PRESS ARTICLE

NEW OPPORTUNITY TO UNLOCK ENERGY POTENTIAL IN DIETARY FIBRE AND BOOST OVERALL MILK PRODUCTION EFFICIENCY

The energy in dietary fibre is some of the most cost-effective available. We talk to AB Vista's Dr Nicola Walker about a new opportunity to unlock even more of its potential.

Fibre is an extremely important component in dairy rations, typically accounting for 45-50% of the dry matter (DM) consumed and forming the primary energy source in some of the best value ration ingredients, such as silages, moist feeds and dried distillers' feeds. Maximising the digestion of that fibre to extract as much energy as possible is therefore a key driver for those looking to increase milk from all feeds, not just forage, and reduce feed costs per litre.

"Fibre plays a vital role in both energy supply and rumen function," states Dr Nicola Walker, AB Vista's ruminant product development manager. "Some of that fibre can't be digested in the rumen – the physically effective fibre – but around two thirds of it can be broken down by rumen microbes."

Research has shown that under ideal conditions, the maximum potential rumen digestibility of plant cell walls – the main source of fibre in ruminant diets – is around 65%. However, that figure can quickly drop to as low as 35% when the rumen environment is sub-optimal.

Rumen fermentation effect

"What's often overlooked is the fact that fibre digestibility in the rumen isn't a fixed value," Dr Walker continues. "It's determined both by the maximum that's potentially digestible and how well the rumen is functioning,

"Sub-acute ruminal acidosis (SARA) triggered by acidic silages or high levels of starchy concentrates, for example, can limit fibre digestion by slowing fibre-digesting microbial activity (see *Figure 1*, blue line), reducing the amount of fibre that can be digested before it leaves the rumen.

"A similar effect can be seen when the lag time before digestion starts is extended, (see *Figure 1*, green line), such as when excess oil in the diet coats the fibre, restricting access for microbial attachment and colonisation."

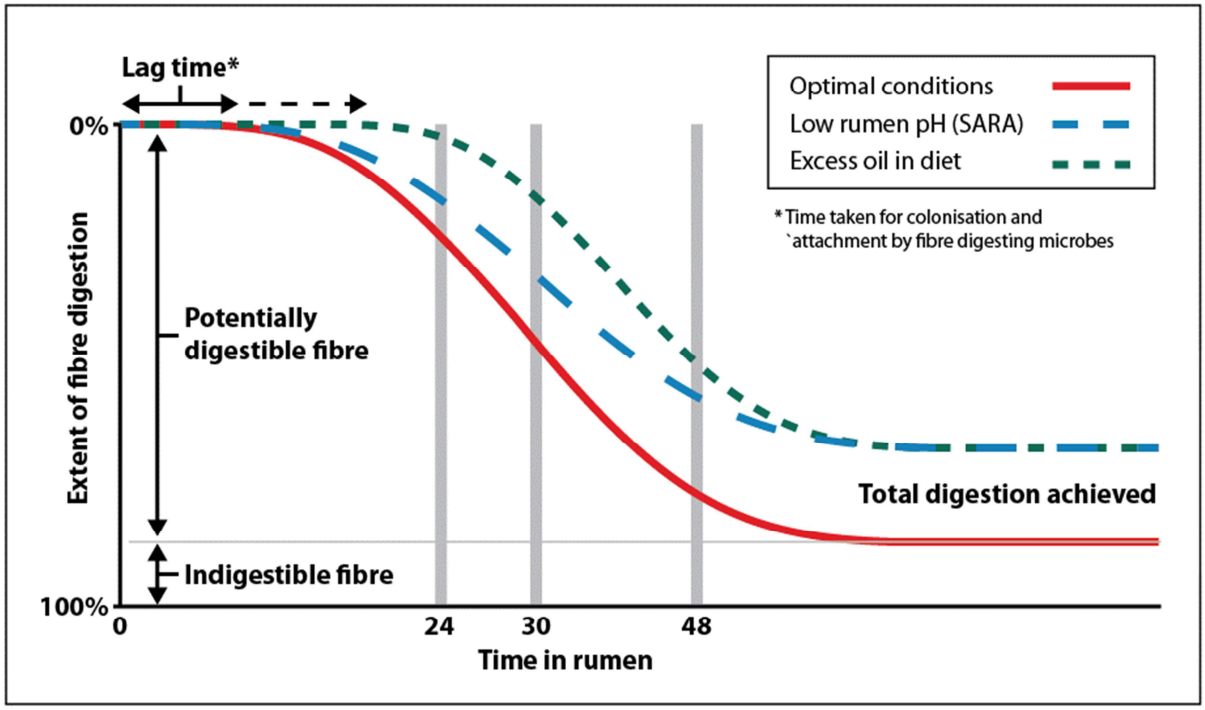


Figure 1 – Graph showing the impact of rumen conditions on the rate and extent of fibre digestion (Source: adapted from USDA-ARS, 2014)

The extent of fibre digestion can also be limited by higher rumen outflow rates, which cuts the time available for microbial activity. Regardless of whether caused by the addition of sodium bicarbonate to correct rumen pH, higher water intakes in hot weather or low fibre diets that are poorly retained in the rumen, the impact on fibre digestibility can be significant.

"So it's important to understand that in addition to there being a distinction between the potentially digestible fibre (neutral detergent fibre, NDF) and the remaining physically effective fibre (lignin and acid detergent fibre, ADF), there's also a difference between the fibre that can be digested and the fibre that actually is digested," Dr Walker adds.

"Ration formulations are based on how much fibre can be digested under close to ideal conditions, so if rumen fermentation is compromised, the ration will supply less

energy than predicted and cows will underperform as a result. Most of the remaining energy will simply be lost and excreted, which is a waste of good nutrients that you've paid to include in the diet."

Supporting rumen function

Undigested fibre does have a number of valuable roles to play, such as promoting rumination, forming the rumen 'mat', contributing to rumen fill and providing the scratch factor that stimulates rumen papillae. However, the target should therefore always be to maximise the proportion of the fibre in the diet that is digested, advises Dr Walker.

"If levels of physically effective fibre are too low, adding extra in the form of chopped straw is relatively cheap and easy," she continues. "But what will significantly increase feed costs per litre is having to either provide additional energy, or accept reduced milk output, due to a shortfall in fibre digestion.

"Maximising fibre digestion also improves the balance of volatile fatty acids (VFA) released in the rumen, which form the primary energy supply to the cow. A greater proportion of butyrate and acetate from fibre breakdown versus the propionate from starch not only lowers the risk of SARA, but also improves the supply of milk fat precursors to better support butterfat production."

Increasing fibre digestion

Until recently, the only practical way to increase fibre digestibility was to improve conditions in the rumen. Fine tuning rations to balance energy and protein supply in the rumen will minimise the risk of SARA and maximise microbial activity, for example, whilst adding slow-release rumen conditioners can help maintain optimum rumen pH where the acid loading is high.

The inclusion of live yeasts to mop up excess oxygen ensures conditions in the rumen remain anaerobic and optimal for fibre-digesting microbes. And ensuring rations contain sufficient digestible and physically effective fibre is essential for good overall rumen function.

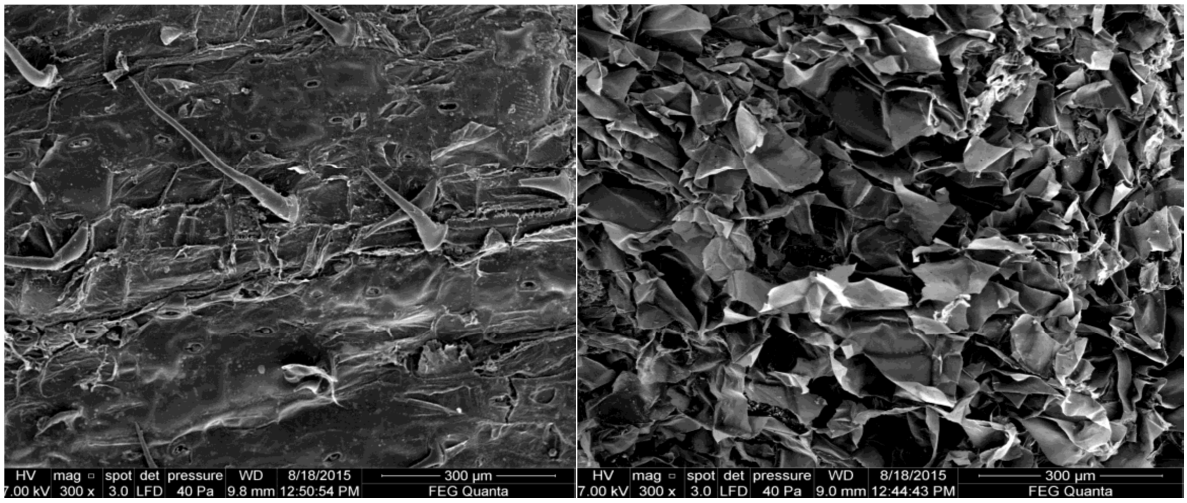
All these factors are still critical if fibre breakdown in the rumen is to be maximised, but a new development is now offering the opportunity to unlock even more of the energy potential in fibre.

"By reducing the lag time before fibre digestion starts in the rumen, it's possible to increase both the rate and extent of fibre digestion in a way that's not been possible before," Dr Walker outlines. "The result is even more energy extracted from the fibre in the diet, and an overall increase in feed efficiency.

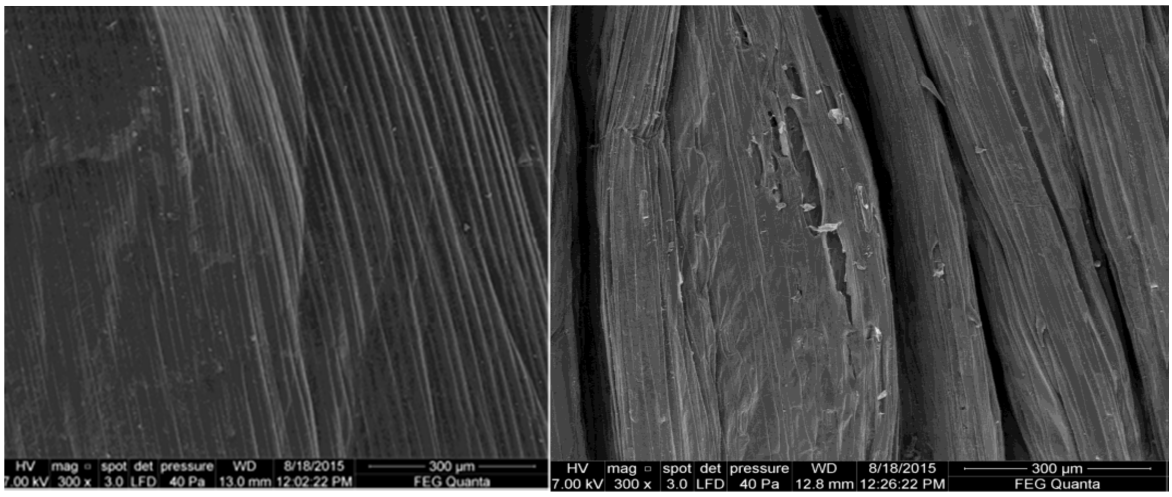
"This can either enable a greater level of production from existing rations, particularly where cows are in negative energy balance, or a reduction in the level of expensive high energy concentrates needed to hit production targets."

Fibre pre-treatment

The effect is achieved using a *Trichoderma reesei*-derived fungal extract applied as a liquid pre-treatment prior to feeding, which roughens and creates pits in the surface of the fibre in the diet. This increases the surface area for attachment and colonisation by fibre-digesting microbes once in the rumen (see *Figure 2*), leading to a lift in the rate and extent of fibre digestion.



a) Maize silage



b) Grass silage

Figure 2 – Effect of fibre pre-treatment (left = control; right = VistaPre-T) on the surface structure of maize silage (a) and grass silage (b)

According to the results of a three-month ADAS-monitored trial on a commercial UK dairy unit, the fibre pre-treatment increased TMR D-value (63% to 67%) and energy content (10.5 to 11.1 MJ ME/kg DM). Milk yield rose by 1.3 litres/cow and milk proteins from 3.58% to 3.70%.

"The trial used 50 first lactation heifers split into two groups and fed a typical maize and grass silage-based TMR," states Dr Walker. "The ration fed to one group was treated with 750 ml/t DM of VistaPre-T fibre pre-treatment (diluted 1:10 in water), which was applied using a watering can and then mixed in."

In addition to the gains in feed efficiency and milk output, heifers receiving the treated TMR also showed improved conception rates, requiring an average of 2.3 inseminations per pregnancy compared to 3.2 in the control group.

"This was most likely due to a rise in energy status, suggesting that in addition to producing more milk, the heifers fed the treated TMR were also better at maintaining or gaining body condition," she adds. "Four months after the trial started, 84% of the heifers in the treated group were confirmed pregnant, as opposed to just 64% in the control group.

"Similar results have been seen in trials carried out in Canada and Bulgaria, and it highlights just how much additional potential is available if fibre digestion can be truly optimised."

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