December 1, 2014 MicroBasics Technical Summary

Effects of Achieve on performance of high producing dairy cows

Consider post rumen effects due to increased absorption efficiency and an increased immune response

Introduction: In today's market there are several yeast (*Saccharomyces cerevisiae*) based products available to dairy nutritionists and producers to choose from, and although much research has been conducted on the benefits of feeding yeast to dairy cows, the results have been inconsistent. As the microbial world in which we live is constantly evolving, so too must information on DFM be kept current in order for nutritionists and dairy producers to make informed decisions.

Advocates of DFM for ruminant nutrition assert improved feed intake, feed efficiency, fiber fermentation, microbial protein synthesis, milk yield, rumen pH and digestion. These well-established modes of action share one key objective; to optimize rumen health. However, worth consideration are the effects DFM may have *post rumen*, specifically in the intestine and the gut-associated lymphoid tissue (GALT).

As the largest immune organ in the body, the intestine or "gut" plays a major role in whole body immunity. The intestinal lymphoid tissue is home to a plethora of immune cells (such as T and B lymphocytes) which work to defend the host against foreign substances and pathogens. These specialized immune cells require amino acids as energy substrates in order to function properly. Since the intestine is the primary site of nutrient absorption and amino acid metabolism (functions of the digestive system), it follows that immune cells and amino acids remain in close proximity, so long as sufficient nutrients are provided through the diet. The availability of single amino acids (and protein) is imperative in maintaining the physical integrity of the intestinal epithelium and subsequently, in fortifying the immune system. The importance of the symbiotic relationship between the digestive system and the immune system cannot be overstated; since a large portion of the immune system resides within the digestive system, establishing gut health translates to increased immunity.

In an effort to determine the effects of two yeast products both post rumen and on the performance of high producing Holstein cows, a comparative experimental trial was conducted early in 2014 by experts from the University of California, Davis, at their research farm in Hanford, CA.

Methods: Early lactation Holstein dairy cattle in three similar pens (315 head/pen) and in similar days in milk (DIM) received the same total mixed ration (TRM), with the exception of yeast products being added to the TMRs per the manufacturer's recommended levels. Pens were randomly assigned treatments (marks the beginning of Period 1). Treatments were switched by pen at four weeks (marks the beginning of Period 2) and eight weeks (marks the beginning of Period 3), creating a 3 x 3 crossover design. *Table 1* depicts the basic strategy of this design.

Table 1

Period	Pen 2	Pen 3	Pen 4
1	XPC	Achieve	Control
2	Achieve	Control	XPC
3	Control	XPC	Achieve

Periods were broken down into a three week adaptation phase and a one week sample collection phase. For two weeks prior to the start of Period 1, all cows received a diet free of any yeast product in an effort to "rinse out" residual effects of yeast feeding. Feedings were then provided twice per day; the morning feeding consisted of TMR plus yeast, while the later feedings were "top-up" loads of control TMR. The quantities of TMR offered to and refused by each pen were monitored and recorded.

Sample & Data Collection: DHIA (Dairy Herd Improvement Association) collected milk samples and recorded milk yields at the end of each experimental period. Samples were analyzed for standard milk constituents.

At the end of each experimental period, fecal, urine and blood plasma samples were collected to determine total tract digestibility, MCP flow and free plasma amino acids, respectively.

Experimental Results & Interpretation: *Table 2* summarizes key results of the trial. There was no significant variance between control and treatment groups in regards to dry matter intake (DMI). Milk yield of the Achieve treated animals was higher compared to both the XPC and control groups. In addition, the Achieve treated animals produced more milk fat and protein, and held higher concentrations of total
EAA and NEAA in plasma.

As depicted by the *Graph A* total EAA and NEAA in animals treated with Achieve was superior to levels recorded for both the XPC and control groups. *Graphs B* and *C* indicate that Achieve

treated animals held significant concentrations of essential amino acids threonine and tryptophan and for non-essential amino acids glycine and asparagine, respectively.

A significant part of the Threonine intake is utilized by the gut itself and is used for the synthesis of endogenous secretions and particularly mucus. Considering the importance of digestive secretions for gut health and for the digestive process, and adequate blood level of threonine is the key to allow proper gut function. Tryptophan may have a role in the regulation of appetite and feed intake through the peripheral control. Melatonin which is produced from tryptophan in the gastrointestinal tract, may serve as a signal for the synchronization of the feeding and digestion processes.

NDF data revealed that fiber digestion was unaffected, while total tract digestion showed an apparent decrease. This apparent decrease could be due to an increase in gut health, resulting in elevated endocrine secretions. In addition, the greater production recorded would likely not have occurred had there been a true decrease in total tract digestion.

MCP flow of the Achieve, XPC and control groups varied only slightly.

Due to the observed increase in absorption efficiency and an increased immune response it follows that Achieve gut health was properly supported in order to *achieve* these increases. A post rumen effect is likely the cause. UC Davis has proposed further research in ruminants on the effect of DFM post rumen.

Graph A

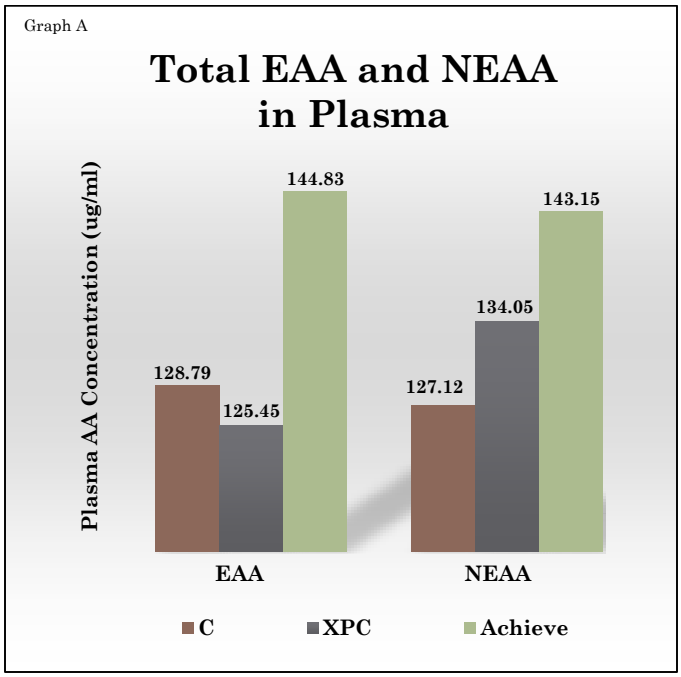
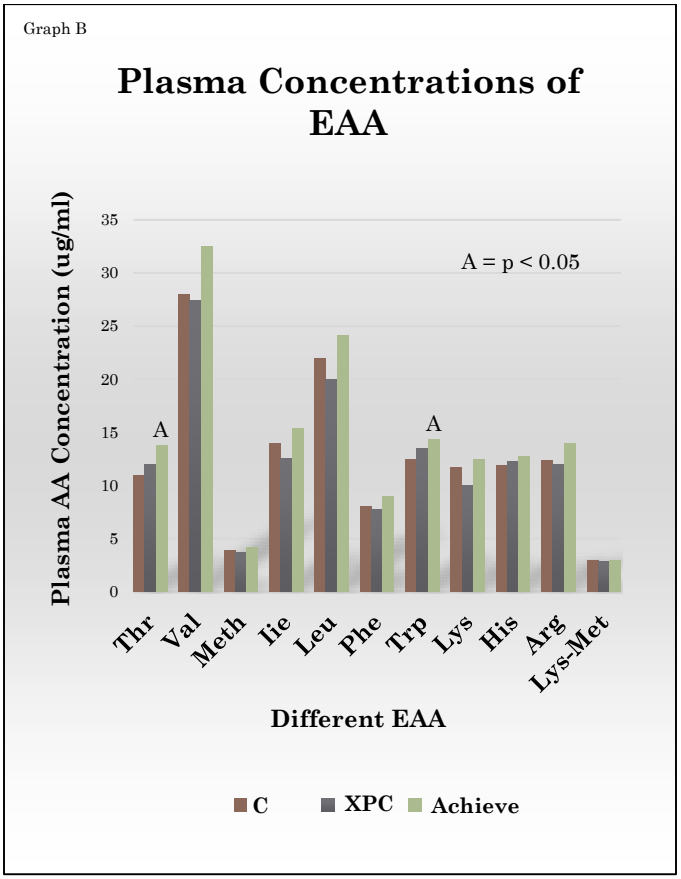


Table 2

Response Criteria	Control	XPC	Achieve
Dry Matter Intake (lb./cow/day)	60.12	59.4	60.19
Milk Yield (lb./day)	105.31	105.64	107.87*
Milk Fat (%)	3.28	3.26	3.27
True Protein (%)	2.85	2.86	2.85
Total EAA and NEAA in Plasma (ug/ml)	128.79	125.45	144.83

* $p < 0.01$ (XPC $p = 0.75$)

Graph B



Graph C