Improving energy release from fibre to reduce costs and improve sustainability

Fibre is a key component in ruminant diets, due to its role in maintaining rumen function and cow health. It is an extremely important energy source, with a substantial part of the energy for milk production extracted from fibre.

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Dairy cows and other ruminant species use microbial fermentation to derive energy from fibre, which contributes up to 70% of their total energy pool. Fibrolytic bacteria attach to fibre surfaces and with the aid of enzymes produced by the microbial biomass, they extract energy in the form of volatile fatty acids (VFAs).

One of the overarching goals in dairy nutrition is to maximise milk from forage. Though it is often perceived that fibre is well digested by ruminants, plant cell wall digestibility is in fact under 50% – which implies there is still significant room for improvement.

If the digestibility of the fibre is not maximised, then a good proportion of the best value energy in the diet can be easily lost, with knock-on effects for growth rates, feed costs and overall profitability.

In high yielding dairy cows, butterfat and milk protein need to be maintained, together with optimal rumen function. With the ongoing volatility in feed ingredient prices, this becomes a major challenge for the dairy producer. To ensure high quality products in today's economic environment, producers may therefore need to look for new opportunities to optimise production.

Maximising fibre utilisation

Highly digestible forage is one of the most cost-effective solutions within ruminant systems and supports both animal health and well-being, and production. By improving rumen microbes' ability to digest fibre, it is possible to help the animal to better utilise fibre, which can have an overall positive effect across the entire farm and improve production margins.

A crude fermentation extract from Trichoderma reesei (VistaPre-T), which works on the fibrous portion of the ration, is a pre-treatment that can be formulated into the total ration to get more energy from home grown forage. It roughens fibre structure by forming pits on its surface, speeding up the microbial attachment and colonisation, assuring reduced lag time, increased fibre digestion, improved performance and feed efficiency.

This process releases previously unavailable energy reserves that lends opportunity to produce more milk from forage and increase overall animal productivity. In field conditions, adequate fibre supply ensures the best responses in the herd. VistaPre-T is applied directly to the total mixed ration (TMR) and allows pre-digestion of the feed prior to consumption by the animal.

A recent in vitro study performed by a leading research facility in Canada has shown improved fermentation parameters, such as improved microbial biomass – a 'gold standard' parameter associated with higher milk production – when TMR was pre-treated with VistaPre-T, compared to the control group.

It demonstrated greater fast pool (gas produced from starch and soluble fibre) and improved slow pool (gas produced from fibre, primarily hemicellulose and cellulose).

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Table 1. Potential energy from grass silage with VistaPre-T (n=74).

N=74	NDF (%)	ADF (%)	Soluble CHO (%)	D-value (%)	ME value (MJ/kg DM)
Average value before pre-treatment	47.9	30.5	4.13	64.9	10.8
Range (before pre-treatment)	34.4-69.5	22.0-43.6	1.26-6.57	48.9-76.2	8.2-12.7
Average value post-treatment	38.9	24.9	5.22	69.7	11.6
Effect of Vista Pre-T	-9.0	-5.6	+1.09	+4.8	+0.8

Table 2. Potential energy from maize silage with VistaPre-T (n=76).

N=74	NDF (%)	DOMD (%)	ME value (MJ/kg DM)
Average value before pre-treatment	44.8	65.0	10.40
Range (before pre-treatment)	34.4-53.4	61.6-76.8	9.9-12.3
Average value post-treatment	30.7	69.8	11.17
Effect of Vista Pre-T	-14.1	+4.8	+0.77

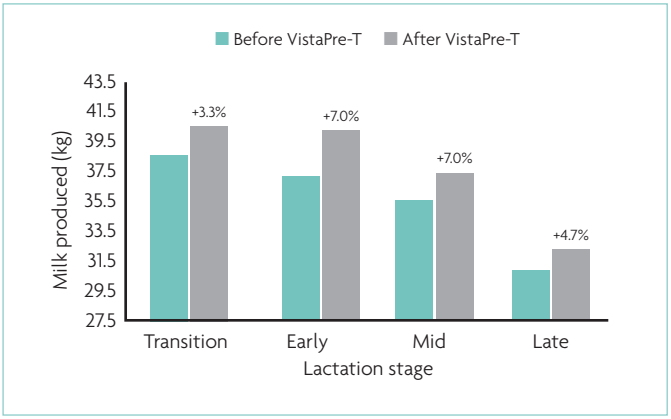

Fig. 1. Average milk yield increase with VistaPre-T per lactation stage. Transition: 0-50 days in milk (DIM), early: 51-100 DIM, Mid: 101-200, Late: 201-400.

Feed ingredients	Control (kg)	VistaPre-T (kg)
Grass silage (2nd cut)	40.00	42.00
NIS pellets	0.80	0.80
Ground maize	4.00	3.80
Molasses	1.50	1.25
Protected fat	0.35	0.20
Limestone	0.07	0.07
Dairy mineral	0.13	0.13
Concentrate	4.75	4.75
VistaPre-T Farm pack	0.00	0.05

Table 3. Feed ingredients in control and VistaPre-T diets (kg/cow/d).

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Also important is NIR analysis, which can be used to monitor the variability in forage, analyse how much more energy can be extracted from forage and calculate the potential reduction in costs of bought in feed. For example, grass and maize silage samples were analysed with NIR before and after treatment with VistaPre-T.

The results (Table 1 and Table 2) clearly demonstrate the mode of action of VistaPre-T and provide the extra energy value which can be accounted for when formulating the diet, averaging 0.8MJ/kg DM.

Application

Manure quality is often the first parameter where we start to notice positive results of improved fibre digestibility. Monitoring this using sieve analysis is an effective tool to see fast responses.

Animal response to increased dietary energy supply will depend on various factors, including lactation stage, body condition and metabolic state.

A great way of monitoring the efficacy of the product is to examine milk yield and milk solids, intakes and fertility records. Energy deficient animals, such as primiparous cows that are still growing, often replenish the deficiency first, reflected in improved body condition and fertility parameters, after which they start to show improvements in milk yield. Because the on-farm application of this forage pre-treatment is flexible, two different concepts can be implemented depending on the needs of the farmer.

- VistaPre-T can be formulated into the total ration to get more energy from forage, reducing reliance on other costly high energy sources such as cereals or protected fats. This saves costs, reduces emissions and maintains a healthier rumen.

A UK study was performed involving 147 Holstein-Friesian dairy cows fed a grass silage-based ration, with VistaPre-T added as a part of a farm pack (50g farm pack, 3.3g pure product per head per day based on average 20kg DMI head/day).

The ration was reformulated to reduce the amount of ground maize, molasses and protected fat, while adding more grass silage (Table 3).

The results showed a 15% reduction in emissions per litre of milk with the inclusion of VistaPre-T, and a 9% improvement in milk yield, compared to the control group.

Protected fat can be an expensive ingredient and it also carries a high carbon footprint. In dairy diets, VistaPre-T can generate approximately 10 MJ of additional energy (coming from 0.8 MJ energy uplift per kg of forage DM, given a cow consumes 12.5kg of forage DM per day on average). This extra energy would be equivalent to 300g of protected fat per cow/day.

VistaPre-T can therefore generate the same amount of energy for a fraction of the cost, saving money and bringing additional benefits of carbon footprint reduction.

- VistaPre-T can be applied on the top of the ration, enabling extra energy supply with a positive ROI through improved performance.

In another study carried out in the UK, 350 milking cows maintained as one group were fed a maize and grass silage-based ration, with VistaPre-T applied on the top of the ration as a part of a farm pack (50g per cow/day).

The average milk yield (kg/cow/day) in the pre-trial period and after feeding VistaPre-T was recorded per stage of lactation and is presented in Fig. 1. – with substantial gains in yield seen in the four lactation stages. ■

Conclusion

Producers are faced with ongoing environmental and commercial pressures, to increase performance and harvest more energy, all while reducing emissions. Using an effective pre-treatment, such as VistaPre-T, to extract more energy from feed and forage is critical to maximise feed efficiency, reduce costs and lower emissions – and consequently improving farm profitability.

In turn, this ensures the sustainability of the farm and the longevity of the herd. Moreover, maximising the energy from fibre is rumen friendly and reduces the need to use starchy cereal grains, which can cause acidosis. This results in additional cost savings and potential health benefits for the animal as well.