

Abstract

Lysine loss was evaluated during in-vitro aerobic exposure of a ration mixed with either nothing (B, ration blank), mechanical extracted soybean meal (MES) with gums (MESG) (P1), MESG with rumen-protected lysine (RPL) (MESGL) first production run (P2), MESGL second production run (P3), RPL (P4), or MESGL third production run (P5). MESGL was manufactured by inserting RPL into soy gums and drying the gums onto MES. RPL comprised lysine mono-hydrochloride embedded in a rumen inert fat matrix. Two ration moisture (M) levels were evaluated: 48% M (L) (as fed 45% corn silage, 55% grain mix) and 58% M (H) (as fed 40% corn silage, 42% grain mix and 18% added water). Free lysine was quantified in water extracts taken from treatments at 0, 6, 18 and 24 hours. Eight replicates were taken for each treatment at each exposure time and lysine reported as microgram lysine per gram of water. Quadratic (orthogonal) polynomials were fitted to characterize the lysine concentration time trends separately for data acquired at L and H. Time trends for MESG runs with (P2, P3, P5) or without (P1) RPL were best characterized as linear trends. Trends for P2, P3, and P5 were not significantly different (F=0.29 on 6 and 11 df, p=0.92 at 48% M; F=0.05 on 3 and 11 df, p>0.99 at 58% M). The trend for P1 showed a significantly lower mean concentration at 48% M (t=-2.52 on 11 df, p=0.03). Overall linear trends for P2, P3 and P5 were not significantly different from P1 (p = 0.25 at L; p=0.81 at H). The concentration time trend for RPL alone (P4) was clearly significantly different from the MESG runs with a highly significant (p<1e-10) quadratic coefficient, much higher average slope and higher mean concentration (or intercept). The overall linear trend of lysine release from RPL, when RPL was inserted into gums under the conditions of this study, was not different from the linear trend of lysine release from native lysine in MES and was different from the linear trend of lysine release from RPL when it was not in gums.

Lysine loss during aerobic exposure of a corn silage based ration with mechanical extracted soybean meal with gums and various rumen-protected lysine products

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Figure 1. Total mixed rations were evaluated in 9-day continuous culture fermentation periods at West Virginia University. The TMR with MESBM_G had more bypass protein than other treatments.

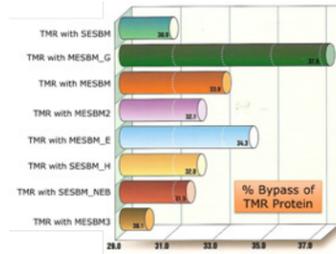
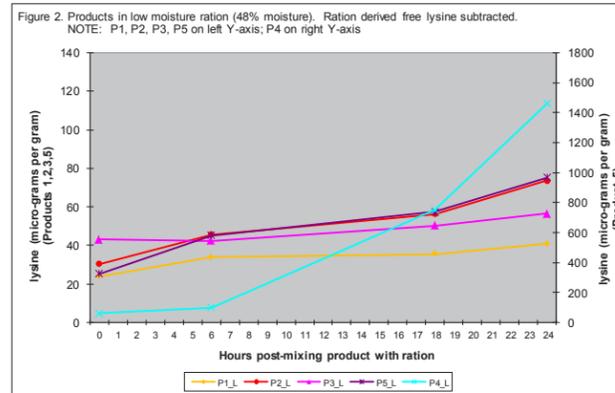
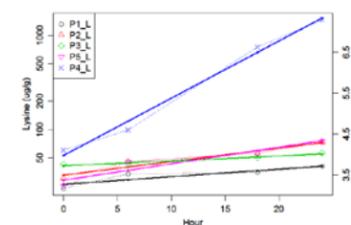


Table 1. Ration composition

Moisture:	Low (48%)	High (58%)
As Fed		
Corn Silage:	45	40
Grain Mix :	55	42
Water:	0	18



48% Moisture: Quadratic orthogonal polynomial fitted lines



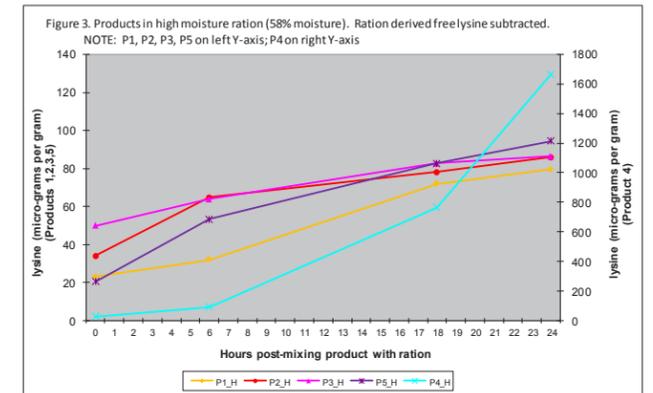
	Moisture 48		Moisture 58	
	Intercept	Linear	Intercept	Linear
P1	3.27	0.018	3.16	0.055
P2	3.49	0.033	3.72	0.034
P3	3.72	0.011	3.96	0.023
P5	3.37	0.040	3.29	0.058
P4	3.97	0.116	3.39	0.173
[Coef s.e.]	(0.12)	(0.007)	(0.16)	(0.011)
Residual s.e.	0.144 on 10 d.f.		0.204 on 10 d.f.	

Results and Discussion

Overall, the linear trend of lysine release from Soy Best PEARL and Soy Best were not different (p=0.25 at L; p=0.81 at H) (Figures 3 and 4). Soy Best had a significantly lower intercept compared to Soy Best PEARL, consistent with the lysine content of the two products: 6.26 versus 9.37 lysine % of RUP for Soy Best and Soy Best PEARL respectively, as reported in product literature. Soy Best PEARL RUP contains 1.5 times more lysine compared to Soy Best. In another study (Weich et al., 2013), plasma lysine was increased 33.3 mg/dL by Soy Best PEARL and 21.4 mg/dL by Soy Best, or 1.6 times more.

The similarity in lysine release rate for Soy Best and Soy Best PEARL in the present study is also consistent with results from a previous study (Sapienza, 2012), in which rumen-undegraded lysine was 62.9 and 61.1 percent of lysine for Soy Best and Soy Best PEARL respectively and were not significantly different (Figure 4). Intestinal digestibility of rumen undegraded lysine in the previous study, measured by means of an enzymatic procedure, was 83.0 and 89.9 % for Soy Best and Soy Best PEARL respectively (Figure 5).

The linear trend of lysine release from LysiPEARL in the present study was significantly different from Soy Best and Soy Best PEARL and had a higher slope, or rate of lysine release.



58% Moisture: Quadratic orthogonal polynomial fitted lines

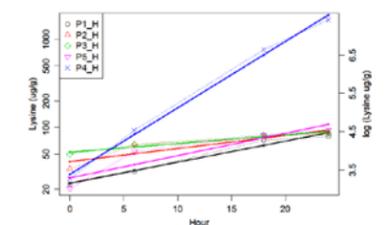


Figure 4. Rumen un-degraded lysine in Soy Best and Soy Best PEARL fortified with rumen-protected lysine

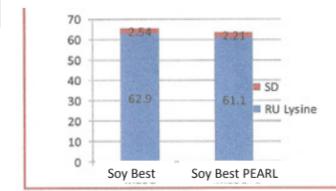
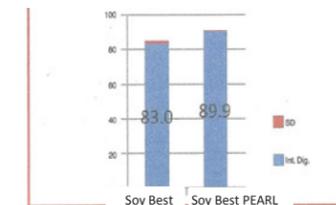


Figure 5. Intestinal digestibility of rumen degraded lysine in Soy Best and Soy Best PEARL



Introduction

A study at Miner Institute showed evidence that physical contact with total mixed ration (TMR) ingredients resulted in approximately 50% of the lysine in Kemin LysiPEARL rumen-protected lysine being released during a 24-hour period (Ji et al. 2012). Kemin LysiPEARL literature shows a rumen undegraded protein (RUP) value for LysiPEARL of 54% of crude protein. Technology has been developed to increase RUP of mechanical-extracted soybean meal (MESBM) using soy gums (MESBM_G). In a study at West Virginia University (Stern et al., 2005), a TMR with MESBM_G had more bypass protein than TMRs with MESBM without gums and other soybean based protein ingredients (Figure 1). The objective of the present study was to quantify the appearance of free lysine in water extracts taken from a corn silage based diet mixed with various rumen protected lysine products during aerobic exposure for 0, 6, 18 and 24 hours in diet at two moisture levels. The products were mechanical extracted high bypass soybean meal with gums (Soy Best, Treatment P1), Soy Best with LysiPEARL injected into the gums (Soy Best PEARL, Treatments P2, P3 and P5) and LysiPEARL (Treatment P4). The purpose was to evaluate the effect of injecting LysiPEARL into fresh soy gums and applying the gums onto mechanical extracted soybean meal on lysine loss during exposure to TMR ingredients.

Materials and Methods

- Two diets were mixed to specifications in Table 1.
- A portion of each ration was set aside to be used as ration blank.
- Added 1 to 2g of rumen-protected lysine product (RPL) and 0.5g arginine (internal standard) to each test vial. Test vials are open plastic cylinders approximately 8 inches (20 cm) in diameter and 5 inches (12 cm) tall, which held approximately 500g of ration mixture.
- Each replicate was mixed thoroughly for approximately 2 minutes with electric mixer (normal beaters).
- Allowed each replicate of each complete mixture to stand at room temperature (70°F, 21°C) for the appropriate number of hours.
 - 2 rations: low (48%) and high (58%) moisture
 - 8 replicates: 8 replicates for each ration and each time of aerobic exposure
 - 5 RPL: listed in Table 2
 - 1 blank: no RPL added to ration blank
 - 4 exposure times: 0, 6, 18 and 24 hours (0 hour was taken immediately after mixing)
- After the appropriate time of exposure 1L of water was added to each replicate and the water with free amino acids was filtered and collected in air tight vials. The vials were sealed and frozen until analyzed.
- Each vial was analyzed for crude protein, lysine and arginine.
- Internal standard was used to validate extraction procedure. Amount of lysine that was freed from each RPL was calculated by: amount measured minus amount in ration blank.



Conclusions

- Lysine release from Soy Best is not different from Soy Best PEARL.
- Soy Best and Soy Best PEARL have a lower rate of lysine release than LysiPEARL.
- Because of gums technology, the native lysine and the fortified lysine in Soy Best PEARL appear to behave as one pool and to behave similarly to the native lysine in Soy Best with regard to release in a TMR and with regard to rumen kinetics. The rumen-undegraded lysine in Soy Best PEARL has greater intestinal digestibility than the rumen-undegraded lysine in Soy Best.

Literature Cited

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