

AJINOMOTO®

AJINOMOTO HEARTLAND, INC.

AjiPro™-L

Rumen Protected Lysine

A RELIABLE SOURCE OF LYSINE FOR MILK PRODUCTION

It has been well documented that lysine (Lys) becomes the first limiting amino acid (AA) or a co-limiting AA with methionine (Met) in dairy cows when they are fed a corn-based diet. During the last couple of decades, nutritional requirements for Lys and Met have been intensively investigated. To meet these requirements, ingredients (e.g. blood meal, fish meal and bypass soybean meal) that are high in rumen undegradable protein (RUP) have been commonly used to increase the supply of Lys and/or Met to the dairy cow, and consequently have improved milk production.

Research proven AjiPro-L offers a simpler and more economical way to fulfill the Lys requirement of high producing dairy cows.

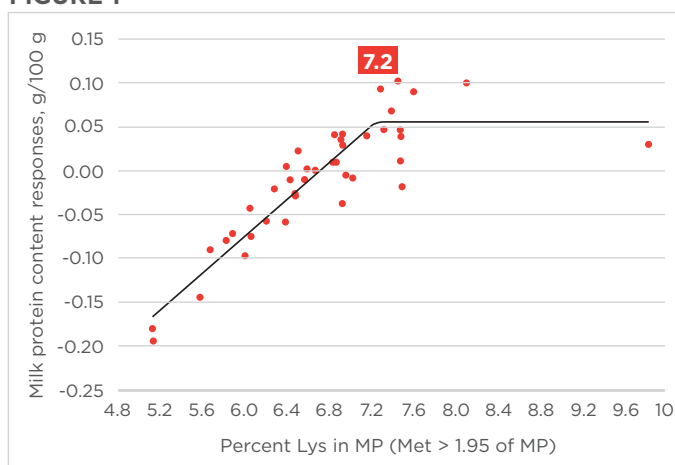


BACKGROUND

Increase in milk protein

Figure 1 was adopted from NRC 2001 showing a relationship between Lys in MP (Metabolizable Protein, %) and predicted milk protein response. Based on this relationship, one should expect an increase in milk protein by 0.106 g/100 g with a 1 point increase of Lys/MP (i.e. from 6.0% to 7.0%). The breakpoint for the requirement for maximum milk protein is calculated as 7.2 Lys/MP (%).

FIGURE 1



Increase in milk yield

Compared to the milk protein response, little information is available regarding the prediction of milk yield response to supplemental Lys. Therefore using published Ajinomoto data, we established a regression equation to predict milk yield response to increased Lys/MP. The form of Lys used in these trials was well characterized. This means that by-pass and digestibility characteristics of each product were well defined for the

products used in these production studies. For more information on these studies, please contact Ajinomoto Heartland directly. The procedure to develop the regression equation was exactly the same as reported by NRC (2001) and Whitehouse et al. (2009).

Table 1 is a list of studies used for the regression analysis of the milk yield response to Lys.

Figure 2 shows the relationship between Lys/MP and predicted milk yield response. There was a linear relationship between Lys/MP and milk yield response (% change). The regression curve did not reach a plateau within the range of Lys/MP tested (5.30 to 7.89), which was different from the milk protein response observed in NRC 2001. A relationship between Met/MP and milk production in our studies could not be determined indicating that Lys alone could be used to increase milk volume. In conclusion, one should expect an increase in milk yield by 6.8% (i.e. from 100.0 lb to 106.8 lb) with a 1 point increase of Lys/MP (i.e. from 6.0% to 7.0%).

FIGURE 2

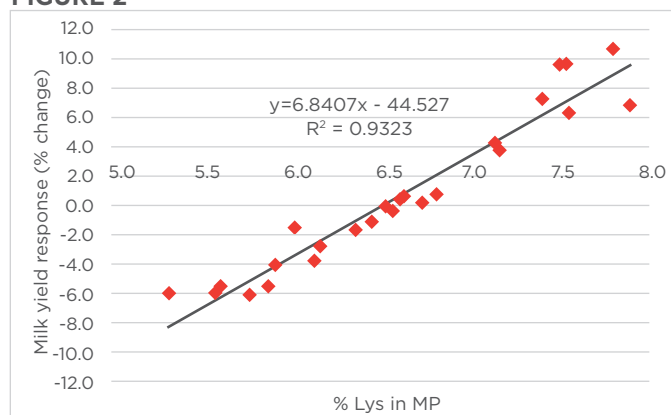


TABLE 1

Location	Period	Conducted by	Publication	Milk yield response, % change from Control
NY	0 - 8wk	Julien, WE et al.	JDS vol. 82, suppl. 1, 1999	+ 10.1
NB, CA	0 - 6wk	Robinson, PH et al.	JDS vol. 79, suppl. 1, 1996	+ 5.9
VT	0 - 4wk	Sniffen, CJ et al.	JDS vol. 82, suppl. 1, 1999	+ 10.4
VT	0 - 6wk	Sniffen, CJ et al.	JDS vol. 82, suppl. 1, 1999	+ 5.6 / + 15.2*
NY	0 - 6wk	Nocek, JE et al.	JDS vol. 82, suppl. 1, 1999	+ 10.8
NS, CA	6 - 12wk	Fredeen, AH et al.	JDS vol. 82, suppl. 1, 1999	+ 9.7
NY	0 - 4wk	Chalupa, W et al.	JDS vol. 82, suppl. 1, 1999	+ 8.9
WA	0 - 10wk	Harrison, JH et al.	JDS vol. 78, suppl. 1, 1995	+ 9.8 / + 12.4*
CA	11 - 18wk	Robinson, PH et al.	JDS vol. 93, E-Suppl., 2010	+ 4.2
NY	5 - 8wk	Nocek and Shinzato	JDS vol. 93, E-Suppl., 2010	+ 3.2 / + 5.8*
NY	17 - 29wk	Boucher, SE et al.	JDS vol. 93, E-Suppl., 2010	+ 2.2

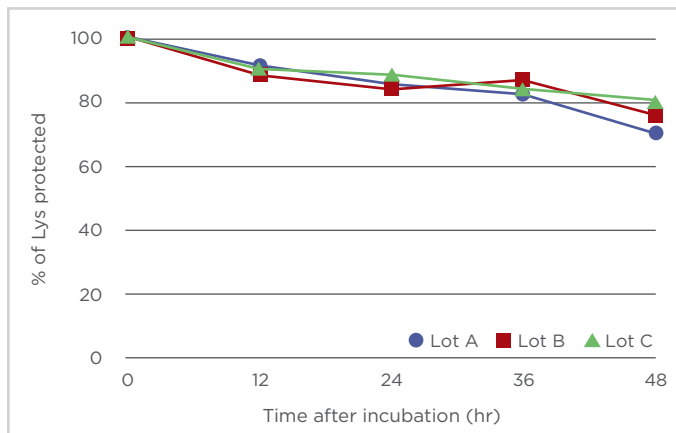
*Two different dosages of supplemental Lys were tested.

AJIPRO-L PRODUCT CHARACTERISTICS

Rumen protection

The *in situ* Dacron bag technique was adopted to measure the degree of rumen protection in lactating dairy cows. As shown in Figure 3 below, 85 to 90% of Lys in AjiPro-L remained undegraded after 24-hours of incubation in the rumen. The degree of protection was highly consistent across the three lots tested. The results reveal AjiPro-L is well protected in the rumen in the high producing dairy cow.

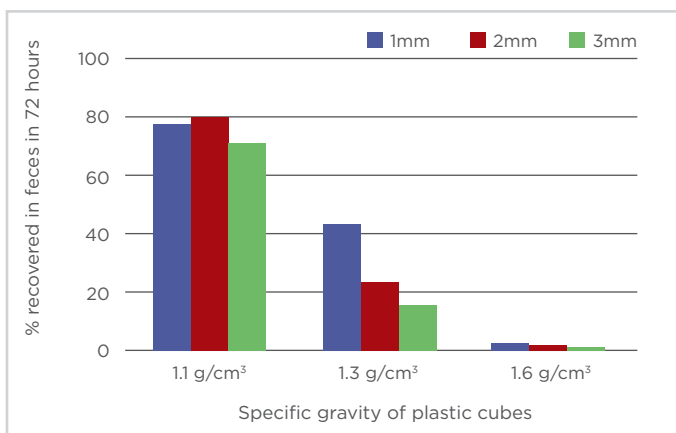
FIGURE 3



Rumen escape and intestinal delivery

Prior research has shown that specific gravity and particle size are important parameters in rumen escape. In order to design a product that optimally escapes the rumen, we prepared plastic cubic particles with three different specific gravities (1.1, 1.3 or 1.6 g/cm³) and sizes (1, 2, or 3 mm edge). We then measured the recovery of particles excreted in the feces of cows 72 hours after ingestion. It was found that the rumen escape, as indicated by the recovery in the feces, could be maximized when the specific gravity was 1.1. At this specific gravity, there was no influence of the particle

FIGURE 4

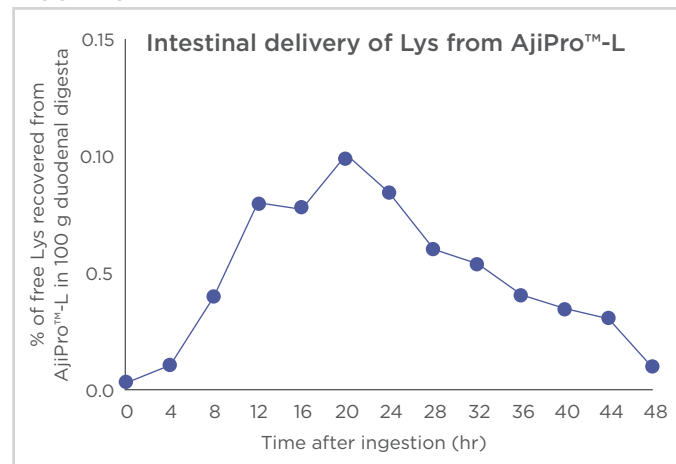


size (see Figure 4). Based on these findings, AjiPro-L was designed to possess the S. G. of 1.10 - 1.15 g/cm³.

Next, the intestinal delivery of AjiPro-L was examined using duodenally cannulated cows with the same technique as in Swanepoel et al. (2010). Figure 5 shows a typical pattern of changes of free Lys concentrations in digesta from cows fed AjiPro-L for 48 hours after ingestion. Y axis represents the amount of free Lys from AjiPro-L in 100 g of digesta collected at each time point.

The technique in Swanepoel et al. (2010) revealed that intestinal delivery of AjiPro-L was approximately 80% of fed amount.

FIGURE 5



Lastly, intestinal digestibility of AjiPro-L was evaluated with a methodology described by Nocek et al. (2010). Average intestinal digestibility of AjiPro-L was approximately 50% of bypass fraction.

In summary, the average efficacy of AjiPro-L is calculated as follows:

Total Lys (%)	40
Bypass rate (% of feed)	80
Intestinal digestibility (% of bypass)	50

Therefore, according to our extensive evaluation, 100 grams of AjiPro-L may provide 16 grams of MP Lysine to the high producing dairy cow.

AJIPRO-L BENEFITS

Figure 6 illustrates the milk yield response in three recent trials conducted in the United States, and Table 2 shows a summary of milk component response in those trials.

FIGURE 6

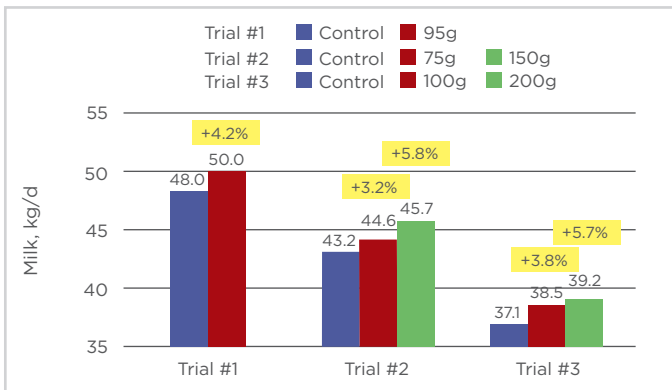


TABLE 2

	Trial #1		Trial #2			Trial #3		
	Cont	95 g	Cont	75 g	150 g	Cont	100 g	200 g
n	170	170	7	8	8	22	22	21
Period	11-18wk		5-8wk			0-4wk		
Lys in MP	6.12	6.60	5.75	6.15	6.55	6.65	7.30	7.95
Milk, kg	48.0	50.0	43.2	44.6	45.7	37.1	38.5	39.2
Protein %	2.82	2.88	2.73	2.73	2.72	3.20	3.17	3.11
Protein, kg	1.35	1.43	1.18	1.22	1.24	1.17	1.20	1.21
Fat %	3.59	3.64	3.80	4.14	3.78	4.74	4.97	4.89
Fat, kg	1.72	1.82	1.66	1.84	1.73	1.73	1.89	1.91

1 Robinson et al., J. Dairy Sci. 2010; Vol. 93, E-Suppl. 1:842 (Abstr.)
 2 Nocek and Shinzato, J. Dairy Sci. 2010; Vol. 93, E-Suppl. 1:235 (Abstr.)
 3 Nocek et al. To be presented in the ADSA-ASAS 2011 Joint Annual Meeting

In summarizing these research results, the weighted average response to 75-100 g/cow/d of AjiPro-L supplementation is as follows:

Lys/ MP	+ 0.50 point
Milk yield	+ 1.91 kg per cow per day (or + 4.09% compared to Control)
Milk protein	+ 0.05 g/100 g (+0.07 kg per cow per day)
Milk fat	+ 0.08 g/100 g (+ 0.11 kg per cow per day)

The average milk yield and milk protein response obtained in our lactation studies (as compared with controls), + 4.09% and + 0.05 g/100 g, respectively, are in-line with predictions described in this article.

AjiPro-L is a reliable and consistent source of metabolizable Lysine for dairy cows, with benefits supported by numerous research studies.

REFERENCES

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