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Effect of Precision Feeding SID Lysine and Amino Acids to Lactating Sows Compared to a Conventional Feeding Strategy on Sow and Litter Performance and Feed Cost in a Commercial Farm

Mikayla S. Spinler, Jordan T. Gebhardt,[1] Joel M. DeRouchey, Mike D. Tokach, Robert D. Goodband, Hyatt L. Frobose,[2] and Jason C. Woodworth

Summary

A total of 728 gilts and parity 1 sows (Camborough, PIC, Hendersonville, TN) and litters (Camborough × PIC 800) were used in a 19-day lactation study to evaluate the effects of precision feeding Lys and other amino acids compared to providing a single lactation diet at a commercial sow farm. Sows were blocked by parity and allotted to one of two treatments at entry into the farrowing rooms. Treatments consisted of a single 1.07% SID Lys lactation diet or a blend of a high and low SID Lys diet to provide a specific targeted SID Lys intake for each day of lactation. Two diets were used to create the blended dietary treatment, a low Lys diet (0.60% SID Lys) or a high Lys diet (1.07% SID Lys). Sows fed the control diet treatment were fed only the high Lys diet. Sows on the blended diet treatment were fed a blend of the low and high Lys diet to target a specific Lys intake for each day of lactation using the Gestal Quattro Opti feeder (Jyga Technologies, St-Lambert-de-Lauzon, Quebec, Canada). Lysine intake targets were based on the NRC (2012)[3] model estimates for gilts and sows with 17 piglets, with the exception that levels were increased by 20% to reach a targeted average Lys intake of approximately 63 g/d. Average Lys intake was 87% of target because sow feed intake during lactation was lower than predicted. As expected, sows fed the control diet treatment had greater ($P < 0.001$; 72.0 vs. 54.8 g/d) Lys intake compared to sows fed the blended diet treatment because they were fed only the high Lys diet. No differences ($P > 0.05$) in entry-to-wean change in sow BW, backfat or loin depth, caliper score, or ADFI were observed between treatments. There were no differences ($P > 0.05$) in litter size at d 2 after equalization or weaning between treatments; however, litters and piglets from sows fed the control treatment tended to have a greater weaning weight ($P = 0.075$) and ADG ($P = 0.090$) compared to litters and piglets from sows fed the blended diet treatment. This is likely due to low Lys intake

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[2] JYGA Technologies, Inc., St-Lambert-de-Lauzon, QC, Canada.
[3] NRC. 2012. Nutrient Requirements of Swine. 11th rev. ed. National Academy Press, Washington, DC.

for sows fed the blend diet treatment to maximize litter growth performance. Feed cost per sow was lower ($P < 0.05$) for sows fed the blend curve in both a low and high ingredient price scenario. No differences ($P > 0.05$) in feed cost per lb of litter weight gain were observed; however, feed cost per weaned pig was lower ($P < 0.05$) for sows fed the blended diet treatment. Sows fed the control diet treatment had a higher ($P < 0.05$) serum urea nitrogen concentration on d 10 and at weaning compared to sows fed the blended diet treatment. Differences were also observed for milk crude protein content on d 10 and at weaning, with sows fed the control diet treatment having greater crude protein ($P = 0.05$) compared to sows fed the blended diet, also likely contributing to the differences observed in piglet weaning weight. Precision feeding sows using diet blending during lactation can be used to reduce feed cost, but future research should focus on using technology to automatically adjust diet blends for low or high feed intake sows to avoid the under or overfeeding of nutrients.

Introduction

Precision feeding can be used to decrease the environmental impact of production animal agriculture and improve animal welfare by preventing the underfeeding or overfeeding of nutrients.[4] The effects of precision feeding sows were evaluated by Spinler et al. (2023)[5,6] in two pilot studies. The first study utilized NRC and INRA[7] modeled Lys estimates for lactating sows. The NRC and INRA Lys estimates were used to create Lys intake curves to target a specific Lys intake for each sow based on parity and litter size by blending a low and high Lys diet compared to a conventional feeding strategy of a single high Lys diet. The results of that study found that sows fed only the high Lys diet with no feed blending had higher litter performance compared to the NRC and INRA curves. Litters from sows fed the NRC curve had higher growth performance than litters from sows fed the INRA curve. Because of this, a second study was conducted using the NRC model, but Lys intake targets for each day of lactation were increased by 20% to target an average of 60 g/d of SID Lys intake. No differences in litter growth performance were observed between litters from sows fed the NRC curve and the control diet treatment. As a result of these experiments, the NRC model Lys curve was used as a base in the current trial but increased by 20% for each parity for sows with an average litter size of 17 piglets.

We hypothesized that precision feeding Lys to sows during lactation could be used to decrease feed cost and achieve similar sow and litter performance in a commercial production system if adequate g/d of Lys intake was achieved. Therefore, the objective of this study was to determine the effects of precision feeding lysine and other AA during sow lactation on sow and litter performance and feed cost compared to a conventional feeding strategy in a commercial setting.

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[4] Gaillard, C., Durand, M., Largouët, C., Dourmad, J. Y., and C. Tallet. 2021. Effects of the environment and animal behavior on nutrient requirements for gestating sows: Future improvements in precision feeding. Anim. Feed. Sci. Technol. 279:115034. doi:10.1016/j.anifeedsci.2021.115034.

[5] Spinler, M. S., J. T. Gebhardt, J. M. DeRouchey, M. D. Tokach, R. D. Goodband, H. L. Frobose, and J. C. Woodworth. 2023. Evaluation of precision feeding SID lysine to lactating sows on sow and litter performance, nitrogen level, and feed cost. Kans. Agric. Exp. Stn. Res. Rep.

[6] Spinler, M. S., J. T. Gebhardt, J. M. DeRouchey, M. D. Tokach, R. D. Goodband, H. L. Frobose, and J. C. Woodworth. 2023. Evaluation of Precision Feeding Standardized Ileal Digestible Lysine to Meet the Lactating Sow's Requirement and Maximize Piglet Growth Performance. Kans. Agric. Exp. Stn. Res. Rep.

[7] InraPorc. 2009. https://inraporc.inra.fr/inraporc/index_en.html.

Materials and Methods

The Kansas State University Institutional Care and Use Committee approved the protocol used in this experiment. The study was conducted at a commercial sow farm in eastern Iowa (Brenneman Pork, Washington, Iowa). Sows were housed in individual farrowing stalls equipped with a self-automated feed system (Gestal Quattro Opti, Jyga Technologies, St-Lambert-de-Lauzon, Quebec, Canada) and a wet dry feed bowl with an additional nipple water. Creep feed was not offered throughout the trial.

Animals and diets

A total of 728 sows (average parity 1.5; Camborough, PIC, Hendersonville, TN) and litters (Camborough × PIC 800) were used in the lactation study. Only gilts and parity 1 sows were farrowing on the farm at the time of the study. Sows were moved from gestation to farrowing at approximately d 114 of gestation. Upon entry into farrowing, sow weight, caliper, backfat depth, and loin depth measurements were taken. Sow caliper score was taken at the last rib. Backfat and loin depth measurements were taken at the 10th rib approximately 2.5 in from the midline using an ExaGo ultrasound machine (BioTronics Inc., Pittsburgh, PA). The 10th rib was identified by finding the trapezius muscle, as the end of the trapezius muscle is where the 10th rib is located.

Sows were allotted to one of two treatments at entry to the farrowing house, a control 1.07% SID Lys diet or a blended diet treatment. Dietary treatments were formed from two basal diets: a low Lys (0.60% SID Lys) and a high Lys (1.07% SID Lys) diet. Pre-farrow, all sows were allowed 5 lb per day of the high Lys diet. After farrowing sows were given ad libitum access to feed and placed on their respective diets the day of farrowing. Sows fed the control diet were fed only the high Lys diet. Sows fed the blended diet treatment were fed a blend of the low and high Lys diet based on parity, with one curve for gilts and one for parity 1 sows using the Gestal Quattro Opti feeders. Blend of the low and high Lys diets was created to target a specific Lys intake, and therefore other amino acids, because they were formulated on a ratio to Lys based on expected feed intake on the farm. Lysine targets were based on the shape of the NRC (2012) model estimate recommendations for each parity with a litter size of 17 piglets but increased by 20% to target an average Lys intake for gilts of 61 g/d and 65 g/d for parity 1 sows using estimated sow feed intake data.

Sow feed intake was analyzed on d 7 and 14 of lactation to identify sows that were eating below or above targeted feed intake based on the previous two days of feed intake. If a sow was eating below targeted feed intake by 25% or greater at either time point, they were fed a curve with a 10% increase in the blend of the high Lys diet for the remainder of the study. If a sow was eating above target feed intake by 10% or greater at either time point, they were fed a diet with a 10% decrease in the blend of the high Lys diet for the remainder of the study. This was done to more closely reach targeted Lys intake for low and high feed intake sows. Sow feed intake throughout lactation was tracked by the Gestal Quattro Opti feeders. Sow feed and Lys intake were analyzed assuming 5% feed wastage. Feeders were calibrated once a week for each diet by taking the average calibration value (weight of feed dropped in five turns of the feeder auger) from five random feeders.

On a subset of sows, blood and milk samples were taken on d 10 of lactation and the day before weaning. Blood samples were collected from 39 control-fed sows and

38 blend-fed sows. Seven mL of blood was collected from the jugular vein using a Monojets blood collection tub (Covidien, Minneapolis, MN) containing no anticoagulant. Sow blood was collected after a 6 h fasting period and then centrifuged and serum was collected and stored at -20°C. Stored serum samples were then analyzed for urea N concentration using a Urea Nitrogen Colorimetric Detection Kit (Arbor Assays, Ann Arbor, MI). Milk samples were collected from 20 control-fed sows and 18 blend-fed sows. Approximately 30 mL of milk was collected and then stored at -20°C. To stimulate milk letdown, the ear was cleaned with isopropyl alcohol, and 0.3 mL of oxytocin was administered in the ear vein. Milk samples were analyzed for crude protein concentration using a LECO TruMac N (LECO Corporation, St. Joseph, MI).

Litters were equalized to approximately 16-17 piglets within 24 h of the end of farrowing. On d 2 of lactation after equalization, litter weight and size were recorded. Litter weight and size were also taken the day before weaning. Pre-weaning mortality for each sow was calculated by taking the litter size at weaning divided by the litter size at d 2 after equalization. The wean-to-service interval was analyzed for each sow that remained in the herd after weaning.

For the economic analysis, a low and high ingredient cost scenario was used. Feed cost in the low ingredient cost scenario was $0.08/lb for the low Lys diet and $0.10/lb for the high Lys diet. Feed cost in the high ingredient price scenario was $0.14/lb for the low Lys diet and $0.16/lb for the high Lys diet. Feed cost per lb of litter gain was calculated by taking feed cost per sow divided by litter gain for both the low and high ingredient price scenario. Feed cost per pig weaned was also calculated for both the low and high ingredient price scenarios by taking feed cost per sow divided by pigs weaned. Revenue per weaned pig was calculated by taking the average pig weaning weight multiplied by a value of $0.50 per lb. Income over feed cost (IOFC) was calculated by subtracting sow feed cost per weaned pig from revenue per weaned pig.

Statistical analysis

Performance data were analyzed using the lmer function of R software, version 1.4.171, as a randomized complete block design. Sow and litter were considered the experimental unit. Treatment was a fixed effect. Block (sow parity) and farrowing room were considered random effects. Litter weight at d 2 was used as a covariate for the evaluation of litter weight at weaning, pig BW at d 2 and weaning, pig ADG, and litter ADG. Pre-weaning mortality was analyzed using a binomial distribution. Serum urea N and milk crude protein were analyzed as a repeated measure using the lmer function of R software with treatment, sample timepoint, and their interaction included as fixed effects. Plate, farrowing room, and sow were included as random effects in the statistical model for serum urea N, and farrowing room and sow were included as a random effect for crude protein analysis. Results are considered significant at $P \leq 0.05$ and marginally significant at $0.05 < P \leq 0.10$.

Results

During the lactation period, the g/d of Lys intake was 87% of targeted Lys intake for sows fed the blended diet treatment because sows ate less feed during the study than expected. Expected feed intake was based on past feed intake records for the farm. The adjustments made to the feed curves during lactation were not great enough to bring average Lys intake closer to target.

There were no differences in sow BW at entry or weaning between treatments, as well as sow BW change from entry to wean ($P > 0.05$; Table 3). No differences ($P > 0.05$) were observed for sow backfat, loin depth, or caliper score at entry or weaning, or changes from entry to wean. Lactation ADFI was similar ($P > 0.05$) between treatments. However, as expected, sows fed the control diet treatment had greater ($P < 0.001$) average daily Lys intake during lactation compared to sows fed the blended diet treatment because they were fed only the high Lys diet. Sows fed the control diet treatment also had greater ($P < 0.001$) N intake compared to sows fed the blended diet treatment. No differences ($P = 0.123$) in wean to estrus interval were observed between treatments.

Differences were observed in litter growth performance during the study (Table 4). There were no differences ($P > 0.05$) in litter size at d 2 or at weaning, as well as litter weight and average piglet weight at d 2. Litters from sows fed the control diet treatment tended to have greater litter weight ($P = 0.082$) at weaning, as well as average piglet BW at weaning ($P = 0.075$) compared to litters from sows fed the blended diet treatment. A tendency for litters ($P = 0.090$) and piglets ($P = 0.062$) from sows fed the control diet treatment to have greater ADG was observed. Sows fed the control diet treatment had greater ($P < 0.001$) Lys intake per lb of litter gain compared to sows fed the blended diet treatment. No difference ($P = 0.318$) in pre-weaning mortality from d 2 to weaning was observed.

There was an interaction ($P = 0.002$; Table 5) between treatment and sampling time for serum urea N content. There was an increase ($P < 0.05$) over time in serum urea N content for sows fed the control diet but no difference ($P > 0.05$) for sows fed the blend diet treatment. Serum urea N concentration was lower ($P < 0.05$) in sows fed the blended diet treatment at d 10 and at weaning when compared to sows fed the control diet. Milk crude protein was greater ($P = 0.050$) for sows fed the control diet treatment at day 10 and weaning than sows fed the blended diet treatment.

For the economic analysis, feed cost per sow for both the low and high ingredient price scenarios was lower ($P < 0.05$) for sows fed the blended diet treatment. No differences ($P > 0.05$) were observed for feed cost per lb of litter weight gain for either price scenario. When looking at feed cost per pig weaned, sows fed the blended diet treatment had a lower ($P < 0.05$) fed cost per pig weaned compared to sows fed the control curve treatment for both a low and high ingredient cost. There was no difference ($P = 0.155$) in revenue per weaned pig between treatments. In both the low and high ingredient price scenarios, no differences ($P > 0.05$) in IOFC per weaned pig were observed.

Because ADFI was lower than anticipated, litter growth performance was also analyzed for only sows who reached an average lactation feed intake of 16 lb or greater on both the control and blended dietary treatment (Table 6). One hundred and fourteen sows fed the control diet treatment and 100 sows fed the blended diet treatment reached an average feed intake of 16 lb or greater during lactation. Lysine and N intake were still greater ($P < 0.001$) for sows fed the control diet treatment compared to the blended as expected because they were fed only the high Lys diet. However, when sows fed the blended diet treatment had an average feed intake of 16 lb or greater, there were no differences ($P > 0.05$) in litter growth performance compared to litters from sows fed the control diet treatment. Lys intake per lb of liter weight gain was still greater ($P < 0.001$) for sows fed the control diet treatment compared to sows fed the blended diet treatment. This analysis would indicate that SID Lys intake of approximately 61 g/d is sufficient to maximize litter weight gain with a litter size of approximately 14.8 weaned pigs and that blend-fed sows were using dietary Lys more effectively toward milk production compared to control-fed sows.

When including only sows with 16 lb or greater average lactation feed intake, feed cost was greater ($P < 0.05$) for sows fed the control diet treatment in a low and high ingredient price scenario. Feed cost per lb of litter weight gain tended ($P = 0.099$) to be higher in the low ingredient price scenario for sows fed the control diet. Feed cost per weaned pig was lower ($P < 0.05$) for sows fed the blended diet in both the low and high ingredient price scenario, but no differences ($P > 0.05$) in revenue per weaned pig were observed. Income over feed cost per pig weaned was higher ($P < 0.05$) for sows fed the blended diet treatment when looking at only sows who met expected feed intake.

In conclusion, there were no differences in sow BW and composition throughout the study. Piglets and litters from sows fed the blended diet treatment tended to have decreased weaning weights and ADG. This is likely due to lower SID Lys intake than targeted, which was below the sow's requirement to maximize litter growth. However, when sows fed the blended diet treatment achieved target Lys intake, they had similar litter growth performance compared to litters from sows fed the control diet treatment. Feed cost per sow and feed cost per weaned pig were lower for sows fed the blended diet treatment. The next steps in this research would include using technology to automatically adjust diet blends to avoid the underfeeding of nutrients based on individual sow feed intake.

Table 1. Composition of lactation diet (as-fed basis)[1]

Ingredient, %	Low Lys	High Lys
Corn	74.57	61.67
Soybean meal, 46.5% CP	11.21	23.93
Corn DDGS	10.00	10.00
Calcium carbonate	1.43	1.36
Monocalcium P, 21% P	1.13	0.99
Sodium chloride	0.50	0.50
L-Lys-HCl	0.15	0.35
DL-Met	---	0.04
L-Thr	---	0.12
L-Trp	---	0.02
Vitamin and trace mineral premix	0.17	0.17
Choline chloride 60%	0.12	0.12
Feed additives[2]	0.74	0.74
Total	100	100
Calculated analysis		
SID amino acids, %		
Lys	0.60	1.07
Ile:Lys	77	63
Leu:Lys	209	145
Met:Lys	37	30
Met & Cys:Lys	74	56
Thr:Lys	68	65
Trp:Lys	20	19
Val:Lys	92	71
His:Lys	56	43
Total Lys, %	0.72	1.22
NE, kcal/lb	1,119	1,089
SID Lys:NE, g/Mcal	2.43	4.46
CP, %	14.5	19.8
Ca, %	0.82	0.81
P, %	0.59	0.62
STTD P, %	0.48	0.48

[1] Feed was manufactured at the Brenneman Pork Feed Mill (Washington, IA).
[2] Feed additives included Dynamate, Dual Defender, Provent, M-Mobilize, Chromax, 0.04%, and Optiphos Plus 2500 G.

Table 2. Number of sows included in each response criteria[1]

Response criteria	Control	Blend
Sow BW[2]	229	223
Sow caliper score[3]	355	360
Sow back fat[4]	330	344
Sow loin depth[4]	325	342
Wean-to-service interval[5]	286	296
Litter weight[6]	328	340
Serum urea N[7]	39	38
Milk crude protein[7]	20	18

[1] A total of 728 gilts and parity 1 sows (Camborough, PIC, Hendersonville, TN) and litters (Camborough × PIC 800) were used.
[2] The sow scale malfunctioned during the last week of the study and thus 276 sow weaning weights were not collected. If a weaning weight for a sow was missed, sow entry weight was also removed from data analysis.
[3] Sow caliper scores were only analyzed for parity 1 sows because the PIC caliper was not designed to be used on gilts. If a caliper score was missing at entry or weaning, both were removed from data analysis.
[4] Some sow backfat and/or loin depth measurements were missed throughout the study due to unsatisfactory ultrasound images, which resulted in being unable to analyze backfat and loin depth or the wrong sow ID being recorded. If a backfat or loin depth measurement was missing at entry or weaning, both were removed from data analysis.
[5] Wean-to-service interval was only recorded for sows that remained in the herd after farrowing.
[6] The piglet scale malfunctioned during the trial resulting in some litter weights being missed. If a litter weight was missed at d 2 or weaning, both were removed for the data set.
[7] Milk and blood samples were taken on a subset of sows from each treatment.

Table 3. Evaluation of precision feeding standardized ileal digestibility lysine on sow performance in a commercial setting[1]

Item	Control[2]	Blend	SEM	*P* =
No. of sows, n	364	364		
Parity	1.6	1.5	0.07	0.859
Lactation length, d	19.3	19.3	0.26	0.656
Sow BW, lb				
Entry	477.5	479.1	36.92	0.611
Wean	415.4	419.2	35.85	0.252
Sow BW change, lb				
Entry to wean	-62.3	-60.0	3.69	0.395
Sow caliper score[3]				
Entry	12.0	12.0	0.20	0.826
Wean	10.4	10.3	0.21	0.319
Change (entry to wean)	-1.6	-1.7	0.24	0.442
Sow back fat, mm				
Entry	17.4	17.5	0.26	0.798
Wean	14.4	14.8	0.30	0.105
Change (entry to wean)	-2.9	-2.6	0.38	0.113
Sow loin depth, mm				
Entry	68.4	68.5	1.32	0.813
Wean	65.6	65.8	1.55	0.802
Change (entry to wean)	-2.6	-2.6	0.82	0.949
Lactation ADFI, lb	14.8	14.9	1.08	0.334
Lys intake, g/d	72.0	54.8	3.87	< 0.001
N intake, g/d	212.1	182.6	12.98	< 0.001
Wean-to-service interval, d	4.5	4.6	0.11	0.123

[1]A total of 728 gilts and parity 1 sows (Camborough, PIC, Hendersonville, TN) and litters (Camborough × PIC 800) were used.
[2]Sows were allotted to one of two treatments upon entry to the farrowing house. A control high Lys diet (1.07% SID Lys) or a blended diet of a low (0.60% SID Lys) and high Lys diet to target a specific Lys requirement based on the NRC (2012) recommendations plus 20%.
[3]Caliper scores only include measurements from parity 1 sows, not gilts.

Table 4. Evaluation of precision feeding standardized ileal digestibility lysine on litter performance in a commercial setting[1]

Item	Control[2]	Blend	SEM	*P* =
Litter characteristics				
Litter size, n				
d 2	16.7	16.7	0.21	0.913
Wean	14.6	14.5	0.20	0.593
Litter weight, lb				
d 2	53.4	52.7	3.47	0.307
Wean[3]	153.7	150.2	8.05	0.082
Mean piglet BW, lb				
d 2[3]	3.2	3.2	0.20	0.781
Wean[3]	10.6	10.4	0.50	0.075
Litter ADG d 2 to wean, lb/d[3]	5.2	5.0	0.45	0.090
Piglet ADG d 2 to wean, lb/d[3]	0.35	0.34	0.03	0.062
Lys intake, g/lb of litter gain	15.1	12.4	0.72	< 0.001
d 2 to wean mortality, %	12.8	13.4	0.75	0.318
Economic analysis				
Low ingredient prices				
Feed cost, $/sow[4]	31.23	28.86	2.21	< 0.001
Feed cost, $/lb of litter weight gain[5]	0.34	0.34	0.02	0.742
Feed cost, $/pig weaned[6]	2.19	2.05	0.12	< 0.001
Revenue, $/weaned pig[7]	5.25	5.17	0.36	0.155
IOFC, $/weaned pig[8]	3.10	3.15	0.24	0.413
High ingredient prices				
Feed cost, $/sow[4]	46.83	44.53	3.40	< 0.001
Feed cost, $/lb of litter weight gain[5]	0.51	0.52	0.02	0.584
Feed cost, $/pig weaned[6]	3.28	3.16	0.18	0.007
Revenue, $/weaned pig[7]	5.25	5.17	0.36	0.155
IOFC, $/weaned pig[8]	2.01	2.04	0.18	0.649

[1] A total of 728 gilts and parity 1 sows (Camborough, PIC, Hendersonville, TN) and litters (Camborough × PIC 800) were used from farrow to wean. All sows were included in this analysis.
[2] Sows were allotted to one of two treatments upon entry to the farrowing house. A control high Lys diet (1.07% SID Lys) or a blended diet of a low (0.60% SID Lys) and high Lys diet to target a specific Lys requirement based on the NRC (2012) recommendations plus 20%.
[3] Litter weight at d 2 was used as a covariate in the statistical analysis.
[4] Feed cost of the low Lys diet was $0.08/lb for the low ingredient cost and $0.10/lb for the high ingredient cost. Feed cost of the high Lys diet was $0.14/lb for the low ingredient cost and $0.16/lb for the high ingredient cost.
[5] Feed cost, $ per lb of litter weight gain = feed cost lb of litter weight gain per sow
[6] Feed cost, $ per pig weaned = feed cost ppigs weaned per sow
[7] Revenue, $/weaned pig = average pig weaning weight × $0.50
[8] Income over feed cost, $/weaned pig = revenue, $/weaned pig – feed cost, $/weaned pig

Table 5. Evaluation of precision feeding standardized ileal digestibility lysine on blood urea nitrogen and milk crude protein[1]

				P =		
Item	Control[2]	Blend	SEM	Treatment × day	Treatment	Day
Serum urea N, mg/dL						
d 10[3]	14.9[b]	12.7[c]	0.63	0.002	< 0.001	0.002
Weaning	17.5[a]	13.0[c]				
Milk crude protein, %						
d 10	5.5	5.0	0.13	0.455	0.050	0.580
Weaning	5.6	5.2				

[a,b,c] Means in the same row that do not have a common superscript differ ($P < 0.05$).
[1] A total of 39 control- and 38 blend-fed sows were used for blood collection and 20 control- and 18 blend-fed sows were used for milk collection.
[2] Sows were allotted to one of two treatments upon entry to the farrowing house. A control high Lys diet (1.07% SID Lys) or a blended diet of a low (0.60% SID Lys) and high Lys diet to target a specific Lys requirement based on the NRC (2012) recommendations plus 20%.
[3] Blood and milk samples were taken on d 10 of lactation and at weaning to measure blood urea N and milk crude protein.

Table 6. Evaluation of precision feeding standardized ileal digestibility lysine on litter performance in a commercial setting for only sows with and average feed intake of 16 lb or greater[1]

Item	Control[2]	Blend	SEM	*P* =
Count, n	114	100		
Lactation ADFI, lb	16.6	16.8	0.50	0.214
Lys intake, g/d	85.9	64.9	1.26	< 0.001
N intake, g/d	252.2	216.3	5.13	< 0.001
Litter characteristics				
Litter size, n				
d 2	16.7	16.8	0.41	0.854
Wean	14.7	14.9	0.39	0.750
Litter weight, lb				
d 2[3]	54.3	54.2	3.19	0.906
Wean	160.1	161.3	13.28	0.775
Mean piglet BW, lb				
d 2	3.3	3.3	0.17	0.623
Wean	10.9	10.8	0.85	0.598
Litter ADG d 2 to wean, lb/d	5.5	5.6	0.49	0.703
Piglet ADG d 2 to wean, lb/d	0.37	0.37	0.03	0.801
Lys intake, g/lb of litter gain	16.1	12.4	0.93	< 0.001
d 2 to wean mortality, %	11.4	10.9	0.76	0.665
Economics				
Low ingredient prices				
Feed cost, $/sow[4]	36.9	34.00	1.18	< 0.001
Feed cost, $/lb of litter weight gain[5]	0.36	0.34	0.02	0.099
Feed cost, $/pig weaned[6]	2.57	2.36	0.08	< 0.001
Revenue, $/weaned pig[7]	5.43	5.48	0.43	0.638
IOFC, $/weaned pig[8]	2.92	3.18	0.35	0.021
High ingredient prices				
Feed cost, $/sow[4]	55.27	52.52	1.85	< 0.001
Feed cost, $/lb of litter weight gain[5]	0.54	0.52	0.03	0.349
Feed cost, $/pig weaned[6]	3.85	3.65	0.12	0.008
Revenue, $/weaned pig[7]	5.43	5.48	0.43	0.638
IOFC, $/weaned pig[8]	1.65	1.91	0.31	0.033

[1] A total of 214 gilts and parity 1 sows with an average lactation feed intake of 16 lbs or greater (Camborough, PIC, Hendersonville, TN) and their litters (Camborough × PIC 800) were used to compare litter growth performance between litters from control- and blend-fed sows.

[2] Sows were allotted to one of two treatments upon entry to the farrowing house. A control high Lys diet (1.07% SID Lys) or a blended diet of a low (0.60% SID Lys) and high Lys diet to target a specific Lys requirement based on the NRC (2012) recommendations plus 20%.

[3] Litter weight at d 2 was used as a covariate in the statistical analysis.

[4] Feed cost of the low Lys diet was $0.08/lb for the low ingredient cost and $0.10/lb for the high ingredient cost. Feed cost of the high Lys diet was $0.14/lb for the low ingredient cost and $0.16/lb for the high ingredient cost.

[5] Feed cost, $ per lb of litter weight gain = feed cost lb of litter weight gain per sow

[6] Feed cost, $ per pig weaned = feed cost pigs weaned per sow

[7] Revenue, $/weaned pig = average pig weaning weight × $0.50

[8] Income over feed cost, $/weaned pig = revenue, $/weaned pig – feed cost

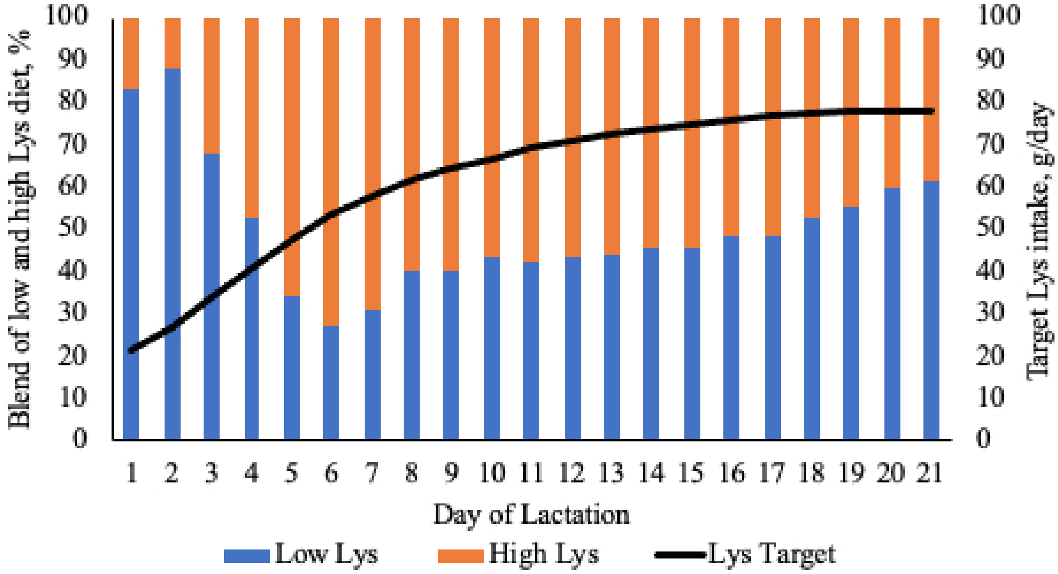

Figure 1. Target Lys intake for parity 1 sows with a litter size of 17 pigs at equalization and the blend of the low and high Lys diet for the blend diet treatment.