Practical study outlines some useful indicators of good rumen function

What's your herd's ru men efficiency score?

Rumen-fill score, faeces score and milk composition ratios, have all been suggested as indicators of rumen efficiency. Since performance levels and herd health are a direct result of the rumen's ability to function to its full potential, the need for some clear guidelines was identified by a team of dairy specialists in Northern Ireland three years ago.

text **Allison Matthews**

The rumen's microbial population converts around 75% of the feed raw materials eaten by the cow into end-products that can be utilised for maintenance and production.

So says Thompsons' technical consultant Professor Fred Gordon, who was involved in the three-year research project on rumen function. "However these microbes are very sensitive to fluctuations in rumen pH, with the most striking and extreme example of this fluctuation being sub-acute rumen acidosis – SARA."

He says that well before SARA becomes an issue, even small fluctuations in rumen pH are reducing the overall efficiency of digestion in the rumen. For example a reduction in rumen efficiency of only 1% could reduce energy supply to the cow by the equivalent of 0.5 litres of milk.

Fred Gordon: "No single assessment can quantify rumen efficiency"

Detailed research

"Due to the inability of producers to assess such changes, an equation has been developed as a direct result of the research project, which will enable a rumen efficiency score to be predicted from diet parameters. This relationship can prove to be particularly effective in detecting those herds where rumen efficiency scores were low and likely to be at risk of SARA," Mr Gordon adds.

Professor Gordon played a central role in both the academic and practical side of the research project,
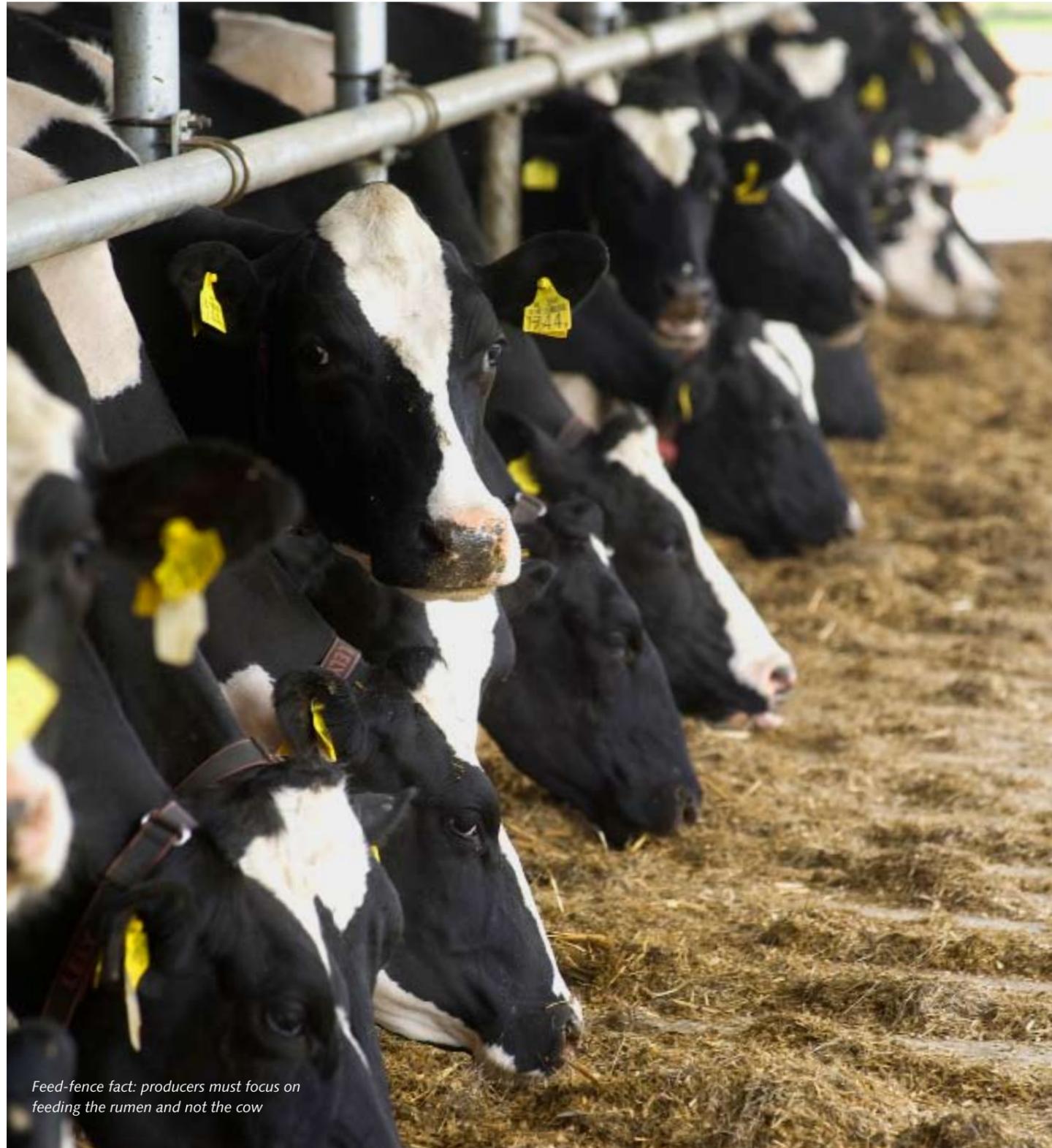
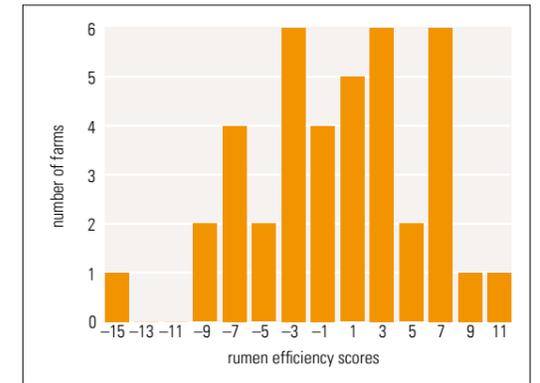*Feed-fence fact: producers must focus on feeding the rumen and not the cow*

Figure 1: Frequency graph of herds with differing rumen efficiency values

which involved an 18-month period of research at Hillborough's Agri-Food and Biosciences Institute, led by Conrad Ferris.

"The initial aspect of the research team's project was undertaken in late winter and involved 42 dairy farms in Northern Ireland, which were selected to provide a wide range of dairy systems. On each farm, more than 35 different types of measurements were taken in order to understand the key drivers of rumen efficiency. These parameters related to different aspects of the herd, ranging from diet characteristics, housing and cow comfort, rumination details and performance data on both a herd basis and on an individual cow basis.

"This data was fed into a database to determine a rumen efficiency score for each of the specific farms. This created the benchmark for potential improvements in rumen efficiency for the project," explains Professor Gordon.

Survey detail

In the survey two technicians visited each farm and completed detailed visual assessments, including milk yield and quality measurements, on 20 cows from each farm – 10 cows, which were between zero and 50 days in milk, and 10 cows, which were between 51 and 150 days in milk.

Manure samples were collected from 12 individual cows in each herd and brought to the laboratory for detailed sieving analysis. Rumination behaviours – such as chews or boluses – were recorded on 10 cows per herd. In addition to these animal assessments a wide range of management issues, such as feeding methods and management, were documented. All feeds were sampled and feeding levels recorded. Table 1 contains some examples of the data.

	mean	min.	max.
faeces data on 12 animals/herd			
faeces consistency score	2.47	1.88,	2.83
faeces sieving-% faeces DM in bottom tray	54.93	40.86	76.26
visual scoring of 20 animals/herd			
cow dirtiness	1.24	1	2.28
rumen fill	2.89	2.4	3.53
body condition score	2.56	2.25	3.18
performance of 20 animals/herd			
yield (kg/day)	32.7	20.9	48.2
butterfat (%)	4.09	2.81	5.87
protein (%)	3.17	2.91	3.47
fat:protein ratio	1.29	0.91	1.89
rumination behaviours of 10 cows/herd			
chews/bolus	61	46.4	74.2
chews/minute	71.7	59.6	85.8

Table 1: Mean herd data, plus the range in herd means

The objective was to develop a scoring method that would quantify the rumen efficiency of each herd. In the past many animal indicators of rumen efficiency have been suggested, including rumen-fill score, faeces score or milk compositional ratios.

"Analysis of the data in Table 1 indicated that no single assessment was able to provide a quantitative measure of rumen efficiency," says Professor Gordon. "The most effective method proved to be a complex one, which encompassed seven different assessments, ranging from milk quality to faeces sieving data. Using this rumen scoring system, a rumen efficiency value was developed for each of the 42 farms. These values ranged from –15 to +11."

A frequency graph of the scores is shown in Figure 1.

Efficiency conclusions

The first clear indication from the data analysis was that there was no link between cow accommodation and rumen efficiency score. Similarly poor rumen efficiencies were not more prevalent within any particular feeding, or feed management system, with low efficiencies being recorded with full and partial TMR, out-of-parlour concentrate dispensers and in-parlour feeding systems.

Professor Gordon explains the nutritional warnings highlighted by the survey: "The overriding factor in all systems was that as metabolisable energy (ME) intake was increased, and the higher the percentages of crude protein and starch and sugar in the overall diet, the poorer the rumen efficiency score."

In contrast, fibre fractions – particularly acid detergent fibre (ADF) – were the major nutritional factors improving

herd performance	range	mean
yield (l)	5,600-11,700	8,839
butterfat (%)	3.17-5.05	4.08
protein (%)	3.02-3.50	3.28
fat:protein ratio	0.95-1.57	1.25
% forage	29.3-82	56.2

Table 2: The range across the dairy systems evaluated in the Northern Ireland survey

rumen efficiency. As a result an equation was developed that enabled the rumen efficiency score to be predicted from diet parameters. This relationship proved to be particularly effective in detecting those herds where rumen efficiency scores were low and likely to be at risk of SARA.

Diet adaption

As producers strive to provide diets with an ever increasing energy density in order to support higher levels of performance, knowledge about rumen efficiency is becoming vital and producers need to be continuously mindful of how the rumen is functioning at any particular point in time.

"The research project identified the large amount of variables that must be considered when assessing rumen function.

"With the ability to identify a rumen efficiency score, and therefore a SARA risk, producers can essentially stay one step ahead," says Professor Gordon.

"Working with your nutritionist to assess rumen performance, and to highlight potential warning signs before they become detrimental to overall herd profitability, is a vital management tool.

"The identification of clear parameters to assess rumen function also provides a platform of knowledge on which product development can begin," he adds. |