

Research Bulletin

Arm & Hammer Animal Nutrition

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MEGAMINE-L™ Improves Performance with Consistent Bypass Lysine Rates, Metabolizable Protein Availability

KEY POINTS

- Supplying consistent levels of bypass lysine has been an ongoing challenge for the dairy industry. When lysine is delivered at optimal levels, production and efficiency can be optimized.
- MEGAMINE-L™ Rumen Bypass Lysine delivers consistent, high-quality bypass lysine and fat to the small intestine, resulting in increased milk production and component yield.
- Two Latin-square trials confirmed the consistency and quality of MEGAMINE-L.

INTRODUCTION

Amino acids are the building blocks of protein, one of the most important nutrients in a dairy cow's diet. Supplying cows with the right levels of amino acids directly influences their ability to reach peak performance.

Limiting amino acids are so named because they limit protein synthesis by the animal when they are not available from the ration. Lysine and methionine are the two most limiting amino acids and cannot be synthesized in the body from other amino acids or precursors; cows must be supplemented with these key essential amino acids through the diet.

Amino Acid Balancing Research Review

According to a recent publication¹, when optimal levels* of lysine and methionine are supplied in the diet—7.5% lysine and 2.5% methionine as a percentage

of metabolizable protein—performance and efficiency improves. In previous research² supporting these findings, 60 Holstein cows were assigned to one of four dietary treatments:

- Group 1: 18.3% crude protein (CP), low rumen undegradable protein (RUP)
- Group 2: 18.3% CP, high RUP
- Group 3: 16.9% CP, high RUP
- Group 4: 17.0% CP, high RUP + bypass methionine (optimal lysine and methionine levels)

The results, outlined in Table 1, show cows fed reduced crude protein diets balanced for amino acids (Group 4) produced significantly more milk and milk protein with greater efficiency than cows fed higher crude protein with a low amount of bypass protein and amino acids (Group 1).

TABLE 1 Optimal Levels of Lysine and Methionine Improve Milking String Performance, Efficiency (n=60)

	Group 1	Group 2	Group 3	Group 4
Dry matter intake (lbs/cow/day)	47.84 ^a	51.37 ^b	51.13 ^b	52.03 ^b
Milk yield (lbs/cow/day)	89.92 ^a	101.82 ^b	94.55 ^a	102.71 ^b
Protein production (lbs/cow/day)	2.64	3.04	2.82	3.17
Protein (%)	2.95 ^a	2.98 ^a	2.99 ^a	3.09 ^b

^{a,b} Indicate significant difference ($P < 0.05$)

Noftsger, et al. 2003.

Current Amino Acid Balancing Practices

Nutritionists have relied on traditional feedstuffs to deliver amino acids, but these feeds provide low, inconsistent levels of limiting amino acids.

Research³ outlined in Table 2 emphasizes how inconsistent lysine levels in blood meal—a commonly fed lysine source—can be, reinforcing the need for a high-quality, consistent bypass lysine source.

TABLE 2 Composition and Variability of Blood Meal Samples³ (N=265)

	Average	5th Percentile	95th Percentile	Standard Deviation
Crude Protein (CP), % DM	90.1	84.4	96.0	3.68
RUP, % CP	76.8	50.4	96.6	14.80
RUP digestibility, %	64.6	19.9	97.6	23.06
Lysine, % CP	9.12	7.44	10.31	0.79

St-Pierre, unpublished observations.

Optimal Levels

Table 3 further explains the optimal lysine and methionine levels needed to achieve peak performance based on the model used to balance rations.

TABLE 3 Optimal Levels of Lysine and Methionine¹

Item	Optimal Lysine	Optimal Methionine	Optimal Lysine:Methionine
	NRC MODEL, 2001		
Milk Protein %	6.8	2.29	2.97:1
Milk Protein Yield	7.1	2.52	2.82:1
CPM MODEL (Version 3.0, based on CNCPS Version 6.0)			
Milk Protein %	7.46	2.57	2.90:1
Milk Protein Yield	7.51	2.50	3.00:1
AMTS / CNCPS MODEL (Version 6.1)			
Milk Protein %	6.68	2.40	2.78:1
Milk Protein Yield	6.74	2.31	2.92:1

MEGAMINE-L is the solution to this ongoing industry challenge of delivering lysine to the small intestine for peak performance and effective protein utilization.

Research-Proven Effectiveness

In vitro and two Latin-square trials⁴ were completed to determine the bypass rate, digestibility and effectiveness of MEGAMINE-L. Both studies confirmed that when optimal levels of amino acids were delivered, performance was maximized.

LATIN-SQUARE TRIAL #1

Overview

Sixteen cows were sorted in four groups for a 16-week trial. All four diets included methionine at 2.6%, and lysine at the following percentages of metabolizable protein:

1. Control
2. Low lysine (6.6% MEGAMINE-L)
3. Medium lysine (7.2% MEGAMINE-L – optimal levels)
4. High lysine (7.6% MEGAMINE-L)

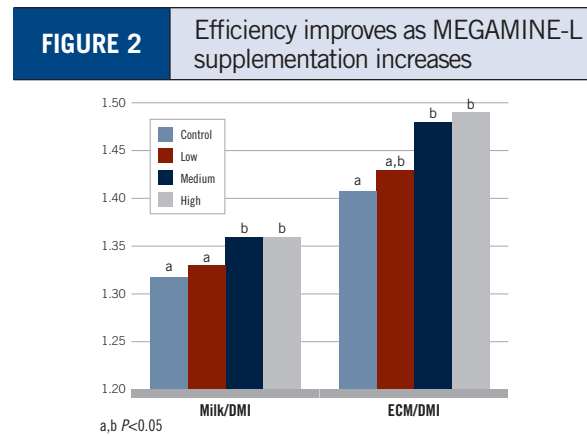
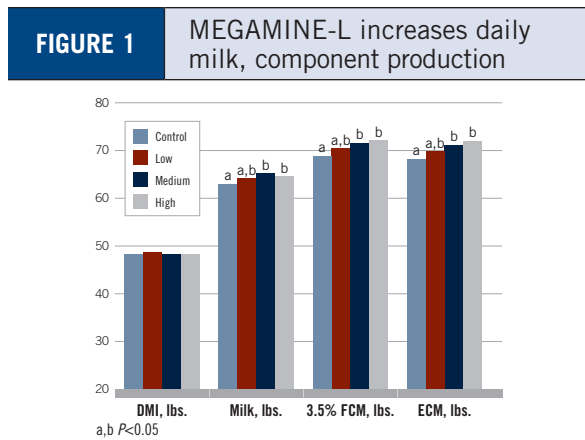
Every two weeks cows were fed a different diet, as reflected in Table 4. This feeding setup was repeated twice.

TABLE 4 Latin-square trial setup				
Cow #	1 and 2	3 and 4	5 and 6	7 and 8
	9 and 10	11 and 12	13 and 14	15 and 16
Period 1	Control	Low	Med	High
Period 2	High	Control	Low	Med
Period 3	Med	High	Control	Low
Period 4	Low	Med	High	Control

Results

Results show that as MEGAMINE-L supplementation increased, so did performance.

- Cows in the medium and high lysine treatments produced more milk and components.
- Component production increased as optimal levels of amino acids were supplied.
- Feed efficiency improved as optimal levels of lysine and methionine were delivered.



LATIN-SQUARE TRIAL #2

Overview

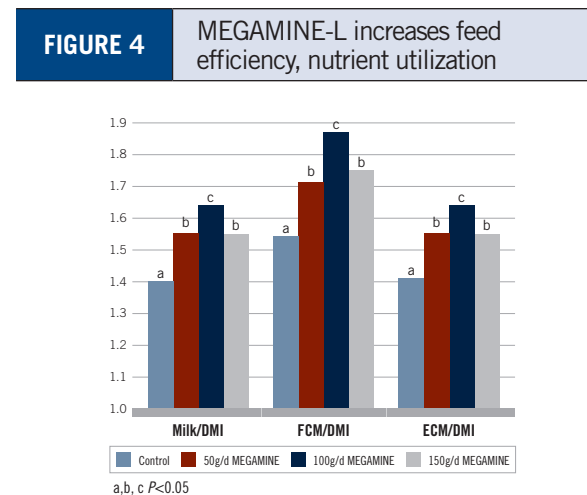
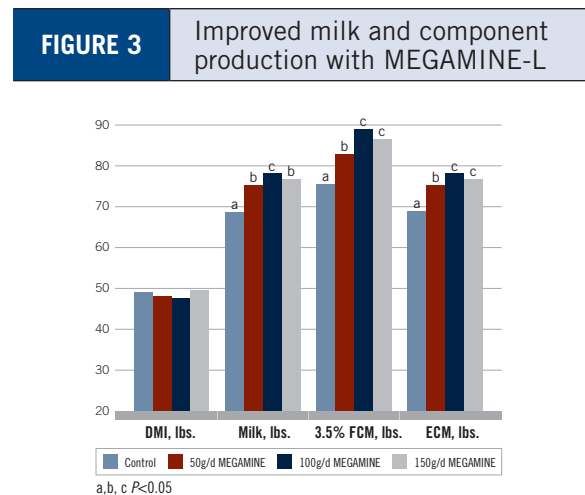
Sixteen cows were sorted in four groups for a 16-week trial. All four diets supplied methionine at 2.4% of metabolizable protein, and lysine at the following levels:

1. Control
2. Low lysine (50g/d MEGAMINE-L)
3. Medium lysine (100g/d MEGAMINE-L)
4. High lysine (150g/d MEGAMINE-L)

Results

The 100g/d diet delivered optimal levels of amino acids in this particular ration. When 100g/d of MEGAMINE-L was fed:

- Milk and component production increased while dry matter intake remained unchanged.
- Feed efficiency improved as a result of better feed utilization.



CONCLUSIONS

MEGAMINE-L consistency and effectiveness confirmed:

- **58% rumen bypass rate at 12 hours of rumen retention.** This represents the amount of lysine that bypasses the rumen and is delivered to the small intestine. This was determined in previous experiments⁴ by incubating nylon bags in ruminally fistulated cows for various lengths of time.
- **Metabolizable lysine percentage averaged 46%, reaching as high as 50%.** This is the total amount of lysine that was digested and absorbed for milk and component synthesis, based on the performance of the animals.
- **Improved milking string performance.** By optimizing lysine and methionine levels in the diet milk and component yields improved while increasing feed efficiency.

DISCUSSION

Previous research¹ demonstrates the need for optimal levels of lysine and methionine to maximize performance and nutrient utilization. This study addresses the need for a high-quality bypass lysine source for peak performance.

The two Latin-square trials confirm that high-producing cows must be supplemented with bypass lysine for optimized performance. MEGAMINE-L combines high-quality lysine with an inert fat to ensure the limiting

amino acid successfully bypasses the rumen and reaches the small intestine for absorption.

Both trials support the concept of supplying optimal levels of amino acids to the cow for peak performance. When supplied at optimal levels—7.5% lysine and 2.5% methionine as a percentage of metabolizable protein*—milk and component production, as well as nutrient utilization, is maximized.

REFERENCES

- 1 Schwab CG, Foster GN. Maximizing Milk Components and Metabolizable Protein Utilization through Amino Acid Formulation, in *Proceedings*. Cornell Nutrition Conference for Feed Manufacturers 2009;1-15.
 - 2 Noftsker S, St-Pierre NR. Supplementation of Methionine and Selection of Highly Digestible Rumen Undegradable Protein to Improve Nitrogen Efficiency for Milk Production. *J Dairy Sci* 2003;86:958-969.
 - 3 Boucher SE. Challenges of Predicting Metabolizable Lysine Content of Ingredients, in *Proceedings*. Cornell Nutrition Conference for Feed Manufacturers 2009;17-28.
 - 4 *In vitro* and Latin-square trial data on file and available on request.
- * Optimal levels may vary depending on ration balancing software.



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