



# Cow Calf Technical Bulletin

## Managing the Role of Rumen Protozoa in Cow/Calf and Stocker Nutrition

**P**rotozoa are an often over-looked component of rumen microbiota. They are present in far lower numbers than the bacteria, but their individual size is so much larger they typically make up about half the biomass in an adult rumen. Yet when a calf is born, there are no protozoa within its system. It won't become "faunated" (populated with ruminal protozoa) until sometime between 6 weeks and 6 months of age, thanks to transfer from other animals via grooming or shared feed and water sources. There are two types of protozoa found in the rumen: holotrichs and entodiniomorphs. They have cilia, or little hairs, on the outside of their one-celled bodies, which aid in movement and drawing food towards them for ingestion.

### Good Guys or Bad Guys?

Ruminal protozoa can play a significant, if not entirely positive, role in the digestion process. These organisms have the ability to degrade hemicellulose, which can leave feed particles more accessible for bacterial fermentation activity. They also utilize sugar and starch, putting them in a competitive situation with the bacteria and fungi. And the entodiniomorph group of protozoans are actually predators of rumen bacteria. Thus, a large protozoa population leads to fewer bacteria. Recent research from Japan also showed that faunation "markedly affected" the bacterial species make-up.

### Defaunation

Defaunation refers to the removal of protozoa from the rumen, which can have significant impacts on the remaining microbial population. When protozoa are reduced or eliminated, bacterial numbers increase. The composition of bacterial species also changes. This results in increases in both Volatile Fatty Acids (VFA, the primary energy supply for the host animal) and Microbial Cell Protein (MCP, the primary protein supply for many ruminants). The make-up of fermentation end products is also altered when protozoa are taken out of the picture, typically resulting in a reduction in both methane and the acetate:propionate ratio; both of these changes are affiliated with improved energy efficiency. Research results have also confirmed improvements in microbial efficiency (flow of microbial protein relative to feed consumed) with defaunation.

### Practical Application

The concept of purposely defaunating cattle has been considered for decades. In 1967, researchers at Kansas State University screened 170 different chemical agents for their potential to eliminate ruminal protozoa. Multiple studies since then have more specifically looked at the impact of various defaunating agents. Ionophores have anti-protozoal properties (Wallace et al., 1994), which may explain the positive

impact they sometimes have in reducing pasture bloat. Some medium chain fatty acids, for example, have been shown to reduce protozoa numbers, with a concurrent reduction in methane production. Generally speaking, growth responses to protozoa removal have been seen in studies where dietary protein was limiting.

The problem is, defaunation is transient. Cattle will either pick protozoa back up from other animals, or the rumen will repopulate internally with protozoa that were safely residing in the reticulum or omasum when the defaunating agent was present in the rumen.

### **Use of Yucca Extracts**

Products made from the yucca plant (specifically, *Yucca schidigera*) have been utilized in livestock diets for decades. These contain steroidal saponins, which are known to be metabolically active in the rumen. Saponins are anti-protozoal, and this has been considered the primary mode of action for improving animal performance and efficiency with yucca-derived additives. These compounds also seem to stimulate some bacteria, and inhibit others – primarily gram positive organisms—in much the same way as ionophores. Evidence suggests that they may also serve anti-inflammatory and antioxidant roles, and it has been shown they can impact intestinal permeability. In addition, some recent research found evidence that yucca's impact on nitrogen metabolism may be due to other components contained in the plant extract.

Saponins contain molecular side chains that bind to the cholesterol in protozoan cell membranes, causing them to rupture and die. Their effectiveness within the rumen has been demonstrated in multiple research trials, where dietary yucca extracts have led to increased MCP flow, improved microbial efficiency, reduced methane production, lower rumen ammonia and serum urea concentrations, and greater VFA production. The anti-protozoal properties of ionophores are due to a different mode of action; it has been suggested that the two would have synergistic effects when used together.

Because saponins are not absorbed from the digestive tract, they are excreted in manure, where they continue to impact microbial activity. A side benefit is a reduction in ammonia release and noxious odors. *Yucca schidigera* extracts are considered GRAS (Generally Recognized As Safe) feed additives, which means distributors may not make claims that would be considered 'medical' by the FDA. Therefore they are officially marketed as tools for ammonia and odor control.

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**#TB-8006**

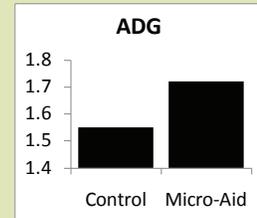


## QLF and Micro-Aid®

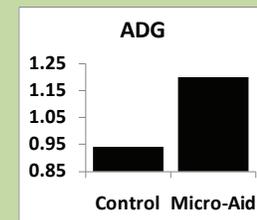
Micro-Aid®, a *Yucca schidigera*-based feed ingredient, is available for inclusion in QLF liquid supplements. The targeted nutrition of QLF and the biologically-active compounds in Micro-Aid function synergistically to enhance forage utilization and animal performance.

Research results document the positive impact of Micro-Aid® in a wide range of hay and pasture-based diets.

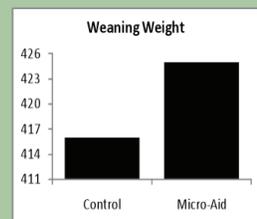
- ▶ Late summer native pasture, soy-based 38% protein supplement, 560-lb steers (*Oklahoma State University*);  
**Micro-Aid addition increased ADG 11%.**



- ▶ Tall fescue paddocks with interseeded Bermudagrass and clover, free-choice 35% protein liquid supplement, 650-lb steers (*University of Arkansas*);  
**Micro-Aid addition increased ADG 19%.**



- ▶ Beef cows, with or without Micro-Aid fed from 80 days pre- to 30 days post-calving (*Oklahoma State University*);  
**Micro-Aid increased calf weaning weights 9 pounds.**



- ▶ In-situ work, cattle receiving low-quality prairie hay and a cottonseed meal/wheat midds protein supplement (*Oklahoma State University*);  
**Micro-Aid addition significantly increased digestibility of dry matter and fiber (NDF).**

### A Natural Fit

- ✓ Micro-Aid® is an all-natural ingredient, approved for use in livestock feed in over 50 countries worldwide.
- ✓ Micro-Aid is not absorbed from the digestive tract, so there is no avenue for residues in meat or milk, and it requires no withdrawal period.
- ✓ Micro-Aid is safe for all classes of livestock, humans, and the environment.

