THE MECHANICS OF **PROTEIN ABSORPTION**

by Sarah Roberts

Because of technologies used to prevent fuel vapour losses, consumers are happily no longer bombarded by petrol and diesel fumes at petrol stations, and in much the same way farmers need to prevent protein wastage in the dairy cow.

Proteins, or rather the amino acids they are comprised of, are the building blocks the dairy cow uses to maintain herself, produce milk, give birth to a healthy calf, and defend herself against pathogens. Protein from feed may be either rumen-degradable protein (RDP) or rumen-undegradable protein (RUP). Rumen-undegradable protein is not fermented by rumen microbes and passes through the rumen to be digested in the abomasum in the same way that microbial protein is digested in the abomasum. Rumen-degradable protein is broken down by rumen microbes into amino acids and ultimately ammonia, which the microbes use to synthesise microbial protein, the most important source of amino acids for the cow.

AN ENERGY COST

Ammonia that is not used to produce microbial protein is absorbed into the blood through the rumen wall and detoxified into urea by the liver. A portion of this urea is recycled through the animal's saliva and the excess is then also excreted in urine and milk. Any situation resulting in inefficient utilisation of RDP by rumen microbes means wastage of the RDP and also involves an energy cost to the cow when she detoxifies and excretes the excess ammonia. Rumen microbes need to have sufficient energy available to them convert RDP into microbial protein. This energy comes from non-fibre carbohydrates, such as starch from maize, and different sources of non-fibre carbohydrates provide sugars to rumen microbes at different rates.

PASTURES

Pastures tend to have high values of crude protein, which is readily degraded, while they tend to be low in sugars, so that energy from fibre degradation is available at a steadier rate. Therefore, providing the rumen with enough energy, in the form of readily degradable starch and sugars, will limit the amount of protein wasted and ensure efficient conversion of this protein into microbial protein. In turn, this enhances fibre digestion as there is more energy and microbial energy. There is also a fine balance between providing enough energy at the right time to rumen microbes and avoiding a drop in the rumen pH that causes acidosis or subclinical acidosis.

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AMINO ACID REQUIREMENTS

Microbial protein alone is not sufficient to meet the amino acid requirements of a lactating dairy cow these days, and additional sources of rumen-undegradable protein and bypass amino acids are added to the diet. These are usually raw materials, such as fishmeal and oilseed cake, which have undergone a heating or extrusion process that leaves a portion of the protein unavailable to rumen microbes. However, these raw materials tend to be costly and because they still contain a portion of degradable protein they still contribute to the potential wastage of protein in the rumen.

No individual protein source is ideally balanced in terms of amino acids to meet the requirements of a high-producing cow, and so there is often an oversupply of excess amino acids that exacerbates protein wastage. By adding specific, first-limiting, rumen-protected amino acids (such as rumen-protected lysine and methionine) to the diet and formulating for the amino acid requirements of the cow, we can reduce the inclusion rates of these protein sources, thereby reducing ration costs, improving protein utilisation, and limiting wastage.

With the rising costs of fuel, fertiliser, and raw materials, among other challenges, it is vital that South African dairy farmers adopt the principle of 'waste not, want not'. To thrive in this challenging economic climate, farmers simply can not afford to overlook methods of improving nutrient utilisation and minimising nutrient wastage. mpo