Understanding the Role and Differences of LIVE YEASTS

Feed conversion efficiency (FCE) is becoming an ever-higher priority for both dairy and beef producers, with many increasingly focused on the potential for better rumen function to improve overall efficiency, and boost margins over feed (MOF). With more accurate ration formulation and the fine tuning of nutrient supply to the rumen capable of achieving only so much, the role of yeasts, buffers and rumen conditioners has come firmly under the spotlight.

However, for yeasts in particular, the way in which they work, the benefits to the rumen environment, and the factors that determine efficacy are often not fully understood. And according to Dr Derek McIlmoyle, AB Vista's EMEA ruminant technical director, that can turn decisions about when and where a yeast will add value into a lottery, with many missing out on the potential gains as a result.

Optimising rumen function

"Yeasts have a really important role to play in high performance ruminant rations, but to get the best return on that investment it's critical that the right type of yeast is used, delivered in a way that optimises efficacy, and in situations where the benefits will outweigh the cost," he states.

"The rumen functions best when conditions are both optimised for fermentation that take place, and as stable as possible. For example, maintaining a pH that's as close to 6.0 as possible is essential – fibre digestion is compromised any time pH drops below 5.8 or rises above 6.2 – as is ensuring conditions remain mostly anaerobic."

Because the rumen microbes responsible for fibre digestion are anaerobic, any oxygen build-up in the rumen, such as when large quantities of rapidly fermenting feeds or acidic silages are fed, will quickly undermine fermentation efficiency. Not only is the activity of the fibre-digesting microbes restricted, but in severe cases the actual numbers present can be substantially reduced.

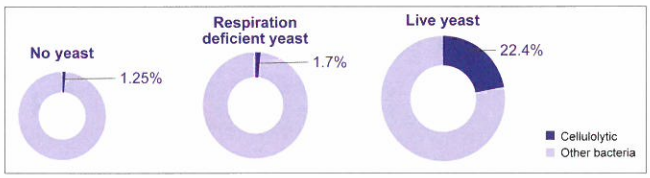
Re-establishing anaerobic conditions

"Buffers and rumen conditioners are useful for re-establishing rumen pH within that ideal 5.8-6.2 range, and yeasts will have some effect on rumen pH. But that's not their main function," Dr McIlmoyle continues.

"The research has shown that yeasts are capable of delivering feed efficiency gains over and above those achieved by optimising rumen pH, by acting to improve overall conditions in the rumen. This is done primarily through the mopping up of excess oxygen, and by competing for sugars, which reduces populations of detrimental aerobic microbes and encourages proliferation of those anaerobic microbes responsible for fibre digestion."

Greatest effect from the addition of a yeast is achieved when that yeast is intact, live and metabolically active (see Figure 1), and when introduced to a rumen where the pH is already close to optimum. It's for this reason that greatest performance gains are often seen when a yeast and a rumen conditioner are used together.

Figure 1: Impact of different yeast types on fibre digesting rumen microbe populations (Source: Newbold et al., 1996)



Proven research results

In one study carried out at the Schothorst Feed Research (SFR) in the Netherlands, the combination of an active live yeast and a rumen conditioner substantially reduced the time rumen pH was below the point at which fibre digestion is compromised (50 vs. 87 mins below pH 5.8) compared to using the yeast alone (see Figure 2). The trial, which used a small group of fistulated Holstein Friesians fed a 65:35 forage-to-concentrate ratio diet, also showed a significant increase in the proportion of acetate (63.0 vs. 61.4%) and butyrate (13.6 vs. 12.8%) volatile fatty acids (VFA) in the rumen.

Figure 2: Effect of active live yeast on rumen pH (Source: Schothorst Feed Research, 2014)

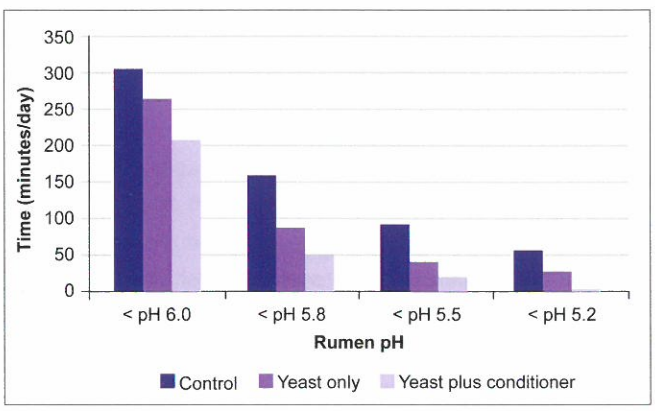


Table 1: Effect of active live yeast on milk production and feed efficiency (Source: Schothorst Feed Research, 2014)

	Control	*Yeast only* [1]	*Yeast plus conditioner* [2]
Fat-corrected milk yield (FCM, kg/day)	37.1	38.6	38.9
Butterfat production (kg/day)	1.46	1.58	1.65
Feed efficiency (kg FCM/ kg DMI)	1.59	1.60	1.65
[1] *Vistacell at 4g/cow/day*			
[2] *Vistacell AB = Vistacell at 4g/cow/d + Acid Buf at 88g/cow/day*			

"The result was a 4% rise in milk fat production from 1.58 to 1.65 kg/day and a 3% improvement in overall feed conversion efficiency – in terms of kg fat-corrected milk yield per kg dry matter intake – from 1.60 to 1.65," explains Dr McIlmoyle (see Table 1).

"However, such results rely heavily on yeast efficacy, so as well as ensuring rumen pH is already close to ideal, it's important to understand the other factors that determine yeast performance. Put simply, not all yeasts are the same, and not all yeasts will reliably and consistently produce a worthwhile return on investment (ROI)."

Understanding yeast differences

The most basic yeasts are those which deliver only prebiotic effects, being dead yeast cultures or extracts that contain very few, if any, viable yeast cells. These can bind with pathogens and act as a food source for beneficial microbes within the rumen, but have no activity themselves, which can limit their impact on the rumen environment.

In contrast, live yeast remain active after ingestion, and it's these live cells that use up excess oxygen and compete for sugars in the rumen as they continue to be metabolically active. Early generation yeasts of this type were typically byproducts of the baking industry, but the latest strains to be introduced have been specifically selected and screened for beneficial effects and survival within the rumen.

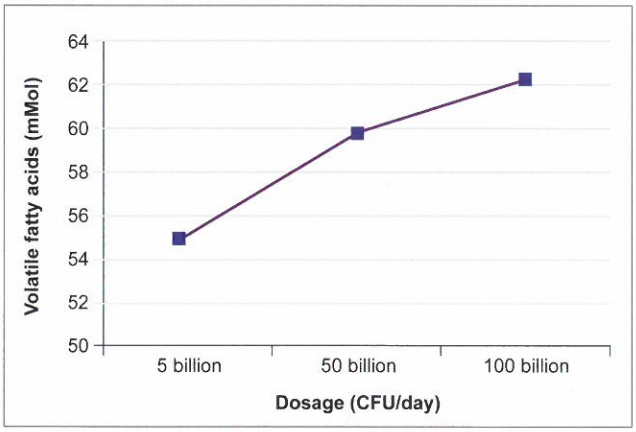
"Dead yeasts will have some impact, helping lower the risk of acidosis and reduce the pathogenic load in the rumen and lower gut," Dr McIlmoyle states. "For example, even cell wall fragments of the *Saccharomyces cerevisiae* yeast have been shown to bind to pathogens and mycotoxins, whilst also stimulating lactic acid bacteria and the animal's immune system.

"And although intact versions of such yeasts, even if hydrolysed, can also act as a source of nutrition and metabolites for beneficial rumen microbes, they're still much less effective than probiotic active live yeasts."

Differentiating live yeasts

And when it comes to assessing the performance of these active yeasts, there are additional factors that need to be considered, highlights Dr McIlmoyle. The number of colony forming units (CFU) contained in a single 'dose' of yeast, for example, is critical to performance in the rumen (see Figure 3), and can range from as low as 10 billion up to 50 billion CFU in commercial yeast products.

Figure 3: Relationship between active yeast dosage and rumen volatile fatty acid (VFA) production (Source: Desnoyers et al., 2009)



"However, CFU count really is just part of the equation," he adds. "Unless the yeast is in a form that can withstand storage, feed manufacture, delivery and ingestion, and remain viable in the rumen, then much of that yeast value can be lost before it has time to act.

"The traditional 'noodle' form of active yeast is now being replaced by more tightly packed structures such as round 'beads' that offer greater CFU counts with better oxygen scavenging properties and longer shelf life (minimum 12 months). The result is a far more consistent delivery of the necessary number of active yeast cells to produce good results in the rumen."

> *"Combining the right strain of active yeast with an effective dose in the rumen is the key to releasing the full potential value yeasts can offer"*

Rumen stability is another factor that can vary considerably, with survivability levels after 24 hours in the rumen ranging from lows of 15% to as high as 37%, depending on the particular yeast chosen. And from a practical perspective, it's also important to realise that not all active yeasts have multi-species registration, with some requiring multiple products to be stocked to cover the full range of livestock species.

"Combining the right strain of active yeast with an effective dose in the rumen is the key to releasing the full potential value yeasts can offer. The result is a three-pronged approach – reducing detrimental microbial populations, optimising the rumen environment, and directly supporting beneficial microbial activity – that will maximise FCE gains."