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Evaluation of Feeding Budgeting Strategy or Complete Diet Blending on Finishing Pig Growth Performance and Carcass Characteristics

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Summary

A total of 252 mixed-sex pigs (PIC 327 × 1050; initial BW = 79.8 ± 0.9 lb BW) were used in a 95-d growth study to compare feed-budgeting strategies and complete diet blending for finishing pigs on growth performance, carcass characteristics, and economics. Feed was delivered to all pens of pigs using a computerized feed delivery system (FeedPro, Feedlogic Corp., Willmar, MN) that is capable of delivering and dispensing 2 separate diets. Four experimental treatments had 9 pens/treatment and 7 pigs/pen in a randomized complete block design. Dietary treatments included: (1) standard 4-phase (0.91, 0.77, 0.67, and 0.61% standardized ileal digestible [SID] lysine, respectively) complete feed program (Standard), (2) blending a high- and low-lysine complete diet to meet the estimated daily SID lysine requirement from d 0 to d 95 (Curve), (3) Treatment 1 diets with 20% greater feed budget allowance per phase (Over), and (4) Treatment 1 diets with 20% lower feed budget allowance per phase (Under). Diets were corn-soybean meal–based with no added fat. The standard diet was budgeted at 117, 138, 158, and 175 lb for Phases 1 through 4, respectively.

Overall (d 0 to 95), no differences ($P \geq 0.11$) were observed in ADG, ADFI, F/G, or final BW among pigs fed the budgeting strategy diets. Pigs phase-fed a standard phase-feeding program tended to have heavier ($P = 0.09$) HCW than pigs fed the Curve and tended to have ($P = 0.10$) greater percentage carcass yield than those fed the Curve or the Over diet. No differences ($P \geq 0.14$) were observed in percentage lean, fat depth, or loin depth. Pigs fed diets blended to a lysine curve had lower feed costs ($P < 0.004$) than all three phase-feeding treatments, but because of heavier HCW, pigs fed the standard feed budget had greater ($P = 0.05$) revenue per pig and tended to have greater ($P = 0.10$) income over feed cost (IOFC) under two separate diet and carcass price scenarios compared with pigs fed with the Curve, with pigs over- and under-budgeted remaining intermediate. Over- and under-budgeting situations in phase feeding programs had minimal impact on growth performance, carcass characteristics, and net returns; furthermore, feeding blended diets to a lysine curve did not improve growth performance and led to lower total revenue than using a standard feed budget.

Key words: feed blending, feed budgeting, finishing pig, phase-feeding

Introduction

Pig growth and efficiency is maximized and nutrient excretion is reduced when pigs are fed diets that match their nutrient requirements. Generally, the optimal concentration of nutrients required by growing pigs decreases over the growing-finishing period, and

[1] Appreciation is expressed to Feedlogic Corp. for financial support to this study.

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phase feeding helps producers adjust to these requirements. In commercial production, phase feeding commonly involves feeding a series of 2 to 5 diets, each differing in energy or amino acid concentrations to match pig nutrient requirements at each weight phase. Delivering multiple phases to more precisely meet changes in nutrient requirements has been shown to have economic and environmental benefits (Van der Peet Schwering et al., 1999[3]); however, these advantages may be offset by the logistical difficulties and cost of additional feed storage, labor, and management. Currently, many production systems find it challenging to accurately estimate feed intake in each phase, which can result in delivering nutrient concentrations above or below pig requirements at different stages of the finishing period. In the case of underfed budgets, pig growth may become limited. In the case of overfeeding budgets, increased feed costs and excess nutrient excretion can occur. Both of these situations can negatively affect the net return of swine operations.

Blend feeding, which involves mixing of 2 base diets in proportionate ratios, can potentially increase the number of phases delivered throughout the finishing period. This feeding strategy has recently become a practical alternative to phase feeding with the development of automatic feeding systems such as the FeedPro system. Although previous studies comparing diet blending to phase feeding have shown conflicting results on growth performance, feed cost per pig has decreased consistently (Moore and Mullan, 2009[4]; Frobose et al., 2010[5]).

The objective of this study was to compare feed budgets or delivery systems in which blending 2 base complete diets using the FeedPro system was compared with a phase feeding program with a standard budget or over- and under-budgeted phase feeding programs to determine their effects on growth performance, carcass characteristics, and economics.

Procedures

All procedures used in this study were approved by the Kansas State University Institutional Animal Care and Use Committee. A total of 252 pigs (PIC 327 × 1050; initially 79.8 ± 0.9 lb BW) were allotted to 1 of 4 experimental treatments using a randomized complete block design. Each treatment had 9 replicate pens and 7 pigs per pen (4 gilts and 3 barrows per pen). The experiment was conducted at the K-State Swine Teaching and Research Center growing-finishing facility. Each pen was 8 ft × 10 ft with adjustable gates facing the alleyway, allowing for continuous provision of 11.4 ft^2 per pig. Pens were equipped with a dry, single-sided self-feeder (Farmweld, Teutopolis, IL) with 2 feeding spaces located in the fence line. The facility also had the FeedPro system, an integrated feed dispensing system, and 12 feed storage bins.

The 4 experimental treatments were: (1) a standard 4-phase complete feed program (Standard), (2) blending a high- and low-lysine complete diet over the entire experi-

[3] Van der Peet Schwering, C. M. C. et al. 1999. Nitrogen and phosphorus consumption, utilization, and losses in pig production: The Netherlands. Livest. Prod. Sci. 58:213–224.
[4] Moore, K., and B. Mullan. 2009. Evaluation of feeding strategies and measurement of feed consumption using the Feedlogic system: Final report. Cooperative Research Centre for an Internationally Competitive Pork Industry, Department of Agriculture and Food, Australia. http://www.porkcrc.com.au/2A-104_Final_Report_0902.pdf. Accessed November 25, 2009.
[5] Frobose et al., Swine Day 2010. Report of Progress 1038, pp. 242–252.

ment (Curve), (3) Treatment 1 diets with 20% greater feed allowance per phase (Over), and (4) Treatment 1 diets with 20% lower feed allowance per phase (Under). All diets were dispensed using the FeedPro system and provided ad libitum access to feed. For the standard 4-phase feeding program as well as the Over and Under treatments, 4 finishing diets (Table 1) were formulated to provide 0.91, 0.77, 0.67, and 0.61% SID lysine corresponding to 2.72, 2.30, 2.00, and 1.81 g SID lys/Mcal ME.

The FeedPro system was programmed to deliver a predetermined amount of feed from each diet to each pen and to automatically update allotted budgets when pigs were removed due to death or illness. Pigs fed the standard treatment were programmed to receive a set feed budget of 117, 138, 158, and 175 lb per pig for Phases 1 to 4, respectively. Pigs fed the Over and Under treatments were assigned feed allowances of 20% higher and 20% lower than their standard counterparts. Phase changes in the Over and Under treatments took place when allotted feed budgets were exhausted on an individual pen basis. Accordingly, the date of phase change in the Over and Under treatments was based on the time when half of the pens within the treatment had automatically switched phases.

For the Curve treatment, a complete high-lysine and low-lysine diet (Table 1) was formulated to provide 0.99 and 0.59% SID lysine (2.97 and 1.75 g SID lys/Mcal ME), respectively. The two diets were blended in varying proportions on a daily basis (Figure 1) to meet a SID lysine estimate curve that was set using previously documented feed intake data for pigs in this facility. The SID lys:ME ratios (g/Mcal) provided by the 4 feeding programs to pigs throughout the finishing period are shown in Figure 2. The figure illustrates the stair-step reduction of lysine:calorie ratios used for the different phase feeding treatments and the more gradual reduction in lysine:calorie ratio for the diet blending treatment. The gradual reduction in the lysine:calorie ratio was achieved by changing the ratio of the two diets provided on a daily basis. All complete diets, ground corn, and supplements were manufactured at the K-State Animal Science Feed Mill. Feed samples were collected after diet manufacturing, homogenized, and analyzed for lysine content at the University of Missouri Agricultural Experiment Station Chemical Laboratories.

Pigs from all treatments were weighed and feed disappearance was recorded on the date of phase changes for the standard treatment to establish equal periods for data comparison. Average daily gain, ADFI, and F/G were calculated from the records collected at each of these phase changes. The data periods were d 0 to 23 (Phase 1), d 23 to 49 (Phase 2), d 49 to 72 (Phase 3), and d 72 to 95 (Phase 4).

On d 95, pigs were weighed and transported (approximately 160 miles) to an abattoir (Triumph Foods, Inc., St. Joseph, MO). Pigs had been individually tattooed according to pen number to allow for data retrieval by pen and carcass data collection at the abattoir. Hot carcass weights were measured immediately after evisceration, and each carcass was evaluated for percentage carcass yield, backfat, and loin depth. Percentage carcass yield was calculated by dividing HCW by live weight obtained at the farm before transport to the abattoir. Fat depth and loin depth were measured with an optical probe (SFK, Herlev, Denmark) inserted between the 3rd and 4th ribs located anterior to the last rib at a distance approximately 2.8 in. from the dorsal midline. Fat-free lean index

(FFLI) was calculated using NPPC (2000[6]) guidelines for carcasses measured with the Fat-O-Meater such that FFLI = ((15.31 + (0.51 × HCW, lb) – (31.277 × last rib fat thickness, in.) + (3.813 × loin muscle depth, in.))/HCW, lb. Grade premiums and sort loss discounts were also included to accurately determine the net revenue generated per pig.

Feed cost was calculated as the sum of diet cost and grind, mix, and delivery (GMD) costs. The individual components of the GMD charges used were (1) grinding = $3.50/ton, (2) mixing = $2.50/ton, and (3) delivery = $6/ton. The complete diets used in all treatments received all three charges (grinding, mixing, and delivery). Feed cost per pig and feed cost per pound of of gain were calculated for each phase and overall according to 2 diet cost scenarios based on July 2010 and October 2011 prices. Total revenue and IOFC were also determined under 2 scenarios (carcass base prices of $72.09 and $87.37/cwt for Scenario 1 and 2, respectively).

Data were analyzed as a randomized complete block design using the MIXED procedure of SAS (SAS Institute, Inc., Cary, NC), with pen as the experimental unit and location in the barn as the blocking factor. Hot carcass weight was used as a covariate for fat depth, loin depth, lean percentage, and FFLI. When treatment effect was a significant source of variation, means were separated using CONTRAST statements in SAS. Least square means were calculated for each independent variable. Statistical significance and tendencies were set at $P < 0.05$ and $P < 0.10$ for all statistical tests.

Results and Discussion

Dietary lysine levels are in general agreement with formulated lysine content (Table 2). Although pen weights and feed disappearance were recorded on d 23, 49, 72, and 95 according to average phase changes in the standard treatment, in the Over treatment, the average dates of diet changes were d 29, 56, and 83 for Phases 2 through 4, respectively. In the Under treatment, the average dates of diet changes were d 18, 42, and 61 for Phases 2 through 4, respectively.

In Phase 1 (d 0 to 23), ADG was lower ($P < 0.04$) in pigs fed the Curve treatment compared with each of the three phase-fed programs (Table 3). Although no differences ($P > 0.47$) in ADFI were observed across treatments, pigs fed the curve program had poorer ($P < 0.04$) F/G than pigs fed over- and under-budgeted phase feeding programs. Although ADG was similar ($P > 0.16$) across all treatments during Phase 2 (d 23 to 49), under-budgeted pigs had greater ADFI ($P < 0.05$) than Curve pigs and poorer F/G ($P < 0.05$) than pigs fed Standard or Curve programs. In Phase 3 (d 49 to 72), pigs in the Standard and Under programs had greater ($P < 0.05$) ADG than pigs fed the Over program, with Curve fed pigs intermediate. Feed intake was similar ($P > 0.18$) across treatments in Phase 3, but pigs fed the Under program had improved ($P < 0.05$) F/G when compared with pigs that were over-budgeted for each phase. In Phase 4 (d 72 to 95), no differences ($P > 0.13$) were observed in ADG, ADFI, or F/G across treatments. Overall (d 0 to 95), no differences ($P > 0.11$) occurred in ADG, ADFI, F/G, or final BW across budgeting programs.

[6] NPPC. 1991. Procedures to evaluate market hogs. Third ed. National Pork Producers Council. Des Moines, IA.

These results agree with Sulabo et al. (2010[7]), who evaluated growth performance of finishing pigs fed a standard phase feeding program or blended diets using the FeedPro system. Moore and Mullan (2009[8]) also compared a conventional 3-phase feeding program from 50 to 195 lb to a 2-diet blend fed in weekly phases using a similar Feedlogic system and found no differences in growth performance; however, a more recent study (Frobose et al., 2010[9]) conducted in a commercial environment found an advantage in ADG for pigs fed a standard 4-phase program over those fed blended diets using the FeedPro system.

For carcass characteristics, there was a trend ($P = 0.09$) for pigs fed the Standard program to have greater carcass yield than pigs fed the Over or Curve diets (Table 4). This result was driven by a trend ($P = 0.10$) for heavier HCW in pigs fed the Standard program compared with Curve. Across treatments, no differences ($P > 0.14$) were observed in percentage lean, fat depth, or loin depth. These results were similar to previous research (Frobose et al., 2011; Sulabo et al., 2011) that showed numerical advantages in HCW for phase-fed pigs over those fed diets blended to a lysine curve.

Feeding diets blended to a lysine curve resulted in the lowest ($P < 0.03$) feed costs in phases 2, 3, and overall, resulting in average feed savings/pig of $4.09 over the three phase-fed strategies (Table 5). For feed cost per pound of gain, feeding Curve diets resulted in greater ($P < 0.03$) costs compared with pigs fed Over diets during Phase 1, with Standard and Under treatments intermediate. Conversely, in Phase 2, curve diets resulted in the most economical weight gain ($P < 0.001$), and in Phase 3, pigs fed Curve and Under programs had lower ($P < 0.04$) feed cost per pound of gain than those fed Over diets. Overall, delivering diets to a lysine curve resulted in lower ($P < 0.01$) cost per pound of gain than over-budgeting and tended ($P < 0.06$) to be lower than standard and under treatments. Total revenue received per pig tended ($P < 0.10$) to be greater ($5.37/pig) for pigs fed Standard diets over Curve or Under programs, which was mainly due to the advantage in ADG in standard pigs, which resulted in heavier HCW. Pigs phase-fed a correctly estimated feed budget (standard) tended ($P < 0.09$) to have greater IOFC than Curve ($4.61/pig) or Over ($4.55/pig) treatments, whereas pigs fed under-budgeted diets performed similarly ($P > 0.49$) to their Standard phase-fed counterparts, giving up just $1.81 per pig.

Blending 2 complete diets to a lysine curve did not significantly affect growth performance compared with the standard 4-phase feeding program. The numerically lower feed costs in the Curve over Standard treatment agree with previous research by Frobose et al. (2010) and Sulabo et al. (2010[10]), who saw feed cost savings of $2.32 and $1.92, respectively. In contrast to previous research, however, these feed savings did not result in an advantage in IOFC in either cost scenario, which was negatively affected by reduced growth performance in the initial phase of the trial for the curve treatment and higher total revenue/pig in each the three phase-feeding treatments.

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[7] Sulabo et al., Swine Day 2010, Report of Progress 1038, pp. 232.

[8] Moore, K., and B. Mullan. 2009. Evaluation of feeding strategies and measurement of feed consumption using the Feedlogic system: Final report. Cooperative Research Centre for an Internationally Competitive Pork Industry, Department of Agriculture and Food, Australia. http://www.porkcrc.com.au/2A-104_Final_Report_0902.pdf.

[9] Frobose et al., Swine Day 2010, Report of Progress 1038, pp. 242–252

[10] Sulabo et al., Swine Day 2010, Report of Progress 1038, pp. 232–241.

Over-budgeted diets may result in restricted growth in the mid- and late-finishing periods due to an oversupply of protein. This agrees with Lee et al. (2000[11]), who showed that excess amino acids that cannot be used for body protein deposition must be deaminated and excreted, resulting in a deterioration of growth and feed efficiency. Conversely, under-budgeted diets appeared to supply a SID lysine:ME ratio slightly below biological requirements during the initial phases of the experiment. Growth performance for under-budgeted pigs was slightly poorer during Phases 1 and 2 (d 0 to 49), but similar to standard pigs in late finishing (d 49 to 95). Based on well-documented compensatory growth responses seen when feeding adequate protein in later growth periods, Main et al. (2008[12]) suggested that as long as lysine requirements are met in late-finishing, feeding slightly less than the lysine requirement in early finishing may offer feed cost savings without forfeiting growth performance. Likewise, in the current study, under-budgeting by 20% appears to result in similar growth performance responses and potential feed cost reductions.

This study indicates that over- and under-budgeting during finishing have minimal impact on net returns, but as additional efforts are made to minimize feed costs in the finishing phase, formulating early finishing diets slightly lower than the pigs' physiological needs may offer an opportunity for feed savings. Furthermore, diet blending appears to offer small improvements in total feed costs, albeit with minor reductions in growth performance. Producers should consider this along with the impact on management, labor, and feed storage space associated with blending diets compared with phase feeding.

[11] Lee, J. H., J. D. Kim, J. H. Kim, J. Jin, and I. K. Han. 2000. Effect of phase feeding on the growth performance, nutrient utilization and carcass characteristics in finishing pigs. Asian-Aus. J. Anim. Sci. 13:1137–1148.

[12] Main, R. G., S. S. Dritz, M. D. Tokach, R. D. Goodband, J. L. Nelssen, and J. M. DeRouchey. 2008. Effects of feeding growing pigs less or more than their lysine requirement in early and late finishing on overall performance. Prof. Anim. Sci. 24:76–87.

Table 1. Diet composition for the phase-feeding and diet-blending treatments (as-fed basis)

	Standard[1]				Curve[2]	
Item	Phase 1	Phase 2	Phase 3	Phase 4	High lysine	Low lysine
Ingredient, %						
Corn	78.42	83.10	86.46	88.45	75.80	89.11
Soybean meal, 46.5% CP	18.95	14.60	11.48	9.63	21.44	8.99
Monocalcium phosphate, 21% P	0.50	0.30	0.23	0.15	0.55	0.13
Limestone	0.95	0.95	0.90	0.90	0.96	0.93
Salt	0.35	0.35	0.35	0.35	0.35	0.35
Vitamin premix	0.15	0.13	0.10	0.08	0.16	0.07
Trace mineral premix	0.15	0.13	0.10	0.08	0.16	0.07
L-lysine HCL	0.30	0.26	0.23	0.22	0.32	0.21
DL-methionine	0.03	---	---	---	0.04	---
L-threonine	0.07	0.04	0.03	0.04	0.09	0.04
Phytase[3]	0.13	0.13	0.13	0.13	0.13	0.13
Total	100	100	100	100	100	100
Calculated analysis						
Standardized ileal digestible (SID) amino acids, %						
Lysine	0.91	0.77	0.67	0.61	0.99	0.59
Isoleucine:lysine	61	63	64	66	60	66
Methionine:lysine	29	28	30	32	29	32
Met & Cys:lysine	56	58	62	66	55	67
Threonine:lysine	62	62	63	66	62	66
Tryptophan:lysine	16.5	16.5	16.5	16.5	16.5	16.5
Valine:lysine	71	74	78	81	69	82
Total lysine, %	1.01	0.86	0.75	0.69	1.10	0.67
ME, kcal/lb	1,515	1,519	1,522	1,525	1,513	1,525
SID lysine:ME, g/Mcal	2.72	2.30	2.00	1.81	2.97	1.75
CP (N × 6.25)	15.80	14.10	12.90	12.20	16.80	12.00
Ca, %	0.54	0.49	0.45	0.43	0.56	0.43
P, %	0.46	0.40	0.37	0.35	0.48	0.34
Available P, %	0.28	0.23	0.21	0.19	0.29	0.19
Diet cost/ton, U.S. $[4]	258.52	249.97	245.06	242.02	263.16	240.88

[1] Phases 1, 2, 3, and 4 were fed in the standard program from d 0 to 23, d 23 to 49, d 49 to 76, and d 76 to 109, respectively. Over and Under programs underwent phase changes automatically when allotted budget was consumed.
[2] Feed delivery based on a lysine estimate curve where a complete high- and low-lysine diet was blended throughout the duration of the experiment.
[3] Phyzyme 2500 (Danisco Animal Nutrition, St. Louis, MO).
[4] Diet costs were calculated with $5.93/bu corn and $355.51/ton soybean meal.

Table 2. Analyzed dietary lysine (as-fed basis)[1]

Diet	Total lysine, %
Phase feeding[2]	
Phase 1	0.98
Phase 2	0.84
Phase 3	0.72
Phase 4	0.69
Feed blending[3]	
High-lysine	1.03
Low-lysine	0.64

[1] Diet samples collected after manufacturing. Samples were analyzed for total lysine at the University of Missouri Experiment Station Chemical Laboratories (Columbia, MO).
[2] Phases 1, 2, 3, and 4 were fed to the standard phase feeding program from d 0 to 23 (117 lb), d 23 to 49 (138 lb), d 49 to 72 (160 lb), and d 72 to 95 (175 lb), respectively. Over and Under treatments underwent phase changes automatically when allotted budget (20% over and 20% under) the standard feed allowances were consumed.
[3] Feed delivery based on a lysine requirement curve where a complete high- and low-lysine diet was blended for the duration of the experiment.

Table 3. Effects of diet blending using the FeedPro system (Feedlogic Corp., Willmar, MN) and over- and under-budgeting in a phase feeding program on finishing pig growth performance[1]

	Feed budgeting program				
Item	Standard	Curve	Over	Under	SEM
Pig weights, lb					
Initial	79.8	79.8	79.8	79.8	0.87
d 23	130.0	128.4	130.4	130.0	1.23
d 49	186.6	184.2	185.2	185.4	1.84
d 72	241.6	237.6	239.8	239.7	2.45
d 95	292.8	289.0	290.5	291.0	2.89
Phase 1 (d 0 to 23)					
ADG, lb	2.19^{b}	2.11^{a}	2.20^{b}	2.18^{b}	0.026
ADFI, lb	4.67	4.61	4.64	4.63	0.061
F/G	2.13^{x}	2.19^{b,y}	2.11^{a}	2.12^{a}	0.022
Phase 2 (d 23 to 49)					
ADG, lb	2.18	2.10	2.11	2.13	0.040
ADFI, lb	5.63^{y}	5.34^{ax}	5.48^{ab}	5.68^{b}	0.113
F/G	2.59^{a}	2.55^{a}	2.60^{ab}	2.67^{b}	0.026
Phase 3 (d 49 to 72)					
ADG, lb	2.39^{b}	2.32^{ab}	2.23^{a}	2.36^{b}	0.046
ADFI, lb	6.56	6.48	6.41	6.37	0.098
F/G	2.75^{ab}	2.79^{ab}	2.91^{b}	2.70^{a}	0.072
Phase 4 (d 72 to 95)					
ADG, lb	2.23	2.23	2.20	2.23	0.044
ADFI, lb	7.22	7.38	7.11	7.22	0.121
F/G	3.25	3.31	3.23	3.23	0.057
Overall (d 0 to 95)					
ADG, lb	2.25	2.18	2.18	2.22	0.027
ADFI, lb	6.01	5.92	5.88	5.97	0.082
F/G	2.68	2.71	2.70	2.68	0.027

[a,b x,y] Within a row, means without a common superscript differ at $P < 0.05$ for statistical significance and $P < 0.10$ for trends.

[1] A total of 252 pigs (initially 79.8 ± 0.9 lb BW) were used with 9 replicate pens per treatment and 7 pigs per pen.

[2] Standard = complete diets in each phase; Curve = blending of high- and low-lysine diet fed to a set lysine curve; Over = Phase feeding diets with 20% greater feed allowance per phase; Under = Phase feeding with 20% lower feed allowance per phase.

Table 4. Effects of diet blending using the FeedPro system (Feedlogic Corp., Willmar, MN) and over- and under-budgeting in a phase feeding program on carcass characteristics of finishing pigs[1]

	Feed budgeting program[2]				
Item	Standard	Curve	Over	Under	SEM
HCW, lb	219.9[y]	215.1[x]	215.9[xy]	217.1[xy]	2.14
Carcass yield, %	75.1[y]	74.5[x]	74.4[x]	74.6[xy]	0.24
Lean, %[3,4]	25.8	24.9	24.6	25.4	0.52
Fat depth, in.[3]	1.01	0.98	0.97	1.00	0.020
Loin depth, in.[3]	2.33	2.29	2.34	2.31	0.041

[1] Carcass data from 252 mixed-sex pigs.
[2] Standard = complete diets in each phase; Curve = blending of high- and low-lysine diet fed to a set lysine curve; Over = Phase feeding diets with 20% greater feed allowance per phase; Under = Phase feeding with 20% lower feed allowance per phase.
[3] Adjusted with HCW as covariate.
[4] Calculated using NPPC (1991) guidelines for lean containing 5% fat. Lean % = (2.83 + (0.469 × HCW) – (18.47 × Fat depth) + (9.824 × Loin depth)/ (HCW).
[a,b x,y] Within a row, means without a common superscript differ at $P < 0.05$ for statistical significance and $P < 0.10$ for trends.

Table 5. Economics of diet blending using the FeedPro system (Feedlogic Corp., Willmar, MN) and over- or under-budgeting in a phase feeding program on finishing pig performance[1]

	Feed budget program[2]				
Item	Standard	Curve	Over	Under	SEM
Feed cost/pig, $					
Phase 1	15.90	15.57	15.76	15.81	0.189
Phase 2	20.79[b]	18.46[a]	20.32[b]	20.54[b]	0.405
Phase 3	24.27[b]	22.91[a]	24.15[b]	23.80[ab]	0.386
Phase 4	24.62	24.09	24.73	24.67	0.355
Total	85.59[b]	81.03[a]	84.95[b]	84.82[b]	0.949
Feed cost/lb gain, $[3]					
Phase 1	0.303[ab]	0.309[b]	0.300[a]	0.303[ab]	0.003
Phase 2	0.353[b]	0.326[a]	0.356[b]	0.357[b]	0.004
Phase 3	0.425[ab,x]	0.413[a,x]	0.456[b,y]	0.421[a,x]	0.012
Phase 4	0.464	0.452	0.470	0.462	0.008
Total	0.386[ab,y]	0.375[a,x]	0.393[b,y]	0.386[ab,y]	0.004
Total revenue, $/pig[4]	192.87[y]	187.24[x]	187.75[x]	190.32[xy]	2.161
IOFC[5]	111.98[y]	107.37[x]	107.43[x]	110.17[xy]	1.953

[a,b x,y] Within a row, means without a common superscript differ $P < 0.05$ for statistical significance and $P < 0.10$ for trends.
[1] Data collected from 252 pigs (approximately 63 pigs per treatment).
[2] Standard = complete diets in each phase; Curve = blending of high- and low-lysine diet fed to a set lysine curve; Over = Phase feeding diets with 20% greater feed allowance per phase; Under = Phase feeding with 20% lower feed allowance per phase.
[3] Feed cost/lb gain = (direct feed cost + grinding, mixing, and delivery [GMD] cost/pig) ÷ total live gain; assumed grinding = $5/ton; mixing = $3/ton; delivery and handling = $7/ton.
[4] Total revenue = carcass base price (($90.27/cwt; includes premiums/discounts for lean and yield) × HCW)/100.
[5] Income over feed cost = total revenue/pig – feed cost/pig.

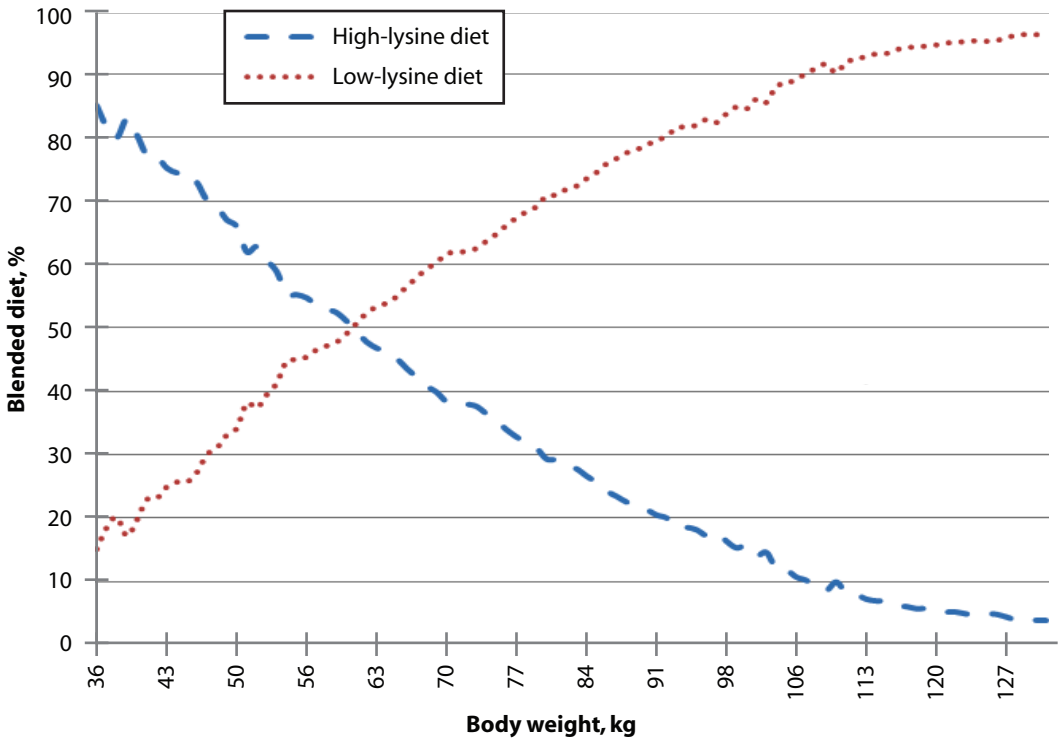

Figure 1. Percentage of the high- and low-lysine diets blended to a set lysine requirement curve using the FeedPro system (Feedlogic Corp., Willmar, MN).

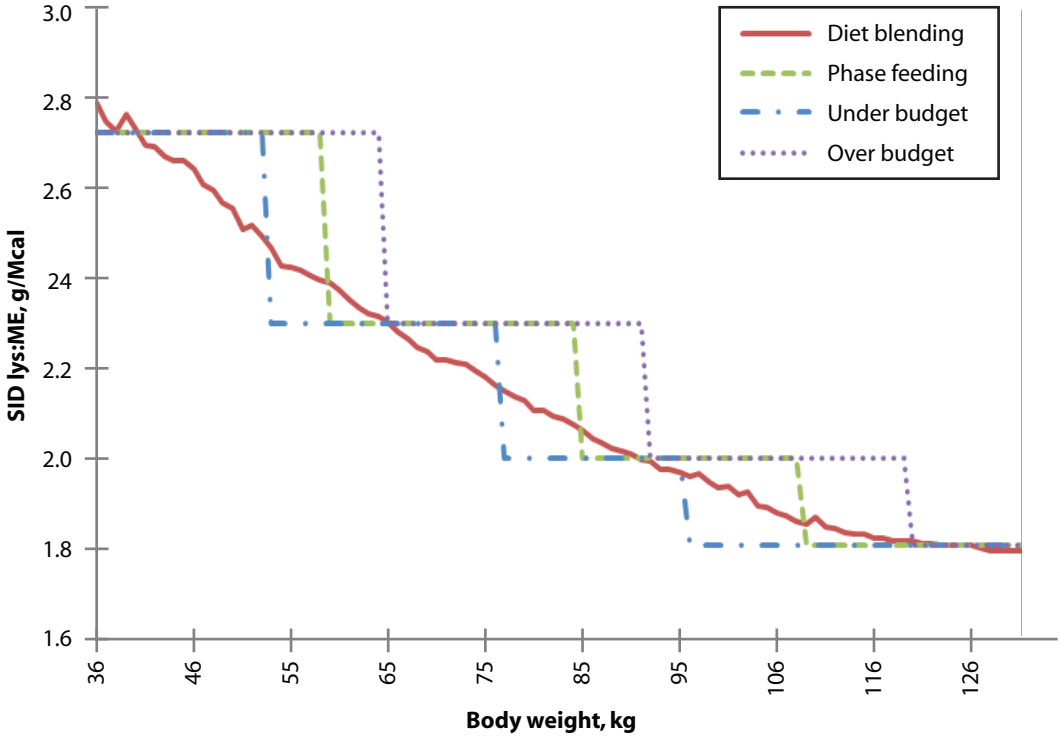

Figure 2. Standardized ileal digestible lys:ME ratio (g/Mcal) delivered to pigs (80 to 291 lb BW) based on a 4-phase feeding program with 3 different feed budgeting strategies compared with blending of high- and low-lysine diets based on a predetermined lysine curve using the FeedPro system (Feedlogic Corp., Willmar, MN).