Research Bulletin
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New Solutions Can Replace Blood Meal as Amino Acid Source

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KEY POINTS

- **New research reveals nutritionists have options for delivering amino acids to dairy rations without feeding inconsistent sources of lysine, like blood meal, and can experience the same or better results.**
- **Dairies with varying situations can customize their approach to amino acid balancing to meet amino acid needs.**

INTRODUCTION

Protein is a critical nutrient for cow health, growth and performance throughout the lifecycle. Through ongoing studies, researchers have identified the specific amino acids that limit protein production and, ultimately, milk production. Extensive research has found lysine and methionine to be the most limiting amino acids in typical dairy cow diets. They must be fed in rumen-bypass forms to ensure sufficient amounts reach the small intestine, and can be used for milk and component production.

To meet limiting amino acid needs, nutritionists have frequently overfed protein, resulting in reduced efficiency. With rising protein prices and increased environmental regulation, solutions are needed to deliver these limiting amino acids without overfeeding protein.

The most concentrated source of lysine available, from a source other than a protected amino acid, is blood meal. Blood meal also brings with it other essential and nonessential amino acids, and on paper looks like an excellent source of nutrients. Unfortunately, blood meal is also highly variable in measured nutrients (crude protein, RUP, RDP, etc.), as well as nutrient characteristics that are not routinely measured (intestinal protein digestibility and amino acid availability).[1] The lysine in blood meal is easily damaged during processing. As a result, diets formulated with blood meal can result invariable production.

The best overall source of amino acids for milk production is rumen microbial protein. Microbial protein supplemented with a small amount of lysine would be the ideal replacement for blood meal in dairy cow diets. FERMENTEN® Rumen Fermentation Enhancer has been shown to improve the production of microbial protein. If this can be augmented by MEGAMINE-L® Rumen Bypass Lysine, then a more consistent source of amino acids can be delivered to the small intestine of the cow. Both MEGAMINE-L and FERMENTEN have been researched at Atlantic Dairy and Forage Institute.

The purpose of this study was to investigate the replacement of blood meal with FERMENTEN and MEGAMINE-L. Model results indicate that a combination of these two ingredients would provide similar results as those seen when high quality, consistent blood meal is fed.

TRIAL OVERVIEW

Diet Formulation

The study compared a control diet with three treatment rations balanced for amino acids using different amino acid sources.

All diets were formulated for equal methionine using a commercially available methionine product (Smartamine®) and to contain 15.5% crude protein in total; diets were isoenergetic. Calculated and analyzed ration profiles are outlined in Table 1.

- **Diet 1 (Control):** Diet was formulated with 15.5% crude protein; the ration met methionine requirements, but was deficient in lysine.
- **Diet 2 (Blood Meal):** Amino acids delivered through blood meal; crude protein was the same as the control.
- **Diet 3 (FERMENTEN):** Amino acids balanced by feeding FERMENTEN at 3% of dry matter using CPM profile; no blood meal was fed.
- **Diet 4 (FERMENTEN + MEGAMINE-L):** Amino acids balanced by feeding FERMENTEN at 1.5% dry matter and meeting remaining lysine requirements with MEGAMINE-L; no blood meal was fed.

TABLE 1 Ration Nutrients by Diet

	Control	Blood Meal	FERMENTEN	FERMENTEN + MEGAMINE-L
CALCULATED				
Methionine, g/d	46.6	47.1	47	46.5
Lysine, g/d	126.5	140.3	140.5	138.6
Metabolizable Protein, g/d	1975	2030	2020	2005
Metabolizable Protein Balance, g/d	-294	-230	-249	-264
ANALYZED				
Dry Matter, %	54.19	55.75	55.81	55.05
CP, %	15.93	15.97	15.83	15.93
ADF, %	20.17	21.13	21.33	21.10
NDF, %	39.20	40.33	39.93	39.53

Trial Design

The trial was set up as a Latin square with 28-day periods:

- **Weeks 1 and 2:** Diet adaptation
- **Week 3:** Total collection (digestibility measured)
- **Week 4:** Production measurements

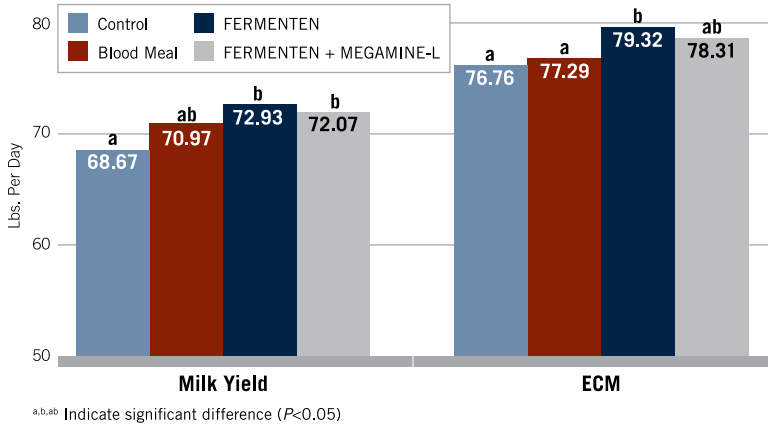
The study utilized 12 post-peak-production cows, which were blocked into four groups by age and production.

All cows were not pregnant in an attempt to eliminate body weight gain/loss and pregnancy as confounding factors of nutrient use.

Diets were fed *ad libitum*. Milk was weighed daily, and weekly averages were calculated. Milk composition was determined at each milking on the last two days of each experimental period.

RESULTS

CHART 1 Milk Yield and Energy-Corrected Milk (ECM) (lbs/d)



a,b,ab Indicate significant difference ($P<0.05$)

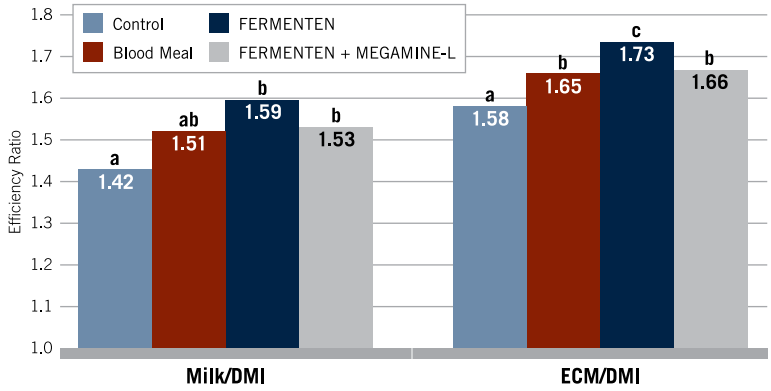
Milk Production

- Cows fed FERMENTEN or FERMENTEN + MEGAMINE-L diets produced more milk and energy-corrected milk (ECM) than the control or blood meal diets.
- Milk component production was similar across treatments.

Feed Efficiency

- The FERMENTEN diet had the highest feed efficiency due to lower DMI and significantly higher production levels.
- All three treatment diets resulted in significantly higher feed efficiency than the control.

CHART 2 Efficiency of Milk and Energy-Corrected Milk (ECM)



a,b,ab,c Indicate significant difference ($P<0.05$)

TABLE 2 DMI (lbs/d)

Control	49.23
Blood Meal	47.36
FERMENTEN	46.43
FERMENTEN + MEGAMINE-L	47.71

DISCUSSION

Body Weight Change

- **Control:** On the control diet, cows produced less milk than the other three groups, but also lost weight. If cows were to maintain body weight while on the control diet, they would have produced even less milk compared to the other three diets.
- **Blood Meal:** When fed blood meal to meet amino acid requirements, cows gained weight. If cows utilized nutrients toward production rather than body weight gain, the blood meal group would have produced more milk, most likely similar to the treatment groups.
- **FERMENTEN and FERMENTEN + MEGAMINE-L Groups:** There was essentially no body weight change when either treatment diet was fed, indicating that nutrients were maximized for milk production.

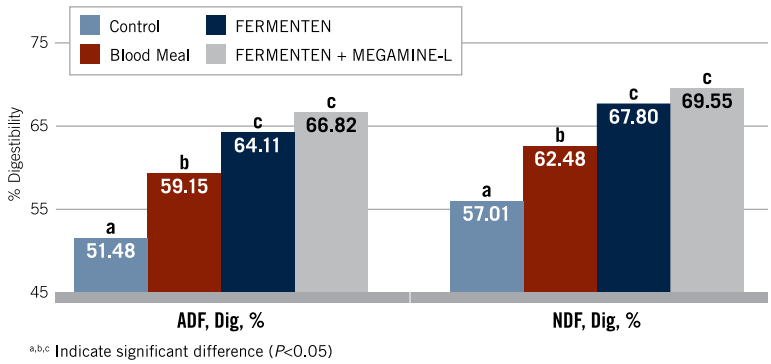
Body weight changes weren't significantly different from each other, but the changes in the control and blood meal treatment groups, were significantly different from zero.

Digestibility

The digestibility results were gathered using the total collection method for both urine and feces.

The blood meal diet had the lowest digestibility of the three treatment diets and the FERMENTEN + MEGAMINE-L diet had the highest. There were numeric differences between treatments favoring the diets containing FERMENTEN. Results showed that FERMENTEN may have improved the digestion of the fiber portion of these diets. Digestibility results when diets were formulated with FERMENTEN were consistent with studies as published in the *Journal of Dairy Science*.[2]

CHART 3 Fiber Digestibility (%)



a,b,c Indicate significant difference ($P<0.05$)

CONCLUSIONS

Researchers concluded feeding FERMENTEN or FERMENTEN + MEGAMINE-L in combination as the main source of amino acids can deliver the same or improved production and efficiency when compared to feeding blood meal, without the inconsistency and variability often experienced with blood meal.

APPLICATIONS

The research concluded that solutions beyond blood meal exist to properly deliver limiting amino acids to the lactating dairy cow:

- FERMENTEN can work effectively to improve production efficiency; nutritionists can use this product alone when the ability to be precise is limited. This may be caused by specific herd challenges like environment, measurability, etc.
- FERMENTEN can replace amino acid sources like blood meal to increase microbial protein production and overall production and efficiency.
- Feeding FERMENTEN + MEGAMINE-L in combination allows for more precise and consistent feeding of rumen-protected amino acids. More precise delivery of limiting amino acids allows for lower crude protein levels to be fed while meeting nutritional requirements.

These new findings provide new ways for nutritionists to balance dairy rations for amino acids. They can begin to more conveniently and effectively implement the practice on dairies.

REFERENCES

1 Boucher SE. Challenges of Predicting Metabolizable Lysine Content of Ingredients, in *Proceedings*. Cornell Nutrition Conference for Feed Manufacturers 2009;16-27.

2 Lean IJ, Webster TK, Hoover W, Chalupa W, Sniffen CJ, Evans E, Block E, Rabiee AR. Effects of Bio-Chlor and Fermenten on Microbial Protein Synthesis in Continuous Culture Fermenters. *J Dairy Sci* 2005;88:2524-2536.

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