Effects of feed additives on rumen fungi. J-S Chang, RE Calza *(Department of Animal Sciences, Washington State University, Pullman, WA USA 99164-6332)*

Several feed additives have been used to enhance animal performance. Research has shown that response to microbial based products is seldom predictable [1]. With detailed information about mode of action it is hoped that less variable products can be developed. Research described here investigates one such product (Amaferm™, Biozyme Inc., St. Joseph, MO) which has increased the production of dairy animals. *Neocallimastix frontalis* EB 188 was used as an in vitro testing system [2].

Secretion of fungal cellulase xylanase, β-glucosidase and changes in morphology were recorded. Calculations suggest the fungal response coefficient remains constant in the presence of varying amounts of additive. A positive correlation between the enhancement of mycelium surface area and enzyme secretion levels is apparent. The additive may also promote leakage of normally intracellular proteins such as malate dehydrogenase. Pilot experiments using organic extractions of this product show that the active component(s) is moderately polar and can be concentrated. Thin layer chromatography separates the extract into inert and intensely stimulating fractions. Wheat bran which serves as carrier for this product caused an acceleration of fungal physiology although it was heat labile.

It has not been possible to suggest a plausible mode of action for this feed additive but the process may involve changes in microbial populations within the rumen [3]. Several grams of Amaferm™ is typically fed to each animal per day. We therefore believe that the active component(s) does not act directly as a nutritional factor or degradative enzyme. It remains feasible that by accelerating fungal physiology, Amaferm™ increases the rate or extent of fiber degradation. This, in turn, may be responsible for enhanced animal performance.

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2. Welch RP, Tsai K-P, Harper EG, Chang JS, Calza RE (1996) *Appl Microbiol Biotechnol* 45, 811-816
3. Newbold CJ, Brock R, Wallace RJ (1992) *Lett Appl Microbiol* 15, 109-112

Dietary and chemical manipulation of rumen fermentation. M Baran *(Institute of Animal Physiology, Slovak Academy of Sciences, Košice, Slovakia)*

Fermentation activity in the rumen appears to be the key component of the digestive processes in ruminants. By manipulating rumen fermentation it is possible to obtain improved conversion of feed to animal products. Two approaches are available to increase the efficiency by which ruminants utilise dietary energy. These are firstly increasing the efficiency by which the energy of feed ration is transformed into end-products of rumen fermentation, especially into volatile fatty acids (VFA), and, secondly, increasing the efficiency by which the end-products of fermentation are utilised for the basal physiological processes and synthesis of animal products.

Fermentation processes in the rumen may be increased and the production of undesirable digestion products (methane) suppressed in two ways: 1) by feed ration including feed intake and composition, and

by modification various technological methods of feed treatment and conservation and 2) by using chemical substances or products of microbial synthesis which are able to transform metabolic processes by rumen microflora.

The manipulation of rumen fermentation by treatment of feed rations is in theory advantageous. However, in practice, it is limited by the technology available to treat and conserve single feeds and, notably, on their effectiveness. Manipulation of rumen fermentation using chemical products of microbial synthesis, such as the polyether antibiotics, has been widely practised in recent years. Monensin, a carboxylic ionophore, is currently the most widely used chemical agent in ruminant production.

The manipulation of rumen digestion is ultimately dependent on factors such as the nature and level of feeding and the animal production system. High levels of production are obtained by feeding high amounts of starch and protein, and it is obvious that rumen optimisation in this production system will be different from that of animals fed rations based on roughage (plant cell walls) and non-protein nitrogen. The optimisation process can be considered in terms of maximising or minimising reactions in the rumen. Processes that should be maximised under all conditions include the degradation of fibre to VFA and microbial protein synthesis. A low methane-high propionate pattern has potential (higher efficiency of fermentation), but may be unfavourable for milk composition (low-fat milk syndrome). Other reactions should be minimised; notably methane production, feed protein degradation, biohydrogenation of unsaturated fatty acids and, to a small extent, fermentation of starch. It is important to keep in mind that each reaction in the rumen must be considered as part of an integrated and interactive network of reactions that constitute rumen metabolism.