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## Microproteins: Just What the Doctor Ordered

**Feed additives can reduce herd health problems.**

by **Thomas Hill**, Oregon State University

Some people say that an apple a day will keep the doctor away. Cattle producers wish this could be just as true for their herds. New developments in medicinal technology show signs to help producers reduce high vet bills.

"Microproteins" is a term that collectively refers to a group of feed additives. This group includes direct-fed microbials (DFM), enzymes, fungi and IgY antibodies. The research results on these feed additives are variable and limited. Different animal production levels, feed preparation practices and mixing methods can partially explain variability.

Nevertheless, producers continue to report positive results when these products are incorporated into beef cattle management systems. The pressure to find alternative growth

promotants that are antibiotic free has resulted in increased interest in microprotein feeding technology. An explanation of these products and their proposed effectiveness follows.

### Direct-fed microbials

Direct-fed microbials are a category of feed additives that is made up of favorable bacteria such as *Lactobacillus acidophilus*, *Bacillus subtilis* and *Enterococcus faecium*. Fed to cattle, these bacteria live and proliferate in the rumen and hindgut. The National Feed Ingredient Association and the Food and Drug Administration (FDA) have established guidelines that regulate, by law, claims for these bacteria-based products.

Cattle producers' use of DFM is widespread: in a nation-wide survey of 267 commercial feedlots, 44% used DFM and 56% did not. The feedlots that used DFM

had a 6.75% improvement in average daily gain (ADG) and 1.5% improvement in feed-to-gain ratio. In summarizing the data from 30 separate feedlot research trials, cattle given DFM had a 10.7% improvement in ADG and 5.4% improvement in feed-to-gain ratio. This increase in cattle performance is believed to be a result of the effect of DFM on rumen pH, elevated levels of propionate, an important volatile fatty acid, and increased populations of existing beneficial rumen microflora.

Additionally, DFM have been shown to affect pathogens in the hindgut. The change in pathogen populations because of DFM is caused by competitive exclusion, the process by which DFM compete with pathogens for space on the intestinal lining.

This effect has resulted in the reduction of scours in nursing calves and the shedding of *E. coli* O157:H7 by as much as 50% in feedlot cattle. Additionally DFM, when colonizing the hindgut, release inhibitors that block the proliferation of pathogens. A limited amount of research from Japan has indicated that DFM enhance the immune system and elevate serum immunoglobulin (Ig) levels.

### Enzymes

The production practice of feeding enzymes to monogastrics, i.e. poultry and swine, is widely used. The adoption of this technology in beef cattle has been slow because early enzyme preparations were subject to degradation in the rumen and the enzyme cost was too high to be profitable. More recently, improvement in enzyme preparation technology and the relative economics of feeding cattle have made the feeding of enzymes a more viable cattle management option.

The addition of enzymes to the cattle diet is designed to improve feed digestibility by degrading cell walls and breaking fatty acid and polypeptide chains. When the structure of these nutrient molecules is changed, digestion and absorption are enhanced.

Enzymes are specific for each diet component, i.e. cellulose, starch, pectin, lipid and protein. This specificity makes it important to have the correct enzyme profile provided for the appropriate diet. The greatest benefit of enzyme technology is the ability to enhance fiber utilization in the diet. Improvement in fiber utilization is important even in high-grain finishing rations.

A series of feedlot cattle trials in which enzymes were fed resulted in a 5% improvement in ADG and 10% improvement in feed efficiency (FE) on average. FDA guidelines require products with enzymes to list the source and activity level of the enzyme. As with DFM,

no label claims regarding animal therapy or production levels are allowed unless FDA animal drug clearance work has been completed.

### Fungi: Yeast and *Aspergillus*

This topic area is extensive and rapidly expanding. Yeast and *Aspergillus* are fungi that are fed in two forms. Yeast can be fed as dry yeast, which contains live cells. Both yeast and *Aspergillus* can be fed as cultures, which contain no live cells but only the metabolites produced by these growing organisms.

Additionally, yeast can be combined with certain minerals to form a yeast mineral complex. Results from one company's yeast preparation or *Aspergillus* can vary from that of another because of variations in processing and fermentation procedures.

All of these factors make for a wide range of effects and uses for fungi products. In general, these products are targeted to enhance rumen function. Effects from feeding fungi are reported to include improving pH stability in the rumen and, as such, reducing the risk of acidosis, increasing fiber digestion.

Increasing the population of rumen bacteria not only enhances fermentation but also leads to an increase in the microbial protein passing to the small intestine where absorption takes place. The enhancement of microbial population counts by fungi is not clearly understood by the scientific community. It has been theorized that fungi are able to detoxify toxins produced by some bacterial pathogens.

In mammals other than cattle, fungi have been shown to create an enhanced immune response, and it is possible that this enhanced immune response is present in cattle. All of these factors would improve cattle performance.

Fungi research results have been variable. This variability underscores the need for a better understanding of fungi, their mechanisms of action, and the interactions between them and animal production levels, other feed additives, diet composition and fermentation methodology.

### IgY antibodies

Antibodies and antibiotics are two distinctly different materials. The two should never be confused. Antibiotics are synthetically produced materials that are given to animals to fight disease. Common antibiotics are chlortetracycline, sulfa and penicillin. Antibodies are produced by the animal's immune system and are the body's own natural defense mechanism to fight disease.

Antibodies, for example, are what give colostrum its important and vital disease-fighting properties. When a producer vaccinates, the goal is to stimulate the animal's immune system to

produce specific antibodies to the pathogens contained in the vaccine. It is possible to feed supplemental antibodies (not antibiotics) to cattle in order to improve animal health.

Supplemental antibodies are created when the domestic laying hen is inoculated with a pathogen such as *E. coli*, *Salmonella*, *Coronavirus*, *Rotavirus* or *Clostridium perfringens*. The chicken does not show signs of these diseases that would be common in cattle. However, the chicken recognizes these foreign pathogens and creates an immune response by building IgY antibodies. These IgY antibodies have the ability to physically associate and deactivate the infectious agent. The chicken's immune system responds to infectious challenges that are both bacterial and viral in nature by producing IgY antibodies.

These IgY antibodies are translocated into the egg yolk where they can be harvested and supplied orally to cattle. Chicken-derived antibodies have two different courses of action in cattle.

One course of action is in calves less than 24 hours of age. When IgY antibodies are supplied in the first 24 hours of life, passive immunity of the calf is improved, because the IgY antibodies are able to cross the small intestine in this narrow time window, allowing the immune system of the newborn calf to be enhanced.

The second course of action is in cattle that are experiencing scours, regardless of age. Supplied orally, the IgY antibodies move through the digestive tract and eventually come into contact with the pathogen in the gut and attack and destroy the disease-causing agent. IgY antibodies have the ability to attack both bacterial and viral organisms. No drug residue or withdrawal or long-term tolerance issues are involved with IgY antibodies. A limitation is that antibodies are very specific for each pathogen and are not broad spectrum in their pathogen targets.

The majority of IgY antibody research has been conducted in Japan and Europe. Application of this technology is more widespread outside the U.S. The U.S. Department of Agriculture (USDA) and FDA do not allow any health claims to be made with the use of this technology except for one product targeted only for *E. coli* which received FDA approval and clearance.

The application of microproteins in the form of direct-fed microbials, enzymes, fungi and IgY antibodies will remain controversial because of variable results. Producer interest continues to increase as more stable microproteins are produced. Cattle production costs continue to rise as the need for growth promotants that fit natural marketing systems are more aggressively sought, and the use of antibiotics in animal agriculture continues to be a focus of political and social concern.

For more information about this management concept, contact [Thomas.W.Hill@oregonstate.edu](mailto:Thomas.W.Hill@oregonstate.edu). **HW**

## AHA member puts microproteins to use

American Hereford Association (AHA) member Jason Hoffman of Hoffman Ranch, McArthur, Calif., stands by the use of direct-fed microbials in his operation. Hoffman's use of Vita Ferm® helped earn his ranch numerous awards such as grand champion polled female and reserve grand polled female at the 2007 National Western Stock Show in Denver. Hoffman Ranch also championed numerous titles at the Ft. Worth Stock Show in Ft. Worth, Texas, and at the Western Nugget National Show in Reno, Nev.

Hoffman says the use of direct-fed microbials in a cattle herd is mainly to keep the herd healthy, especially in show cattle. Vita Ferm Sure Champ pellets help cattle develop more consistent appetites and longer-lasting bloom.

"We feed our show cattle Sure Champ pellets," Hoffman says. "It helps maximize the benefits from feeding grain.

The cattle stayed healthy, average daily gain (ADG) was good, and they have never eaten so well, and it's all because of the pellets."

According to Hoffman, Vita Ferm has been in his family's feeding program for many years. "Vita Ferm is a sure thing. We fed it to our show calves as kids, and we still use it to this day," Hoffman says.

Vita Ferm is part of the ByoZyme® line. It is available in variable formulations for every phase of the beef cycle. Vita Ferm users have seen improvement in areas such as breeding performance, calf weight gain and conversion rates, decreased cow maintenance costs, and improvements in overall herd health. For more about Vita Ferm visit [www.biozymeinc.com](http://www.biozymeinc.com). **HW**