards to acidosis/SARA and the red zone represents the 5.8 pH line which we class as the acidosis risk zone. Cattle are not immediately at risk of acidosis when they drop below the line and it is dependent on the amount of time spent in the risk zone. Cows that spend >5 hours/day under the red line are at a significantly higher risk of SARA/ acidosis.



2013 pH Bolus Commercial Farm Trial

In 2013 we began rumen pH monitoring on farms throughout the south west. Here are some of the findings.

Systems Review - A major goal of the bolus trial was to examine a range of dairy production systems as operated in the South West. No one has monitored cows on commercial dairies before and naturally the different patterns produced by different feeding systems were of great interest to us. The results have given us the edge in understanding the particular patterns and issues associated with individual farm feeding practice and this edge makes for better planned nutritional management. Different systems monitored were:

Total Mixed Rations

The characteristic of this system on south west dairies is the provision of the entire daily feed all at once. Therefore we expect to see most intake and so the largest pH fall after this feed. This is what we have seen; the fall associated with the morning feed makes for a regular daily pattern.

Timings have revealed their vital importance. Changes in this pattern have been associated with low rumen pH and lower milk yield as cows are slow to adapt. If cow events do not happen at the same time every day then this is a management change every day.

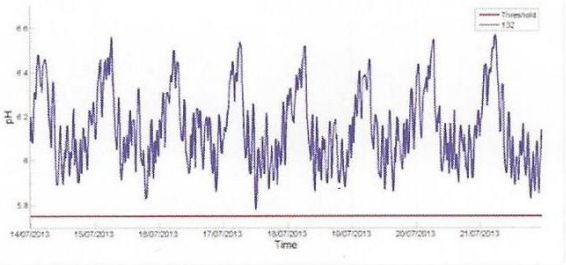
Sub Acute Ruminal Acidosis (SARA)

SARA is defined as periods of moderately depressed ruminal pH, which do not cause ill cows in the short term but instead lead to long term losses in productivity and longevity. This happens because the acidic conditions in the rumen damage the rumen wall and kill the microbes necessary for digestion.

The toxins released from this unhealthy rumen can cause laminitis and other conditions like mastitis become more common. Whilst the benefit of the pH bolus goes well beyond SARA diagnosis, management of this condition is none the less greatly enhanced by the pH bolus.

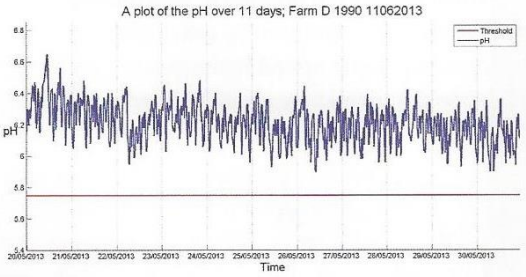
Up until now vets and nutritionists only had clinical signs and invasive needle sampling to use for diagnosis and the mobile nature of the condition left many unanswered questions. We now see why when we look at the pH bolus data and how variable the pH and symptoms of SARA can be.

Not only are the boluses helping to eliminate SARA from commercial dairy herds, but by doing so are revealing many of the management factors causing SARA. Reducing SARA by correcting the management at cow level increases milk production at the same time as eliminating SARA. More traditional approaches of just adding straw have their place, but are often at the expense of production.



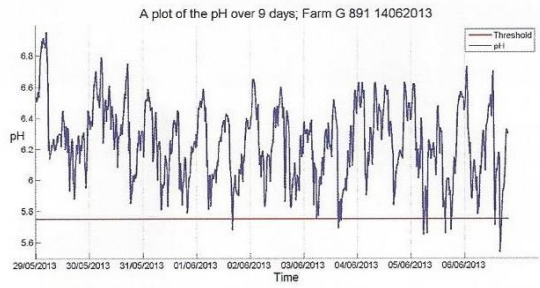
Robots

Cows on robotic systems are fed little and often and are allowed to develop their own behavioural pattern. Therefore, what we have seen are little pH drops often. The ability of the system to allow natural movement and behaviour in the cows is important. Issues of heat stress in July and overcrowding have had the biggest impact on rumen pH in the robotic milked herds.



Grazing/Silage and Parlour Compound Feeding

The pattern for this classic British system is two dips each day, one post each milking. This is what we have seen, note the 2 dips per day on the graph below. However, it has been interesting how much of this dip has been associated with the compound and how much the grazing. Generally it has been possible to attribute 1/3 -1/2 of the pH drop on these farms to the compound feed and the remaining to the fresh forage the cows have eaten afterward. It has been possible to reach this conclusion due to the variability inherent in south west grazing conditions compared to the constant parlour feed. The low input grazing system results below show that this information is invaluable in helping us formulate compound feeds to complement the grazing and silage feeds for these cows.

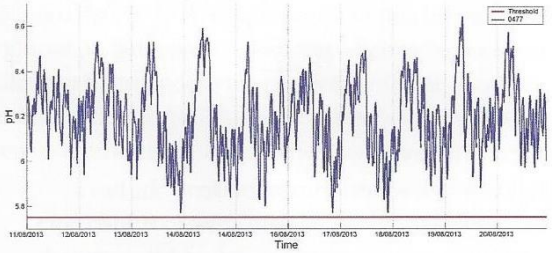


Low Input Grazing

These systems have shown the potency of high sugar grass leys. The results below show the effect on rumen pH of lush seed grazing in a rotation which includes older pasture. We are not saying reseeds are bad, far from it, instead the results highlight the issue of variability in grazing provision, causing cows adaptation challenges.

Partial Mixed Rations

Again a very popular system in the south west and one which can be difficult to get right. Patterns for PMR have been more like TMR than parlour fed cows. The dynamics of getting the ingredients, mixing and timing of the morning feed right in these herds has been the main factor in rumen pH, timing in particular has been more important than perhaps appreciated previously.



Results across all the systems;

pH falls are associated with intake of fermentable carbohydrate. Basic assumptions based on forage concentrate divisions are limited given the quality and nature of forages and concentrates fed on English dairy farms. Feeding cows for health and productivity needs a more perceptive appreciation of the rumen effects of all feeds than is currently practiced by many nutritionists.

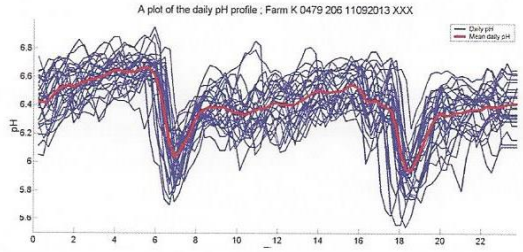
The dynamics of feed intake are fundamental to stable rumen pH. Cows eating irregular quantities, caused by variable feed timing, feed access or grazing quality struggle to maintain a natural regulation of their rumen pH. Cow management has as much to do with a stable and productive rumen as the diet formulation.

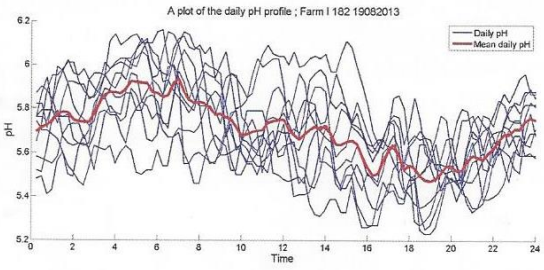
Routine

When we think about the fact that a cow is designed to ferment feed, then it follows that she has many mechanisms to maintain a healthy environment in her rumen for microbes to flourish. She will naturally move to correct ration imbalances as we see from cows chosing to eat fibre or salt at certain times. But to be able to do this she must have an idea of what is coming, if faced with a constantly changing feeding routine it is logical that it will be difficult for her to reach equilibrium. The pH bolus trial results include daily average pH graphs. These have turned out to be a great way to compare a cows feeding behaviour over

time. Compare the graphs below – the blue lines are each day laid on top of each other, the red is the daily average.

The first cow has a more consistent routine and this order allows her to self regulate. The result is more milk and better health. The second graph is from a cow who is struggling to find her routine and she has at times a low pH.

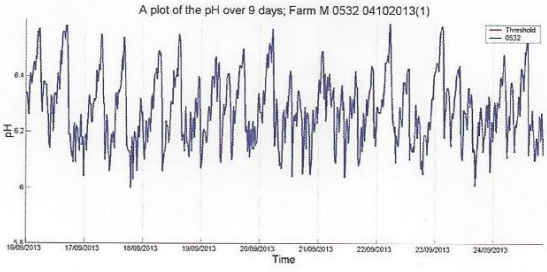




Targeted Additives

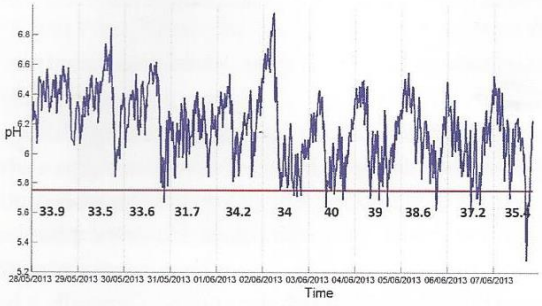
Does this cow below need rumen buffers? She has a stable pH well above the level damaging to rumen flora. No farmers like using more expensive additives they do not need. We don't either.

Here with the aid of the bolus readings we were able to remove antacids and buffers saving the farm many thousands of pounds per year. We see this improvement in targeting of additive usage as a big financial benefit of commercial farm rumen pH monitoring.



Variable Intakes

Take the graph below for grazed cows with variable times of fence movement. The litres are shown too – there was a milk response when the natural impulse of the cow to graze in the morning was best harnessed by grazing management. The big drops in pH correspond to the greatest intake of fermentable feed – in this case grass in the morning!



Where the Information Came From

The previous results are from the herd of David and Sarah Luxton who farm in North Devon. They have been impressed at how much the bolus information adds to their herd management. The results have yielded an insight into much more than just the pH drop feeding parlour feed twice a day has on grazed/housed cows.

David

Boluses have enabled us to examine issues which were restricting intakes at both grass and at housing. Correcting these issues has increased intake and therefore milk production. Often these seemed to be little timing or management issues which were overlooked otherwise - examining bolus information gives data to help streamline these management issues.

Sarah

Attention to detail is essential to good stockmanship and the information from the boluses has been a brilliant tool with this aim in mind. Feeding high energy feeds is important for health and fertility, but doing it the wrong way can do more harm than good. The bolus information has allowed us to feed lots of energy in a safe and controlled way.