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Effects on overall performance of feeding commercially grown pigs less or more than their lysine requirement in early and late finishing

Abstract

A total of 1154 gilts (PIC L337 Ã— C22, initially 72.3 Â± 1.7 lb) were used to determine effects on subsequent growth performance of feeding less than or at the estimated lysine requirement for optimal growth and feed efficiency in early finishing (70 to170 lb). From d 0 to 27 and d 27 to 55, pigs were fed a diet containing 2.75 and 2.25 g lysine/Mcal ME, respectively, which was less than their estimated requirement. Pigs fed at their estimated requirements were provided diets containing 3.30 and 2.75 g lysine/Mcal ME from d 0 to 27 and 27 to 55, respectively. Pigs within each early finishing treatment subsequently were fed less than, at, or more than (1.75, 2.25, 2.75 g lysine/Mcal ME, respectively) the estimated lysine requirement from 170 lb to slaughter at 255 lb. In early finishing (70 to 170 lb), pigs fed at the estimated lysine requirement had improved (P<0.003) ADG, feed efficiency, and income over marginal feed costs (IOMFC) compared with those of pigs fed less than their estimated dietary lysine requirement. But pigs fed less than the lysine requirement had lower (P<0.001) feed cost per pound of gain. In late finishing (170 to 255 lb), ADG, feed efficiency, feed cost per pound of gain, and IOMFC improved (quadratic, P<0.006) with increasing dietary lysine, and were optimized at the estimated lysine requirement (2.25 g lysine/Mcal ME). Pigs fed lysine-deficient diets in early finishing had improved (P<0.005) feed efficiency and feed cost per pound of gain in late finishing, compared with those of pigs fed adequate lysine in early finishing. Carcass lean measures improved (quadratic, P<0.02) with increasing dietary lysine in late finishing. Feed costs per pound of gain from d 0 to 104 were increased (P<0.001) when feeding increased dietary lysine in early finishing, and were not affected (P>0.17) by late finishing dietary treatment. Overall IOMFC was not affected (P>0.62) by the lysine-to-calorie ratio (g lysine/Mcal ME) fed in early finishing (70 to 170 lb), and increased (linear, P<0.02) with increasing lysine in late finishing (170 to 255 lb). But increasing dietary lysine from 2.25 to 2.75 g lysine/ Mcal ME in late finishing did not improve (P>0.89) d 0 to 104 IOMFC. Due to compensatory improvements in late finishing feed efficiency and feed cost per pound of gain, pigs fed diets less than biological requirements in early finishing, and subsequently fed at the estimated lysine requirement in late finishing, had lower (0.145 vs. 0.148 Â± $0.001, P<0.03) feed cost per pound of gain, and similar IOMFC (79.62 vs. 79.13 Â± $ 0.62 per head, P>0.70) to that of pigs fed at the estimated dietary lysine requirement throughout finishing. Understanding the biologic and economic dynamics of over- and under-feeding lysine in early (70 to 170 lb) and late (170 lb to 255 lb) finishing provides guidance in formulating cost-effective feeding strategies. This study suggests that, as long as lysine requirements are being met in mid-late finishing (170 lb to slaughter), feeding slightly less than the lysine requirement for optimal performance in early finishing reduces feed costs without sacrificing overall IOMFC.; Swine Day, 2004, Kansas State University, Manhattan, KS, 2004

Keywords

Swine day, 2004; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 940; Kansas Agricultural Experiment Station contribution ; no. 05-113-S; Compensatory Gain; Lysine; Pigs; Swine

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EFFECTS ON OVERALL PERFORMANCE OF FEEDING COMMERCIALLY GROWN PIGS LESS OR MORE THAN THEIR LYSINE REQUIREMENT IN EARLY AND LATE FINISHING[1]

R. G. Main[2], S. S. Dritz[2], M. D. Tokach, R. D. Goodband, and J. L. Nelssen

Summary

A total of 1154 gilts (PIC L337 × C22, initially 72.3 ± 1.7 lb) were used to determine effects on subsequent growth performance of feeding less than or at the estimated lysine requirement for optimal growth and feed efficiency in early finishing (70 to170 lb). From d 0 to 27 and d 27 to 55, pigs were fed a diet containing 2.75 and 2.25 g lysine/Mcal ME, respectively, which was less than their estimated requirement. Pigs fed at their estimated requirements were provided diets containing 3.30 and 2.75 g lysine/Mcal ME from d 0 to 27 and 27 to 55, respectively. Pigs within each early finishing treatment subsequently were fed less than, at, or more than (1.75, 2.25, 2.75 g lysine/Mcal ME, respectively) the estimated lysine requirement from 170 lb to slaughter at 255 lb. In early finishing (70 to 170 lb), pigs fed at the estimated lysine requirement had improved (P<0.003) ADG, feed efficiency, and income over marginal feed costs (IOMFC) compared with those of pigs fed less than their estimated dietary lysine requirement. But pigs fed less than the lysine requirement had lower (P<0.001) feed cost per pound of gain. In late finishing (170 to 255 lb), ADG, feed efficiency, feed cost per pound of gain, and IOMFC improved (quadratic, P<0.006) with increasing dietary lysine, and were optimized at the estimated lysine requirement (2.25 g lysine/Mcal ME). Pigs fed lysine-deficient diets in early finishing had improved (P<0.005) feed efficiency and feed cost per pound of gain in late finishing, compared with those of pigs fed adequate lysine in early finishing. Carcass lean measures improved (quadratic, P<0.02) with increasing dietary lysine in late finishing. Feed costs per pound of gain from d 0 to 104 were increased (P<0.001) when feeding increased dietary lysine in early finishing, and were not affected (P>0.17) by late-finishing dietary treatment. Overall IOMFC was not affected (P>0.62) by the lysine-to-calorie ratio (g lysine/Mcal ME) fed in early finishing (70 to 170 lb), and increased (linear, P<0.02) with increasing lysine in late finishing (170 to 255 lb). But increasing dietary lysine from 2.25 to 2.75 g lysine/Mcal ME in late finishing did not improve (P>0.89) d 0 to 104 IOMFC. Due to compensatory improvements in late finishing feed efficiency and feed cost per pound of gain, pigs fed diets less than biological requirements in early finishing, and subsequently fed at the estimated lysine requirement in late finishing, had lower (0.145 vs. 0.148 ± $0.001, P<0.03) feed cost per pound of gain, and similar IOMFC (79.62 vs. 79.13 ± $ 0.62 per head, P>0.70) to that of pigs fed at the estimated dietary lysine requirement throughout finishing. Understanding the biologic and economic dynamics of over- and

[1]Appreciation is expressed to New Horizon Farms, Pipeston, MN, and its employees for use of pigs, facilities, and technical assistance.

[2]Food Animal Health and Management Center.

under-feeding lysine in early (70 to 170 lb) and late (170 lb to 255 lb) finishing provides guidance in formulating cost-effective feeding strategies. This study suggests that, as long as lysine requirements are being met in mid-late finishing (170 lb to slaughter), feeding slightly less than the lysine requirement for optimal performance in early finishing reduces feed costs without sacrificing overall IOMFC.

(Key Words: Compensatory Gain, Lysine, Pigs.)

Introduction

Understanding the effects of lysine:calorie ratio (g lysine/Mcal ME) on growth rate, feed efficiency, carcass composition, and economic return is essential in the development of cost-effective feeding programs for growing pigs. Recent research indicates pigs fed high-energy diets (1,624 kcal ME/lb) in early finishing (<150 lb) have only modest improvements in growth and feed efficiency over a broad range of lysine:calorie ratios (g lysine/Mcal ME). In these studies, feed cost per pound of gain increased linearly with increasing lysine:calorie ratio. But IOMFC was maximized as the biological requirements for optimizing growth and feed efficiency were met. On the other hand, pigs in late finishing (>150 lb) had larger improvements in gain, feed efficiency, feed cost per pound of gain, and IOMFC as the lysine-to-calorie ratio increased. These studies indicated that feed cost per pound of gain was improved, and reductions in IOMFC were rather modest, when feeding marginal, lysine-deficient diets early in the grow-finish period, compared with the rather severe economic penalties of feeding marginally deficient diets in late finishing (> 150 lb). Therefore, the objective of this study was to determine the biologic and economic effects of feeding finishing pigs less than or at estimated dietary lysine requirements in early (< 170 lb) finishing, and subsequently feeding them less than, at, or more than lysine requirements from 170 lb to slaughter.

Procedures

Forty-two pens of pigs, with 27 to 28 gilts per pen (n =1,154, PIC L337 × C22, initially 72.3 ± 1.7 lb), were used to determine the effects of feeding less than (phase 1, d 0 to 27 = 2.75; phase 2, d 27 to 55 = 2.25 g lysine/Mcal ME) or at (phase 1, d 0 to 27 = 3.30; phase 2 d 27 to 55 = 2.75 g lysine/Mcal ME) the estimated lysine requirement for optimal growth and feed efficiency. Seven pens of pigs within each early finishing treatment (or whole plot) were then fed less than, at, or more than (1.75, 2.25, 2.75 g lysine/Mcal ME, respectively) the estimated lysine requirement in phase 3 (d 55 to 104) of this study. An overview of trial design, feeding phases, lysine requirement classifications, and diet information are outlined in Tables 1 and 2. The estimated lysine requirements used were determined in previous series of studies in these commercial finishing research facilities with same genotype and pig source (i.e., estimated lysine requirements for gilts from 70 to 265 lb, g lysine/Mcal ME = -0.00744 × BW, lb + 4.004).

All diets were based on corn-soybean meal, with 6% added choice white grease. Lysine:calorie ratios (g lysine/Mcal ME) were achieved by manipulating the ratio of corn to soybean meal. To ensure that lysine was the first-limiting amino acid, no crystalline lysine was used. All other nutrients were formulated to be non-limiting. The lysine:calorie ratios discussed in this paper are expressed as total grams lysine:Mcal of ME according to National Research Council's values for ingredient nutrient content. Lysine expressed as a percentage of the diet is illustrated in Table 2. A subsample of each diet was analyzed for lysine content, and all values were within analytical variation of calculated values.

Each pen was 10 ft × 18 ft, with a 4-hole self-feeder and one cup waterer. Finishing facilities were total slatted, deep pitted, and

double curtain-sided, with a total of 48 pens per barn. Pig weights by pen and feed disappearance were measured throughout the 104-d trial period. Four pigs per pen were sold to slaughter on d 83. The remaining pigs in each pen were weighed and tattooed with a unique tattoo number on d 104. Pen identification was maintained through the packing plant to enable carcass data (carcass yield, fat and loin depth at the 10th rib, lean percentage, and grade premium) to be collected for each pen. Gain, feed intake, feed conversion, feed cost per pound of gain, and IOMFC were measured. Income over marginal feed costs is defined as the value of the pigs weighed off-test, less the feed costs incurred during the trial period. In each phase (phases 1, 2, and 3), an average pig value was calculated by assessing value to the weight gained during that feeding phase at $40.00/CWT. Feed costs incurred during each phase were then subtracted from the derived value of the weight gain to calculate IOMFC for each pen. In evaluating the overall trial (d 0 to 104), an average pig value was calculated by using the calculated carcass weight and carcass grade-premium data from each pen. Calculated carcass weight was derived by multiplying average sale weight by the carcass yield for each pen. Average feed cost per pig was then subtracted from the derived pig value to attain the IOMFC for each pen.

Data from early finishing (phases 1 and 2) were analyzed to determine differences in being fed less than or at the estimated lysine requirement (i.e., whole plot treatments) from 70 to 170 lb. Data from late finishing and the overall d 0 to104 trial data were analyzed as a split plot, with whole-plot effects of early finishing dietary treatment (less than or at estimated lysine requirement), and subplot effects of increasing lysine-to-calorie ratio (g lysine/ Mcal ME) in late finishing. Pen was used as the experimental unit for all data in the analyses.

Results and Discussion

In phases 1 (70 to 120 lb) and 2 (120 to 170 lb), ADG, feed efficiency, and IOMFC improved ($P<0.01$, Tables 3 and 4) as lysine:calorie ratio increased from 2.75 to 3.30 and from 2.25 to 2.75, respectively. But feed cost per pound of gain was reduced ($P<0.0005$) in pigs fed 2.75 g lysine/Mcal ME in phase 1. Feed cost per pound of gain was not affected ($P>0.27$) by dietary treatment in phase 2. When collectively evaluating early finishing (phases 1 and 2, 70 to 170 lb) performance, ADG, feed efficiency, and IOMFC improved ($P<0.003$, Table 4) in pigs fed 3.30 and 2.75 g lysine/Mcal ME in phases 1 and 2 respectively. But feed cost per pound of gain was reduced ($P<0.001$) in pigs fed 2.75 and 2.25 g lysine/Mcal ME in phases 1 and 2. These results agree with previous research indicating feed cost per pound of gain is reduced when feeding less than the lysine biological requirement for optimal growth and efficiency in early (<170 lb) finishing. But IOMFC improves when increasing dietary lysine improves growth and feed efficiency.

In late finishing (phase 3, 170 to 255 lb), pigs in 7 pens within each early-finishing treatment (less than or at estimated lysine requirement) were fed 1.75, 2.25, or 2.75 g lysine/Mcal ME diets. In the first 28 days of late finishing (170 to 220 lb), ADG, ADFI, feed efficiency, feed cost per pound of gain, and IOMFC improved (linear, $P<0.05$, Table 5) as dietary lysine increased. Pigs fed lysine-limiting diets in early finishing (70 to 170 lb) had improved ADG ($0.13 \pm .06$ lb/d, $P = 0.05$) compared with that of pigs fed adequate lysine diets in early finishing when fed 2.25 or 2.75 g lysine:Mcal ME in late finishing. Feed efficiency (2.67 vs. 2.75 ± 0.02) and feed cost per pound of gain (0.158 vs. $0.163 \pm \$ 0.001$) improved ($P<0.002$) in pigs fed lysine-limiting diets in phases 1 and 2, with those of compared to pigs fed adequate lysine in early finishing. These compensatory improvements in

feed efficiency suggest that lean deposition may increase in pigs previously being fed diets deficient in dietary lysine.

In the final 11 days of late finishing (220 to 255 lb), ADG, feed efficiency, feed cost per pound of gain, and IOMFC improved (quadratic, P<0.01) with increasing dietary lysine. These parameters were optimized at 2.25 g lysine/Mcal ME. Early-finishing dietary treatment did not affect (P>0.16) parameters measured the final 11 days before slaughter.

In evaluating the entire late-finishing feeding period (170 to 255 lb), ADG and feed efficiency improved (quadratic, P<0.006) with increasing dietary lysine. Gain and feed-efficiency improvements were minimal beyond 2.25 g lysine/Mcal ME. Pigs fed lysine-limiting diets in early finishing had improved feed efficiency (2.73 vs. 2.80 ± .01, P<0.005) and feed cost per pound of gain (0.161 vs. 0.166 ± $0.0008, P < 0.005) in late finishing, compared with that of pigs fed adequate lysine in early finishing. Feed cost per pound of gain and IOMFC improved (quadratic, P<0.002) with increasing lysine in late finishing. Feed cost per pound of gain and IOMFC were optimized at 2.25 g lysine/Mcal ME.

In evaluating the entire 104-d feeding period, ADG and feed efficiency improved due to increasing lysine in early (P<0.02, Table 6) and late finishing (linear, P<0.001, quadratic P < 0.10). Minimal improvements in gain and feed efficiency occurred due to increasing lysine to more than 2.25 g lysine/Mcal ME in late finishing. Feed cost per pound of gain increased (0.146 vs. 0.149 ± $0.0005, P<0.001) in pigs fed increased lysine in early finishing, but was not affected (P>0.17) by phase 3 dietary lysine. Carcass yield was not affected (P>0.20) by dietary treatment, but 10th rib backfat, loin depth, lean percentage, and lean premium improved (quadratic, P<0.02) as late-finishing dietary lysine increased. Although carcass lean measures were optimized when 2.25 g lysine/Mcal ME was fed at late finishing, numeric improvements in backfat and lean percentage were observed as lysine increased to 2.75 g lysine/Mcal ME. Pigs fed the lysine-deficient diets in early finishing tended to have increased 10^{th}-rib backfat (0.67 vs. 0.65 ± .009, P<0.09). But reducing dietary lysine in early finishing did not affect loin depth (2.24 vs. 2.24 ± 0.01 in, P>0.89) or lean percentage (55.3 vs. 55.6 ± 0.15%, P>0.13). Carcass weight, carcass value, and feed costs per pig increased due to increasing dietary lysine in both early (P<0.04) and late (linear, P<0.02) finishing. Income over feed cost was not affected (P>0.62) by dietary lysine treatment fed in early finishing, but IOMFC improved (linear, P<0.01, quadratic, P<0.11) with increasing lysine in late finishing. Although the effects of phase 3 dietary lysine on IOMFC were linear, numeric improvements were not observed in treatments in excess of 2.25 g lysine/Mcal ME.

Pigs fed less than the dietary lysine requirements for optimal growth and efficiency in early finishing did not compensate for gain differences during early finishing. [i.e., d 55 weights = 168.7 vs.173.9 ± 1.09 lb (SED). with sale weights = 252.8 vs. 256.0 ± 0.67 lb (SED) for pigs fed the limiting and adequate lysine diets in early finishing, respectively]. But pigs fed diets having less than the biological requirement in early finishing had compensatory improvements (P<0.005) in feed efficiency and feed cost per pound of gain in late finishing. Therefore, pigs fed diets having less than the biological requirement in early finishing, and subsequently fed at (2.25 g lysine/Mcal ME) the biological requirement in late finishing, had lower (P<0.03) feed cost per pound of gain and similar IOMFC (83.46 vs. 82.97 ± $ 1.33 per head, P>0.72), compared with those of pigs fed adequate dietary lysine throughout finishing.

Understanding the biologic and economic effects of lysine-to-calorie ratio in both early (70 to 170 lb) and late (170 to 255 lb) finish-

ing provides guidance in formulating cost-effective feeding strategies. These data support previous research indicating that penalties for feeding high-energy diets having less than the lysine-to-calorie ratio required for optimum growth and efficiency in early finishing (<150 to 170 lb) are modest, and feed cost per pound of gain is reduced. But the biologic and economic penalties for feeding less than the estimated dietary lysine requirement in late finishing (>150 to 170 lb) are rather severe.

Table 1. Overview of Trial Design[a]

Phases 1 and 2					
Estimated Lysine Requirement Status					
Deficient			Optimum		
21 pens			21 pens		
Phase 3[b]					
Estimated Lysine Requirement Status					
Deficient	Optimum	Excess	Deficient	Optimum	Excess
7 pens	7 pens	7 pens	7 pens	7 pens	7 pens

[a]Studies were conducted to evaluate effects of feeding grow-finish gilts (PIC L337 x C22, n= 1154) either less than (deficient) or at (optimum) the estimated lysine requirement for optimal performance in early (70 to 170 lb) finishing, and subsequently feeding less than, at, or more than (excess) the estimated lysine requirement in late (170 to 255 lb) finishing.
[b]Pigs in seven pens within phase 1 and phase 2 dietary treatment (21 pens) were subsequently fed one of three diets of increasing dietary lysine in phase 3.

Table 2. Description of Feeding Phases, Lysine Requirement Status, and Trial Diets[a]

	Duration, Day	Weight Range, lb	Estimate Lysine Requirement Status	Lysine:Calorie Ratio (g lysine: Mcal ME)	Total Lysine, %	TID Lysine, %	Cost/Ton $
			Deficient	2.75	0.99	0.81	123.65
Phase 1	0 to 27	70 to 120	Optimum	3.30	1.18	0.99	129.51
			Deficient	2.25	0.81	0.7	118.28
Phase 2	0 to 27	120 to 170	Optimum	2.75	0.99	0.81	123.69
			Deficient	1.75	0.63	0.54	112.97
			Optimum	2.25	0.81	0.70	118.28
Phase 3	55 to 104	170 to 255	Excess	2.75	0.99	0.81	123.69

[a]Dietary treatments were divided into three phases of growth, with pigs being fed either less than (deficient) or at (optimum) the estimated lysine requirement for optimal biological performance in phase 1 and phase 2, and subsequently fed either less than, at, or more than (excess) the estimated lysine requirement in phase 3.

[b]Diet costs were calculated with $ 1.85/bu corn and $150/ton, 46.5% soybean meal, along with a $12/ton manufacturing and delivery charge.

Table 3. Effects of Feeding Less Than or at the Estimated Lysine Requirement in 70- to 120-lb Gilts[a]

	Lysine:Calorie Ratio, (g lysine/Mcal ME)			
	2.75	3.3		
	Total Lysine, %			
	0.99	1.18		
	Estimated Requirement Status			
Item, day 0 to 27	Deficient	Optimum	SEM	Probability (P<)
Weight day 0, lb	72.2	72.4	1.68	0.64
ADG, lb	1.68	1.75	0.02	0.008
ADFI, lb	3.53	3.47	0.04	0.15
F/G	2.10	1.99	0.01	0.0001
Feed cost / lb, $	0.124	0.129	0.0009	0.0005
IOMFC, $/hd[b]	11.61	11.85	0.19	0.24
Weight d 27, lb	117.76	120.27	2.21	0.003

[a]A total of 1154 gilts (PIC L337 * C22) housed at the rate of 27 to 28 pigs/pen and 21 replications per treatment in phase 1 (d 0 to 27) were used to evaluate effects of feeding less than (deficient) or at (optimum) the estimated lysine:calorie ratio (g lysine:Mcal ME) for optimal growth and efficiency.
[b]Income over marginal feed costs = Value of gain on a $40/CWT live weight basis - feed costs during trial period.

Table 4. Effects of Feeding Less Than or at the Estimated Lysine Requirement in 120- to 170-lb Gilts[a]

	Lysine:Calorie Ratio, (g lysine/Mcal ME)			
	2.25	2.75		
	Total Lysine, %			
	0.81	0.99		
	Estimated Requirement Status			
Item, day 27 to 55	Deficient	Optimum	SEM	Probability (P<)
ADG, lb	1.80	1.90	0.02	0.0001
ADFI, lb	4.26	4.34	0.04	0.07
F/G	2.37	2.28	0.02	0.0001
Feed cost / lb, $	0.140	0.141	0.001	0.27
IOMFC, $/hd[b]	12.12	12.70	0.15	0.002
Weight d 55, lb	168.7	173.9	2.40	0.0001

[a]A total of 1154 gilts (PIC L337 * C22) housed at the rate of 27 to 28 pigs/pen and 21 replications per treatment in phase 2 (d 27 to 55) were used to evaluate effects of feeding less than (deficient) or at (optimum) the estimated lysine:calorie ratio (g lysine:Mcal ME) for optimal growth and efficiency.
[b]Income over marginal feed costs = Value of gain on a $40/CWT live weight basis – feed costs during trial period.

Table 5. Phase 1 and Phase 2 (70- to 170-lb gilts) Performance Summary

	Phase 1, Lysine:Calorie Ratio (g lysine/Mcal ME)			
	2.75	3.3		
	Phase 2, Lysine:Calorie Ratio (g lysine/Mcal ME)			
	2.25	2.75		
	Estimated Requirement Status			
Item, day 0 to 55	Deficient	Optimum	SEM	Probability (P<)
ADG, lb	1.74	1.82	0.016	0.0001
ADFI, lb	3.90	3.91	0.04	0.80
F/G	2.24	2.14	0.010	0.0001
Feed cost / lb, $	0.132	0.135	0.001	0.001
IOMFC, $/hd[b]	23.73	24.54	0.25	0.004

[a]A total of 1154 gilts (PIC L337 * C22) housed at the rate of 27 to 28 pigs/pen and 21 replications per treatment in phase 1 and phase 2 (d 0 to 55) were used to evaluate effects of feeding less than (deficient) or at (optimum) the estimated lysine:calorie ratio (g lysine:Mcal ME) for optimal growth and efficiency.

[b]Income over marginal feed costs = Value of gain on a $40/CWT live weight basis - feed costs during trial period.

Table 6. Effects of Feeding Less Than, At, or More Than the Estimated Lysine Requirement in 170- to 255-lb Gilts[a]

	Phases 1 and 2 Deficient Lysine			Phases 1 and 2 Optimum Lysine								
	Phase 3; Lysine:Calorie Ratio											
	1.75	2.25	2.75	1.75	2.25	2.75						
	Total Lysine, %											
	0.63	0.81	0.99	0.63	0.81	0.99						
	Estimated Phase 3 Requirement Status							Probability (P<)				
Item	Deficient	Opti-mum	Excess	Deficient	Optimum	Excess	SEM	Phases 1 and 2	Phase 3	Phases 1 and 2 * Phase 3	Linear Phase 3	Quad. Phase 3
Day 55 to 83												
ADG, lb	1.64	1.84	1.87	1.68	1.77	1.82	0.03	0.24	0.0001	0.18	0.0001	0.10
ADFI, lb	4.78	4.80	4.67	4.86	4.82	4.79	0.07	0.08	0.09	0.67	0.05	0.31
F/G	2.91	2.61	2.49	2.90	2.73	2.63	0.04	0.002	0.0001	0.16	0.0001	0.11
Feed cost / lb, $	0.164	0.155	0.154	0.164	0.162	0.163	0.002	0.002	0.04	0.15	0.03	0.16
IOMFC, $/hd[b]	9.91	11.60	11.86	10.21	10.83	11.07	0.29	0.049	0.0002	0.15	0.0001	0.10
Weight d 83, lb	215.0	220.6	221.6	221.8	223.6	224.5	2.80	0.0006	0.05	0.73	0.02	0.4
Day 83 to 104												
ADG, lb	1.75	1.91	1.87	1.73	1.88	1.89	0.04	0.61	0.0007	0.83	0.001	0.01
ADFI, lb	5.12	5.24	5.23	5.23	5.21	5.39	0.07	0.16	0.13	0.32	0.05	0.83
F/G	2.93	2.75	2.80	3.02	2.77	2.86	0.06	0.19	0.001	0.82	0.009	0.005
Feed cost / lb, $	0.166	0.163	0.173	0.171	0.164	0.177	0.003	0.19	0.004	0.85	0.04	0.005
IOMFC, $/hd[b]	7.93	8.74	8.15	7.62	8.55	8.06	0.29	0.32	0.012	0.92	0.23	0.006
Day 55 to 104												
ADG, lb	1.68	1.87	1.87	1.70	1.81	1.84	0.03	0.25	0.0001	0.32	0.0001	0.006
ADFI, lb	4.91	4.97	4.88	5.00	4.97	5.01	0.06	0.09	0.83	0.28	0.83	0.57
F/G	2.92	2.66	2.61	2.94	2.75	2.72	0.03	0.005	0.0001	0.32	0.0001	0.001
Feed cost / lb, $	0.165	0.158	0.161	0.166	0.162	0.168	0.0016	0.005	0.006	0.31	0.63	0.002
IOMFC, $/hd[b]	17.79	20.33	20.09	17.83	19.32	19.15	0.36	0.04	0.0001	0.31	0.0001	0.0002
Sale Weight, lb	246.3	256.0	256.1	252.8	257.0	258.1	3.07	0.0032	0.0022	0.39	0.0014	0.10

[a]A total of 1154 gilts (PIC L337 * C22) housed at the rate of 27 to 28 pigs/pen with 21 pens in each early finishing treatment were subsequently fed either less than (deficient), at (optimum), or more than (excess) the estimated lysine requirement from d 55 to slaughter (phase 3).
[b]Income over marginal feed costs = Value of gain on a $40/CWT liveweight basis - feed costs during trial period.

Table 7. Overall Performance Summary (70- to 255-lb gilts)

	Phases 1 and 2 Deficient Lysine			Phases 1 and 2 Optimum Lysine								
	Phase 3; Lysine:Calorie Ratio											
	1.75	2.25	2.75	1.75	2.25	2.75						
	Total Lysine, %											
	0.63	0.81	0.99	0.63	0.81	0.99						
	Estimated Phase 3 Requirement Status							Probability (P<)				
Item, day 0 to 104	Deficient	Optimum	Excess	Deficient	Optimum	Excess	SEM	Phases 1and 2	Phase 3	Phases 1 and 2 * Phase 3	Linear Phase 3	Quad. Phase 3
Weight d 0, lb	71.7	72.6	72.3	72.4	72.2	72.4	1.72	0.53	0.77	0.49	0.57	0.65
ADG, lb	1.72	1.79	1.81	1.76	1.82	1.84	0.02	0.004	0.001	0.85	0.0002	0.10
ADFI, lb	4.34	4.38	4.35	4.38	4.40	4.41	0.04	0.10	0.62	0.73	0.45	0.53
F/G	2.53	2.44	2.41	2.48	2.41	2.41	0.02	0.02	0.0001	0.36	0.0001	0.06
Feed cost / lb, $	0.146	0.145	0.146	0.148	0.148	0.150	0.001	0.001	0.17	0.51	0.50	0.08
Sale weight, lb	246.3	256.0	256.1	252.8	257.0	258.1	3.07	0.003	0.002	0.39	0.001	0.10
Carcass yield, %	75.2%	75.0%	75.3%	75.4%	74.8%	74.7%	0.2%	0.20	0.23	0.31	0.20	0.26
10th-rib backfat, in[b]	0.72	0.65	0.64	0.69	0.64	0.63	0.01	0.09	0.0001	0.0001	0.0001	0.0001
Loin depth, in[b]	2.21	2.26	2.25	2.20	2.27	2.26	0.01	0.88	0.0001	0.12	0.0001	0.0001
Lean, %[b]	54.42	55.64	55.75	54.96	55.84	56.04	0.16	0.14	0.0001	0.0001	0.0001	0.0001
Lean premium, $/CWT	3.32	3.93	3.87	3.61	4.05	4.08	0.13	0.21	0.0002	0.78	0.0003	0.02
Carcass weight, lb	185.35	192.03	192.83	190.56	192.12	192.69	2.56	0.03	0.05	0.32	0.02	0.32
Carcass value, $	101.32	106.11	106.44	104.70	106.39	106.79	1.46	0.04	0.004	0.26	0.002	0.13
Feed cost/pig, $	25.54	26.49	26.80	26.75	27.26	27.90	0.27	0.0003	0.0001	0.56	0.0001	0.50
IOMFC, $/hd[c]	75.78	79.62	79.64	77.95	79.13	78.86	1.28	0.62	0.03	0.26	0.02	0.13

[a]A total of 1154 gilts (PIC L337 * C22) housed at the rate of 27 to 28 pigs/pen with 21 pens in each early finishing treatment were subsequently fed either less than (deficient), at (optimum), or more than the estimated lysine requirement from d 55 to slaughter (phase 3).
[b]Adjusted to a common carcass weight for analysis.
[c]Income over marginal feed costs = Value of gain on a $40/CWT liveweight basis - feed costs during trial period.