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Effects of Different Standardized Ileal Digestible Lysine Programs on Grow-Finish Pig Growth Performance and Economics

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Summary

A total of 2,160 pigs (PIC 337 × 1050; initially 68.3 ± 1.36 lb) were used to evaluate the effects of different standardized ileal digestible (SID) Lys curves and phase-feeding strategies on grow-finish pig performance and economics. Pens of pigs (27 pigs/pen) were allotted to one of four treatments with 20 replicate pens per treatment. Treatments consisted of: A) a six-phase program with 92% of the SID Lys requirement fed in phases 1 to 3 and 100% in phases 4 to 6; B) a six-phase program with 100% SID Lys fed throughout; C) a six-phase program with 86% SID Lys requirement fed in phases 1 to 3 and 94% in phases 4 to 6; and D) a four-phase program with SID Lys levels of 86%, 92%, 100%, and 108% of the requirement fed across phases. The estimated SID Lys requirements were based on the 2021 PIC mixed-sex estimates. From d 0 to 42, pigs fed the four-phase Lys program (86% of the SID Lys requirement in phase 1 and 92% in phase 2) had greater ($P < 0.05$) ADG than pigs fed 86% of the SID Lys requirement in phases 1 to 3, with intermediate performance observed for pigs fed 92% and 100% of the SID Lys requirement in phases 1 to 3. No differences were observed in ADFI among treatments. Consequently, pigs fed 92% of the Lys requirement in phases 1 to 3 and pigs fed the four-phase Lys program were heavier at d 42 than pigs fed 86% of the Lys requirement in phases 1 to 3, with pigs fed 100% intermediate ($P < 0.05$). Feed efficiency was improved ($P < 0.05$) for pigs fed either 92% or 100% of the SID Lys requirement in phases 1 to 3 compared with pigs fed 86% of the requirement in phases 1 to 3, whereas pigs fed the four-phase program were intermediate. From d 42 to 84, no differences were observed in ADG, ADFI or F/G among treatments. On d 84, pigs fed the 4-phase Lys program were heavier ($P < 0.05$) than those fed 86% of the SID Lys requirement in phases 1 to 3 followed by 94% in phases 4 to 6, and those pigs fed 100% the requirement throughout, with pigs fed 92% of the SID Lys requirement in phases 1 to 3 followed by 100% in phases 4 to 6 intermediate. Overall (d 0 to 84), pigs fed the four-phase Lys program had numerically the greatest ($P = 0.073$) ADG and pigs fed 86% of the SID Lys requirement in phases 1 to 3 followed by 94% in phases 4 to 6 having the lowest. No differences were observed in ADFI or F/G among treatments. There were no differences in mortality or total removals and mortality. Feed cost per pig

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and feed cost per pound of gain were reduced for pigs fed 86% of the SID Lys requirement in phases 1 to 3 followed by 94% in phases 4 to 6 compared with pigs fed 100% of the requirement throughout ($P \leq 0.013$). Nevertheless, no differences were observed in revenue per pig placed or income over feed cost. In summary, the four-phase feeding program, which increased SID Lys from 86 to 108% of the requirement estimate across phases improved growth performance and final body weight. In contrast, the reduced SID Lys program (86 to 94% of requirement) lowered feed costs but also reduced growth performance, resulting in no differences in income over feed cost among treatments.

Introduction

Lysine is the first-limiting amino acid in typical corn-soybean meal-based diets for swine and plays a critical role in lean tissue accretion and overall growth performance. Because Lys and other nutrient requirements vary with body weight and age, phase feeding is commonly implemented in commercial production systems to more closely match nutrient supply with animal requirements[3].

Standard Lys curves, such as those developed by genetic suppliers, are commonly used to guide diet formulation. However, economic and logistical considerations can lead to adjustments in these curves, which could include reducing dietary Lys levels in earlier body weights and then supplying at or above requirement in late finishing to achieve compensatory growth[4]. Also, as producers evaluate the body weight ranges of different diet phases, this can lead to different durations of under- or overfeeding Lys as compared with the estimated requirement. While these strategies may reduce feed cost and operational complexity, their impact on growth performance can vary across different systems. Therefore, the objective of this study was to evaluate the effects of modifying Lys curves and phase-feeding strategies on growth performance of grow-finish pigs.

Procedures

The protocol used in this experiment was approved by the Kansas State University Institutional Animal Care and Use Committee. The experiment was conducted at a commercial research site in southwest Minnesota. The barns were naturally ventilated and double-curtain-sided with totally slatted floors. Each pen (10 × 18 ft) was equipped with a five-hole stainless steel dry self-feeder (Thorp Equipment, Thorp, WI) and a bowl waterer to provide ad libitum access to feed and water throughout the experiment. Diets were manufactured and fed in mash form (Hord Farms West Feed Mill, Pipestone, MN). Daily feed additions to each pen were accomplished using a robotic feeding system (FeedPro; Feedlogic Corp., Willmar, MN) that recorded feed deliveries for individual pens.

Animals and diets

A total of 2,160 pigs (PIC 337 × 1050, initially 68.3 ± 1.36 lb) were used in an 84-d study. Pigs were housed in mixed-gender pens with 27 pigs per pen across two barns, each with 40 pens used for the experiment. Pens of pigs were blocked by initial BW and

[3] NRC. 2012. Nutrient requirements of swine. 11th rev.ed. Natl. Acad. Press, Washington, DC.

[4] Menegat, M. B., S. S. Dritz, M. D. Tokach, J. C. Woodworth, J. M. DeRouchey, and R. D. Goodband. 2020. Phase-feeding strategies based on lysine specifications for grow-finish pigs. J. Anim. Sci. 98:skz366. doi:10.1093/jas/skz366

allotted to one of four dietary treatments in a randomized complete block design with 20 pens per treatment.

Treatments were based on the 2021 PIC mixed-sex Lys curve[5] and phase-feeding strategy and SID Lys level was determined based on average weight during each phase. The Lys curve was: SID Lys, g/Mcal of NE = 0.0000327185 × (weight, lb)2 – 0.0214484253 × weight, lb + 6.0773690201.

Treatments A, B, and C followed a six-phase feeding program, whereas treatment D used a four-phase program. For treatments A, B, and C, phases 1 through 6 were provided from approximately 68 to 75, 75 to 125, 125 to 155, 155 to 195, 195 to 240, and 240 to 250 lb BW, respectively. For treatment D, phases 1 through 4 were provided at approximately 68 to 75, 75 to 155, 155 to 220, and 220 to 250 lb BW, respectively. The four SID Lys programs were: A) six-phase program with 92% of the SID Lys curve fed in phases 1 to 3 and 100% in phases 4 to 6; B) six-phase program with 100% of the SID Lys curve fed in all phases; C) six-phase program with 86% of the SID Lys curve fed in phases 1 to 3 and 94% in phases 4 to 6; and D) four-phase program with SID Lys levels of 86%, 92%, 100%, and 108% of the requirement estimate fed across the four phases. Pigs were provided ad libitum access to feed and water throughout the study. Diet phase changes were implemented based on the estimated average body weight of each barn. At each phase transition, new diets were added on top of the remaining feed in the feeder to ensure a smooth transition between diets.

Pens of pigs were weighed, and feed delivery and disappearance were recorded at the start of the trial and approximately every 14 d thereafter. These measurements were used to calculate average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (F/G).

Economic responses were calculated for each feeding program. Feed cost per pig placed was determined by dividing the total feed cost per pen by the number of pigs placed at the beginning of the study. Feed cost per lb of gain was calculated by dividing the total feed cost per pen by the total body weight gain of pigs within the pen over the entire experimental period. Revenue per pig was calculated by multiplying total pen weight gain (including pigs that were removed or died) by a 75% carcass yield and a market price of $85/cwt carcass, and then dividing by the number of pigs placed in the pen. Income over feed cost (IOFC) was calculated by subtracting total feed cost per pen from total revenue per pen and dividing the result by the number of pigs placed at the beginning of the study.

Ingredient pricing included corn at $4.00/bu, soybean meal at $300/ton, DDGS at $150/ton, liquid Lys at $0.60/lb, L-Methionine at $1.40/lb, L-Threonine at $0.95/lb, L-Tryptophan at $3.50/lb, L-Valine at $1.70/lb, and copper sulfate at $1.70/lb.

Statistical analysis

Data were analyzed as a randomized complete block design using RStudio (Version 4.0.2, R Core Team, Vienna, Austria) with the lmer function from the lme4 package. In the model, treatment was used as fixed effect and block as random effect. The pen served as the experimental unit for all analyses. Mortality data were analyzed using a binomial

[5] PIC. 2021. PIC® Nutrition and Feeding Guidelines. Imperial Version 2021.04.14. PIC North America, Hendersonville, TN. Available from: PIC Nutrition and Feeding Guidelines.

distribution. Differences among treatments were considered significant at $P \leq 0.05$ and marginally significant at $0.05 < P \leq 0.10$.

Results and Discussion

Results are presented for two periods: d 0 to 42 and d 42 to 84. Day 42 corresponded to the end of phase 3 for Lys programs A, B, and C, and the end of phase 2 for program D.

From d 0 to 42, pigs fed the four-phase Lys program (86% of the SID Lys requirement in phase 1 and 92% in phase 2) had greater ($P < 0.05$) ADG than those fed 86% of the SID Lys requirement in phases 1 to 3, with pigs fed 92 or 100% of the SID Lys requirement during phases 1 to 3 intermediate. No differences in ADFI were observed among treatments. Pigs fed either 92% or 100% of the SID Lys requirement during phases 1 to 3 had improved ($P < 0.05$) F/G compared with pigs fed 86% of the SID Lys requirement during phases 1 to 3, with pigs fed the four-phase Lys program intermediate. On d 42, pigs fed 92% of the SID Lys requirement from phases 1 to 3 and those fed the four-phase Lys program had greater ($P < 0.05$) BW compared with pigs fed 86% of the SID Lys requirement in phases 1 to 3, with intermediate values observed for pigs fed 100% of the SID Lys requirement.

From d 42 to 84, no evidence for differences in ADG, ADFI, or F/G was observed among treatments. On d 84, pigs fed the 4-phase Lys program were 3.9 lb heavier ($P < 0.05$) than pigs fed 100% of the SID Lys requirement throughout the entire finisher period. Pigs fed the 4-phase Lys program were also 5.8 lb heavier ($P < 0.05$) than pigs fed 86% of the SID Lys requirement in phases 1 to 3 followed by 94% in phases 4 to 6. Pigs fed 92% of the SID Lys requirement in phases 1 to 3 followed by 100% in phases 4 to 6 were intermediate in final weight.

For overall performance (d 0 to 84), pigs fed the 4-phase Lys program tended to have ($P = 0.073$) numerically the greatest ADG, and pigs fed 86% of the SID Lys requirement in phases 1 to 3 followed by 94% in phases 4 to 6 having the lowest. No differences were observed in ADFI or F/G.

Pigs fed 86% of the SID Lys requirement in phases 1 to 3 followed by 94% in phases 4 to 6, as well as pigs fed the four-phase Lys program (86%, 92%, 100%, and 108% Lys) had numerically greater removals ($P = 0.062$) compared with pigs fed 92% of the Lys requirement in phases 1 to 3 followed by 100% in phases 4 to 6 or pigs fed 100% of the requirement throughout the entire finisher period. However, no significant differences were observed for mortality or removals and mortality.

Pigs fed 86% of the Lys requirement in phases 1 to 3 followed by 94% in phases 4 to 6 had the lowest feed cost per pig ($P < 0.05$), whereas pigs fed 100% SID Lys throughout the entire finishing period had the greatest feed cost per pig. Similarly, feed cost per lb of gain was lower ($P < 0.05$) for pigs fed 86% of the Lys requirement in phases 1 to 3 followed by 94% in phases 4 to 6, compared with pigs fed 100% of the SID Lys requirement throughout the finishing period and pigs fed the four-phase Lys program. Despite differences in feed cost, no differences were observed in revenue per pig placed or IOFC.

In summary, reducing dietary SID Lys below the estimated requirement in early phases decreased initial growth performance but improved feed efficiency when higher SID Lys levels were maintained or increased in later phases. The four-phase Lys program (86

to 92 to 100 to 108% of SID Lys requirement) resulted in the greatest final body weight and numerically improved overall ADG, although it did not improve overall feed efficiency or economic return compared with other treatments. Feeding reduced SID Lys concentrations (86% of the SID Lys requirement in phases 1 to 3 and 94% in phases 4 to 6) lowered feed cost; however, there were no differences in income over feed costs among all treatments. These results indicate that feeding different SID Lys and phase feeding strategies can result in similar income over feed costs but providing SID Lys above the estimated requirement in late finishing when previously fed below estimated requirements may enhance final weight.

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Table 1. Composition of treatment A (92% phase 1 to 3; 100% phase 4 to 6) diets across phases 1 to 6 (as-fed basis)[1]

	Dietary phase: % of PIC SID Lys:					
	1	2	3	4	5	6
Item	92	92	92	100	100	100
Ingredient, %						
Corn	61.84	67.17	71.00	77.36	79.58	79.34
Soybean meal, 46.4% CP	14.68	9.97	6.51	10.25	8.25	8.80
DDGS, 5.5% oil	20.00	20.00	20.00	10.00	10.00	10.00
Calcium carbonate	1.06	1.02	0.97	0.91	0.88	0.86
Monocalcium phosphate, 21% P	0.32	0.19	0.05	0.05	---	---
Salt	0.35	0.35	0.35	0.35	0.35	0.35
Liquid Lys 55%[2]	0.79	0.77	0.70	0.62	0.55	0.41
L-Met[2]	0.12	0.09	0.05	0.09	0.07	0.02
L-Thr	0.19	0.17	0.14	0.16	0.14	0.09
L-Trp	0.06	0.07	0.06	0.05	0.05	0.03
L-Val	0.06	0.05	0.03	0.05	0.03	---
Vitamin-trace mineral premix	0.11	0.11	0.10	0.08	0.08	0.08
Phytase[3]	0.05	0.05	0.05	0.05	0.05	0.05
Copper sulfate	0.03	0.03	---	---	---	---
Tiamulin[4]	0.18	---	---	---	---	---
Chlortetracycline[5]	0.20	---	---	---	---	---
Calculated analysis						
SID amino acids, %						
Lys	1.08	0.95	0.83	0.83	0.74	0.68
Ile:Lys	55	53	53	53	54	61
Leu:Lys	133	139	149	134	143	159
Met:Lys	33	32	30	33	33	30
Met and Cys:Lys	56	56	56	58	59	59
Thr:Lys	62	62	63	64	65	65
Trp:Lys	18.7	19.0	18.9	18.9	19.0	19.2
Val:Lys	68	68	68	68	68	73
His:Lys	37	38	39	37	39	44
NE, kcal/lb	1,076	1,095	1,107	1,133	1,139	1,138
SID Lys:NE, g/Mcal	4.56	3.95	3.42	3.33	2.96	2.70
CP, %	18.2	16.3	14.9	13.9	13.0	13.0
Ca, %	0.54	0.49	0.43	0.41	0.39	0.38
STTD P, %	0.40	0.36	0.32	0.30	0.28	0.29
Ca:P	1.20	1.20	1.20	1.20	1.19	1.16

[1] Percentage reported compared with PIC Lys recommendation. Phases 1, 2, 3, 4, 5, and 6 were fed from approximately 68 to 75, 75 to 125, 125 to 155, 155 to 195, 195 to 240, and 240 to 250 lb BW, respectively.

[2] CJ Bio (Seoul, Korea).

[3] Quantum Blue 2G (AB Vista, Marlborough, Wiltshire, England) added at 454 FTU/lb of feed and provided an estimated release of 0.15% STTD P.

[4] Denagard 10 (Elanco, Indianapolis, IN).

[5] Aureomycin 100 (Phibro Animal Health Corporation, Teaneck, NJ).

Table 2. Composition of treatment B (100% phase 1 to 6) diets across phases 1 to 6 (as-fed basis)[1]

	Dietary phase: % of PIC SID Lys:					
	1	2	3	4	5	6
Item	100	100	100	100	100	100
Ingredient, %						
Corn	58.47	64.51	68.96	77.36	79.58	79.34
Soybean meal, 46.4% CP	18.11	12.64	8.52	10.25	8.25	8.80
DDGS, 5.5% oil	20.00	20.00	20.00	10.00	10.00	10.00
Liquid Lys 55%[2]	0.79	0.79	0.74	0.62	0.55	0.41
Calcium carbonate	1.07	1.02	0.98	0.91	0.88	0.86
Monocalcium phosphate, 21% P	0.24	0.12	---	0.05	---	---
Salt	0.35	0.35	0.35	0.35	0.35	0.35
L-Met[2]	0.13	0.11	0.07	0.09	0.07	0.02
L-Thr	0.19	0.18	0.16	0.16	0.14	0.09
L-Trp	0.06	0.06	0.06	0.05	0.05	0.03
L-Val	0.06	0.06	0.04	0.05	0.03	---
Vitamin-trace mineral premix	0.11	0.11	0.10	0.08	0.08	0.08
Phytase[3]	0.05	0.05	0.05	0.05	0.05	0.05
Copper sulfate	0.03	0.03	---	---	---	---
Tiamulin[4]	0.18	---	---	---	---	---
Chlortetracycline[5]	0.20	---	---	---	---	---
Calculated analysis						
SID amino acids, %						
Lys	1.17	1.03	0.90	0.83	0.74	0.68
Ile:Lys	56	54	53	53	54	61
Leu:Lys	131	135	144	134	143	159
Met:Lys	33	33	31	33	33	30
Met and Cys:Lys	56	57	56	58	59	59
Thr:Lys	62	62	64	64	65	65
Trp:Lys	18.6	18.6	18.7	18.9	19.0	19.2
Val:Lys	68	68	68	68	68	73

His:Lys	38	37	38	37	39	44
NE, kcal/lb	1,068	1,089	1,102	1,133	1,139	1,138
SID Lys:NE, g/Mcal	4.95	4.30	3.72	3.33	2.96	2.70
CP, %	19.5	17.4	15.7	13.9	13.0	13.0
Ca, %	0.54	0.48	0.43	0.41	0.39	0.38
STTD P, %	0.40	0.36	0.32	0.30	0.28	0.29
Ca:P	1.20	1.20	1.20	1.20	1.19	1.16

[1] Percentage reported compared with PIC Lys recommendation. Phases 1, 2, 3, 4, 5, and 6 were fed from approximately 68 to 75, 75 to 125, 125 to 155, 155 to 195, 195 to 240, and 240 to 250 lb BW, respectively.

[2] CJ Bio (Seoul, Korea).

[3] Quantum Blue 2G (AB Vista, Marlborough, Wiltshire, England) added at 454 FTU/lb of feed and provided an estimated release of 0.15% STTD P.

[4] Denagard 10 (Elanco, Indianapolis, IN).

[5] Aureomycin 100 (Phibro Animal Health Corporation, Teaneck, NJ).

Table 3. Composition of treatment C (86% phase 1 to 3; 94% phase 4 to 6) diets across phases 1 to 6 (as-fed basis)[1]

	Dietary phase: % of PIC SID Lys:					
	1	2	3	4	5	6
Item	86	86	86	94	94	94
Ingredient, %						
Corn	64.40	68.84	71.82	78.78	79.49	79.45
Soybean meal, 46.4% CP	12.06	8.35	5.81	8.88	8.53	8.81
DDGS, 5.5% oil	20.00	20.00	20.00	10.00	10.00	10.00
Calcium carbonate	1.06	1.02	0.97	0.90	0.88	0.86
Monocalcium phosphate, 21% P	0.39	0.23	0.06	0.06	---	---
Salt	0.35	0.35	0.35	0.35	0.35	0.35
Liquid Lys 55%[2]	0.79	0.73	0.64	0.60	0.46	0.33
L-Met[2]	0.10	0.07	0.02	0.08	0.04	---
L-Thr	0.18	0.15	0.12	0.15	0.10	0.06
L-Trp	0.07	0.06	0.06	0.05	0.04	0.03
L-Val	0.06	0.04	0.03	0.05	0.01	---
Vitamin-trace mineral premix	0.11	0.11	0.10	0.08	0.08	0.08
Phytase[3]	0.05	0.05	0.05	0.05	0.05	0.05
Copper sulfate	0.03	0.03	---	---	---	---
Tiamulin[4]	0.18	---	---	---	---	---
Chlortetracycline[5]	0.20	---	---	---	---	---
Calculated analysis						
SID amino acids, %						
Lys	1.02	0.90	0.78	0.78	0.70	0.64
Ile:Lys	53	53	55	53	58	65

Leu:Lys	135	144	158	138	154	170
Met:Lys	32	31	28	33	31	29
Met and Cys:Lys	56	56	56	58	59	59
Thr:Lys	62	62	63	64	65	66
Trp:Lys	19.0	18.7	19.0	19.1	19.1	19.6
Val:Lys	68	68	71	69	71	77
His:Lys	37	38	40	38	42	47
NE, kcal/lb	1,082	1,099	1,108	1,137	1,138	1,137
SID Lys:NE, g/Mcal	4.26	3.70	3.20	3.13	2.78	2.54
CP, %	17.1	15.6	14.5	13.3	13.0	13.0
Ca, %	0.55	0.49	0.43	0.41	0.39	0.38
STTD P, %	0.40	0.36	0.32	0.30	0.28	0.29
Ca:P	1.20	1.21	1.20	1.20	1.18	1.16

[1] Percentage reported compared with PIC Lys recommendation. Phases 1, 2, 3, 4, 5, and 6 were fed from approximately 68 to 75, 75 to 125, 125 to 155, 155 to 195, 195 to 240, and 240 to 250 lb BW, respectively.

[2] CJ Bio (Seoul, Korea).

[3] Quantum Blue 2G (AB Vista, Marlborough, Wiltshire, England) added at 454 FTU/lb of feed and provided an estimated release of 0.15% STTD P.

[4] Denagard 10 (Elanco, Indianapolis, IN).

[5] Aureomycin 100 (Phibro Animal Health Corporation, Teaneck, NJ).

Table 4. Composition of treatment D (86% phase 1; 92% phase 2; 100% phase 3; and 108% phase 4) diets across phases 1 to 4 (as-fed basis)[1]

	Dietary phase: % of PIC SID Lys:			
	1	2	3	4
Item	86	92	100	108
Ingredient, %				
Corn	64.41	68.59	78.26	79.52
Soybean meal, 46.4% CP	12.06	8.69	9.44	8.33
DDGS, 5.5% oil	20.00	20.00	10.00	10.00
Calcium carbonate	1.06	1.00	0.90	0.86
Monocalcium phosphate, 21% P	0.39	0.14	---	---
Salt	0.35	0.35	0.35	0.35
Liquid Lys 55%[2]	0.79	0.74	0.61	0.55
L-Met[2]	0.10	0.07	0.09	0.07
L-Thr	0.18	0.15	0.15	0.14
L-Trp	0.06	0.06	0.05	0.05
L-Val	0.06	0.05	0.05	0.03
Vitamin-trace mineral premix	0.11	0.10	0.08	0.08
Phytase[3]	0.05	0.05	0.05	0.05
Copper sulfate	0.03	0.03	---	---

Tiamulin[4]	0.18	---	---	---
Chlortetracycline[5]	0.20	---	---	---
Calculated analysis				
SID amino acids, %				
Lys	1.02	0.91	0.80	0.75
Ile:Lys	53	53	53	54
Leu:Lys	135	143	136	143
Met:Lys	32	31	33	33
Met and Cys:Lys	56	56	58	59
Thr:Lys	62	62	64	65
Trp:Lys	18.5	18.6	19.0	19.0
Val:Lys	68	68	68	68
His:Lys	37	38	38	39
NE, kcal/lb	1,082	1,099	1,136	1,139
SID Lys:NE, g/Mcal	4.26	3.75	3.20	2.97
CP, %	17.1	15.8	13.5	13.0
Ca, %	0.55	0.47	0.40	0.38
STTD P, %	0.40	0.34	0.29	0.28
Ca:P	1.20	1.20	1.20	1.17

[1] Percentage reported compared with PIC Lys recommendation. Phases 1, 2, 3, and 4 were fed from approximately 68 to 75, 75 to 155, 155 to 220, and 220 to 250 lb BW respectively.

[2] CJ Bio (Seoul, Korea).

[3] Quantum Blue 2G (AB Vista, Marlborough, Wiltshire, England) added at 454 FTU/lb of feed and provided an estimated release of 0.15% STTD P.

[4] Denagard 10 (Elanco, Indianapolis, IN).

[5] Aureomycin 100 (Phibro Animal Health Corporation, Teaneck, NJ).

Table 5. Effects of four different SID Lys feeding programs on growth performance of finishing pigs[1]

	SID Lys program, %[2]					
	A	B	C	D		
Item:	92% (phase 1 to 3), 100% (phase 4 to 6)	100% (phase 1 to 6)	86% (phase 1 to 3), 94% (phase 4 to 6)	86% (phase 1), 92% (phase 2), 100% (phase 3), 108% (phase 4)	SEM	*P* =
BW, lb						
d 0	68.3	68.3	68.3	68.4	1.36	0.939
d 42	157.2[a]	157.1[ab]	154.8[b]	158.0[a]	2.00	0.005
d 84	257.2[ab]	256.8[b]	254.9[b]	260.7[a]	2.64	0.002
d 0 to 42						
ADG, lb	2.05[ab]	2.05[ab]	2.00[b]	2.05[a]	0.021	0.023
ADFI, lb	4.76	4.75	4.74	4.81	0.092	0.559
F/G	2.32[b]	2.32[b]	2.37[a]	2.34[ab]	0.032	0.013
d 42 to 84						
ADG, lb	2.46	2.45	2.45	2.49	0.017	0.318
ADFI, lb	7.38	7.37	7.34	7.46	0.112	0.419
F/G	3.01	3.01	2.99	2.99	0.042	0.683
Overall, d 0 to 84						
ADG, lb	2.24	2.24	2.21	2.26	0.016	0.073
ADFI, lb	6.01	6.01	5.98	6.07	0.093	0.400
F/G	2.68	2.68	2.70	2.68	0.034	0.421
Removals, %	4.3	4.7	6.5	7.5	0.85	0.062
Mortality, %	2.2	1.5	1.0	0.7	0.60	0.162
Total removals and mortality, %	6.4	6.1	7.4	8.2	1.20	0.504
Economics						
Feed cost/pig placed	43.94[ab]	44.63[a]	42.71[b]	44.00[ab]	0.838	0.013
Feed cost/lb gained	0.242[ab]	0.244[a]	0.239[b]	0.244[a]	0.0032	0.001
Revenue/pig placed	115.91	116.44	113.70	115.10	1.396	0.360
IOFC/pig placed	71.96	71.81	70.98	71.08	0.960	0.755

[1] A total of 2,160 pigs (PIC 337 × 1050) were used in a finishing trial to determine the effect of four Lys feeding programs on growth performance. There were 27 pigs per pen and 20 replications per treatment.

[2] Treatments A, B, and C were fed across six dietary phases, whereas treatment D was fed across four phases, each with different standardized ileal digestible (SID) Lys concentrations. For treatments A, B, and C, phases 1 through 6 were fed from approximately 68 to 75, 75 to 125, 125 to 155, 155 to 195, 195 to 240, and 240 to 250 lb BW, respectively. For treatment D, phases 1 through 4 were fed from approximately 68 to 75, 75 to 155, 155 to 220, and 220 to 250 lb BW, respectively. The SID Lys feeding levels were developed based on the 2021 PIC mixed-sex Lys curve (PIC, Hendersonville, TN).