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Effects of corn source and increasing lysine content on growth performance in swine

Abstract

Three studies were conducted to evaluate the effect on growth performance when NutriDense (ND) corn is used in conjunction with increasing amounts of L-lysine, threonine, and methionine. NutriDense corn is a nutritionally enhanced product containing a stacked set of traits to provide greater nutrient density than is provided by conventional yellow dent corn (YD). In Experiment 1, a total of 320 pigs (initial 40.2 lb) were blocked by weight to one of eight dietary treatments. Pigs were fed corn-soybean meal diets with either YD or ND corn and with 3, 5, 7, or 9 lb of crystalline L-lysine per ton of complete feed. Rates of methionine and threonine to lysine were balanced across all dietary treatments by the addition of DL-methionine and L threonine. There were no corn-source Ã— L-lysine amount interactions in this experiment. Increasing L-lysine decreased ADG (linear, P<0.01) and worsened F/G (linear, P<0.01; quadratic, P<0.10). There was no effect (P>0.23) of corn source on ADG, ADFI, or final weight, but pigs fed diets with ND corn had improved (P<0.05) feed efficiency. Experiments 2 and 3 were conducted at a commercial swine research facility in southwestern Minnesota. In Experiment 2, a total of 1,189 gilts (initially 87.7 lb) were used; in Experiment 3, a total of 1,136 gilts (initially 187.3 lb) were blocked by weight in a 28-d growth assay. In both experiments, there were six dietary treatments that included either YD or ND corn and increasing amounts of Llysine HCl (3, 6, and 9 lb/ton). In Experiment 2, there were no corn-source Ã— L-lysine content interactions. Increasing dietary L-lysine HCl decreased ADG (linear, P<0.01) and worsened F/G (linear, P<0.01; quadratic, P<0.08). Feeding pigs diets with ND corn increased (P<0.07) ADG and improved (P<0.01) feed efficiency. In Experiment 3, there was a corn source Ã— L-lysine content interaction (P<0.02) for ADG and F/G. This interaction occurred because there was a greater decrease in ADG for pigs fed diets with YD corn and increasing Llysine, compared with ADG of pigs fed diets with ND corn. No other interactions were observed (P>0.53). Increasing L-lysine decreased ADG (quadratic, P<0.01) and worsened F/G (quadratic, P<0.01). Feeding pigs diets with ND corn increased (P<0.01) ADG and improved (P<0.01) F/G, but had no effect on ADFI. The use of ND corn in swine diets will reduce the amount of threonine and methionine needed when high concentrations of crystalline L-lysine are used in corn-soybean meal diets. Also, because ND corn has 34% more tryptophan than typical YD corn does, higher concentrations of L-lysine, in conjunction with threonine and methionine, can be used before tryptophan becomes the dietary limiting amino acid. These studies indicate that the use of ND corn can reduce the need for threonine and methionine supplementation when supplementing with more than 0.15% Llysine HCl.; Swine Day, 2005, Kansas State University, Manhattan, KS, 2005

Keywords

Swine day, 2005; Summary Publication of Report of Progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 964; Kansas Agricultural Experiment Station contribution; no. 06-63-S; L-lysine; Pigs; Yellow dent corn; Swine

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EFFECTS OF CORN SOURCE AND INCREASING LYSINE CONTENT ON GROWTH PERFORMANCE IN SWINE

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Summary

Three studies were conducted to evaluate the effect on growth performance when NutriDense (ND) corn is used in conjunction with increasing amounts of L-lysine, threonine, and methionine. NutriDense corn is a nutritionally enhanced product containing a stacked set of traits to provide greater nutrient density than is provided by conventional yellow dent corn (YD). In Experiment 1, a total of 320 pigs (initial 40.2 lb) were blocked by weight to one of eight dietary treatments. Pigs were fed corn-soybean meal diets with either YD or ND corn and with 3, 5, 7, or 9 lb of crystalline L-lysine per ton of complete feed. Rates of methionine and threonine to lysine were balanced across all dietary treatments by the addition of DL-methionine and L-threonine. There were no corn-source × L-lysine amount interactions in this experiment. Increasing L-lysine decreased ADG (linear, $P<0.01$) and worsened F/G (linear, $P<0.01$; quadratic, $P<0.10$). There was no effect ($P>0.23$) of corn source on ADG, ADFI, or final weight, but pigs fed diets with ND corn had improved ($P<0.05$) feed efficiency.

Experiments 2 and 3 were conducted at a commercial swine research facility in southwestern Minnesota. In Experiment 2, a total of 1,189 gilts (initially 87.7 lb) were used; in Experiment 3, a total of 1,136 gilts (initially 187.3 lb) were blocked by weight in a 28-d growth assay. In both experiments, there were six dietary treatments that included either YD or ND corn and increasing amounts of L-lysine HCl (3, 6, and 9 lb/ton). In Experiment 2, there were no corn-source × L-lysine content interactions. Increasing dietary L-lysine HCl decreased ADG (linear, $P<0.01$) and worsened F/G (linear, $P<0.01$; quadratic, $P<0.08$). Feeding pigs diets with ND corn increased ($P<0.07$) ADG and improved ($P<0.01$) feed efficiency.

In Experiment 3, there was a corn source × L-lysine content interaction ($P<0.02$) for ADG and F/G. This interaction occurred because there was a greater decrease in ADG for pigs fed diets with YD corn and increasing L-lysine, compared with ADG of pigs fed diets with ND corn. No other interactions were observed ($P>0.53$). Increasing L-lysine decreased ADG (quadratic, $P<0.01$) and worsened F/G (quadratic, $P<0.01$). Feeding pigs diets with ND corn increased ($P<0.01$) ADG and improved ($P<0.01$) F/G, but had no effect on ADFI.

The use of ND corn in swine diets will reduce the amount of threonine and methionine needed when high concentrations of crystalline L-lysine are used in corn-soybean meal diets. Also, because ND corn has 34% more

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tryptophan than typical YD corn does, higher concentrations of L-lysine, in conjunction with threonine and methionine, can be used before tryptophan becomes the dietary limiting amino acid. These studies indicate that the use of ND corn can reduce the need for threonine and methionine supplementation when supplementing with more than 0.15% L-lysine HCl.

(Key Words: L-lysine, Pigs, Yellow Dent Corn.)

Introduction

NutriDense (ND) corn is nutritionally enhanced with a stacked set of traits to provide greater nutrient density than is provided by conventional yellow dent corn (YD). Specifically, it contains approximately 23% more lysine, 19% more sulfur amino acids, 18% more threonine, and almost 34% more tryptophan than YD corn contains. Feeding trials at Kansas State University indicated that the energy value of NutriDense corn was approximately 5% greater than the energy density of yellow dent corn. Because ND corn contains greater amounts of amino acids, inclusion of ND corn in the diet can decrease soybean meal use and change the amino acid balance, which should decrease the need for secondary amino acids when high concentrations of crystalline L-lysine are used.

Recent reductions in the price of L-threonine have made it feasible to add L-threonine and DL-methionine with L-lysine to further reduce the soybean meal content in diets based on corn and soybean meal. Tryptophan becomes the next limiting amino acid when high concentrations of these three amino acids are used. Because tryptophan is increased to a greater extent than other amino acids in NutriDense corn, there is the possibility that larger amounts of crystalline L-lysine could be used in NutriDense diets than in diets with yellow dent corn before pig performance is reduced.

The objective of these studies was to evaluate the effects of replacing soybean meal with crystalline lysine, threonine, and methionine in diets containing yellow dent corn or NutriDense corn on growth performance of nursery, growing, and finishing pigs.

Procedures

All procedures used in these experiments were approved by the Kansas State University Animal Care and Use Committee. All three experiments were arranged as factorials, with two corn sources (ND or YD) and either four (3, 5, 7, and 9 lb/ton; Experiment 1) or three (3, 6, and 9 lb/ton; Experiments 2 and 3) rates of L-lysine HCl replacing soybean meal in the diet. L-threonine and DL-methionine were also added to the diet to maintain minimum ratios for these amino acids Nutrient values for ND corn were provided by Exseed Genetics (Table 1); nutrient values for YD and true ileal-digestible (TID) amino acid values were from NRC (1998). All experimental diets were balanced to maintain a constant TID threonine-to-lysine ratio, TID sulfur amino acid (TSAA)-to-lysine ratio, TID lysine-to-calorie ratio, and Ca and P concentrations within each trial.

In Experiment 1, a total of 320 pigs (PIC 337 × C22 initially 40.2 lb) were used in a 17-d growth assay. Pigs were blocked by weight and were allotted to one of eight treatments. There were five pigs per pen and eight pens per treatment. Pigs were housed in the Kansas State University Segregated Early Weaning facility. Each pen was 4 × 4 ft and contained one self-feeder and one nipple waterer to provide *ad libitum* access to feed and water (Table 2). Pigs were weighed, and feed disap-

pearance was measured, on d 7, 14, and 17 to determine ADG, ADFI, and feed efficiency.

Experiments 2 and 3 were conducted at a commercial swine research facility in southwestern Minnesota. The facility has four individual barns, each 41 × 250 ft, with 48, 10 × 18 ft, totally slatted concrete pens. Each pen was equipped with a four-hole dry self-feeder (Staco, Schaefferstown, PA) and a one-cup waterer to allow *ad libitum* access to feed and water. The finishing facilities were double curtain-sided, deep-pit barns that operated on manual ventilation during the summer and on automatic ventilation during the winter. Pigs and feeders were weighed on d 0, 14, and 28 to determine the response criteria of ADG, ADFI, and F/G.

In Experiment 2, a total of 1,189 gilts (PIC 337 × C22, initially 87.7 lb) were blocked by weight in a 28-d growth assay. Pigs were randomly allotted to one of six dietary treatments in a complete, randomized design. Each pen contained approximately 28 ± 1 pigs per pen and seven replicates (pens) per treatment, with number of pigs per pen balanced across treatment. Experimental diets were based on corn and soybean meal and were fed in meal form (Table 3).

In Experiment 3, a total of 1,136 gilts (PIC 337 × C22, initially 187.3 lb) were blocked by weight in a 28-d growth assay. Pigs were randomly allotted to one of six dietary treatments in a complete, randomized design. Each pen contained approximately 27 ± 1 pigs per pen and seven replicates (pens) per treatment, with number of pigs per pen balanced across treatment. Experimental diets were based on corn and soybean meal and were fed for 28 d in meal form (Table 4).

Data from all three experiments were analyzed by using the PROC MIXED procedure of SAS (SAS Inst. Inc., Cary, NC) as a randomized complete-block design in the nursery study and a completely randomized design for the finishing studies, with pen as the experimental unit in all studies. After testing for interactions between corn source and lysine concentration, linear and quadratic polynomial contrasts were used to determine the effects of increasing rates of lysine. Single-degree-of-freedom contrasts were used to determine differences between corn sources.

Results and Discussion

In Experiment 1, there were no corn-source × L-lysine rate interactions for the overall nursery study (Table 5). Increasing L-lysine decreased ADG (linear, $P<0.01$; Table 6). There was no effect ($P>0.28$) of increasing L-lysine on ADFI, but increasing L-lysine worsened F/G (linear, $P<0.01$). The largest change in F/G occurred between the 3- and 5-lb/ton additions of L-lysine HCl. Increasing dietary L-lysine also reduced (linear, $P<0.01$) final weight. There was no effect ($P>0.23$) of corn source on ADG, ADFI, or final weight, but nursery pigs fed diets with ND corn had improved ($P < 0.05$) feed efficiency.

During Experiment 2, there were no corn-source × L-lysine interactions for the overall study (Table 7). Increasing dietary L-lysine HCl decreased ADG (linear, $P<0.01$) and worsened F/G (linear, $P<0.01$; quadratic, $P < 0.08$; Table 8). There was no effect of L-lysine content on ADFI or final weight. Feeding growing pigs diets with ND corn increased ($P<0.07$) ADG and improved ($P < 0.01$) feed efficiency.

In Experiment 3, there was a corn-source × L-lysine content interaction ($P<0.02$) for ADG and F/G for the overall finishing study (Table 9). This interaction occurred because there was a greater decrease in ADG for pigs fed diets with YD corn with increasing L-

lysine than for pigs fed diets with ND corn. No other interactions were observed ($P>0.53$).

Increasing L-lysine decreased ADG (quadratic, $P<0.01$) and worsened F/G (quadratic, $P<0.01$). Increasing L-lysine also decreased (linear, $P<0.01$) final pig weight. Feeding pigs diets with ND corn increased ($P<0.01$) ADG and improved ($P<0.01$) feed efficiency, but had no effect on ADFI.

Results from these studies agree with other studies at Kansas State University in which pigs fed diets with ND corn had improved performance, compared with that of pigs fed diets with YD corn. Previous studies have shown increased ADG and improvements in feed efficiency when ND corn replaced YD corn in swine diets that were balanced on an equal lysine-to-calorie ratio, due to the increased dietary energy density provided by the ND.

In corn-based swine diets, replacing soybean meal with increasing amounts of L-lysine, threonine, methionine, and tryptophan has been shown to maintain growth performance. The negative responses in our trials were likely due to a deficiency in tryptophan in diets when high concentrations of crystalline L-lysine were added to the diet. In Experiment 3, for example, with a 9 lb/ton inclusion of L-lysine, the TID tryptophan-to-lysine ratio was only 11% for YD corn; this is well below the 18% recommended by the NRC (1998). By simply using ND corn, however, which has 34% more tryptophan, the TID tryptophan-to-lysine ratio increases to 13%.

The use of ND corn in swine diets will reduce the amount of threonine and methionine needed when high concentrations of crystalline L-lysine are used. In addition, because ND corn has 34% more tryptophan than typical YD corn does, higher concentrations of L-lysine, in conjunction with threonine and methionine, can be used before tryptophan becomes the dietary limiting amino acid. These studies indicate that the use of ND corn can reduce the need for threonine and methionine supplementation when supplementing with more than 0.15% L-lysine HCl.

Table 1. Nutrient Composition of Corn Sources (As-fed Basis)

Item	Yellow Dent Corn[a]	NutriDense Corn[b]
Lysine, %	0.26	0.32
Isoleucine, %	0.28	0.41
Leucine, %	0.99	1.35
Methionine, %	0.17	0.21
Met & Cys, %	0.36	0.43
Threonine, %	0.29	0.34
Tryptophan, %	0.06	0.08
Valine, %	0.39	0.55
ME, kcal/kg	1,551	1,630
CP, %	8.50	10.00
Ca, %	0.03	0.03
P, %	0.28	0.32
Available P, %	0.04	0.13

[a]Values are from NRC (1998).
[b]Values were provided by Exceed Genetics.

Table 2. Experimental Diets, Experiment 1 (As-fed-Basis)

	YD[a]	ND[a]	YD	ND	YD	ND	YD	ND
Lysine, lb/ton:	3	3	5	5	7	7	9	9
Ingredient, %								
Corn	65.28	---	68.17	---	71.05	---	73.90	---
NutriDense corn	---	65.10	---	67.95	---	70.80	---	73.65
Soybean meal (46.5% CP)	31.27	31.55	28.15	28.48	25.04	25.41	21.96	22.30
Monocalcium P (21% P)	1.71	1.60	1.77	1.65	1.83	1.70	1.89	1.75
Limestone	1.00	1.05	1.00	1.05	1.00	1.05	1.00	1.05
Salt	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Vitamin premix	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Trace mineral premix	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
L-Threonine	0.03	0.02	0.07	0.07	0.12	0.11	0.16	0.15
Lysine HCl	0.15	0.15	0.25	0.25	0.35	0.35	0.45	0.45
DL-methionine	0.06	0.04	0.09	0.07	0.12	0.10	0.15	0.13
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated composition								
Lysine, %	1.23	1.28	1.22	1.27	1.22	1.27	1.21	1.26
ME, kcal/lb	1,497	1,549	1,497	1,551	1,498	1,554	1,498	1,557
Protein, %	20.09	21.18	18.89	20.04	17.68	18.89	16.49	17.74
Ca, %	0.82	0.82	0.82	0.82	0.82	0.82	0.83	0.82
P, %	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
True digestible amino acids								
TID lysine:ME, g/Mcal	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33
Lysine, %	1.10	1.14	1.10	1.14	1.10	1.14	1.10	1.14
Isoleucine:lysine, %	0.69	0.74	0.64	0.69	0.60	0.65	0.55	0.60
Leucine:lysine, %	1.47	1.61	1.40	1.55	1.33	1.49	1.26	1.44
Methionine:lysine, %	0.32	0.31	0.33	0.33	0.35	0.34	0.36	0.35
Met & Cys:lysine , %	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Threonine:lysine , %	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Tryptophan:lysine, %	0.20	0.20	0.18	0.19	0.17	0.17	0.15	0.16
Valine:lysine, %	0.77	0.83	0.72	0.78	0.67	0.74	0.63	0.70

[a]YD: yellow dent corn; ND: NutriDense corn.

Table 3. Experimental Diets, Experiment 2 (As-fed Basis)

	YD[a]	ND[a]	YD	ND	YD	ND
Lysine, lb/ton:	3	3	6	6	9	9
Ingredient, %						
Corn	73.77	---	78.09	---	82.39	---
NutriDense corn	---	73.85	---	78.15	---	82.50
Soybean meal (46.5% CP)	23.85	23.87	19.18	19.21	14.54	14.55
Monocalcium P (21% P)	0.70	0.58	0.80	0.68	0.88	0.76
Limestone	0.85	0.93	0.85	0.92	0.84	0.92
Salt	0.35	0.35	0.35	0.35	0.35	0.35
Vitamin premix	0.15	0.15	0.15	0.15	0.15	0.15
Trace mineral premix	0.15	0.15	0.15	0.15	0.15	0.15
L-threonine	0.01	---	0.08	0.06	0.14	0.13
Lysine HCl	0.15	0.15	0.30	0.30	0.45	0.45
DL-methionine	0.02	---	0.06	0.04	0.11	0.08
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated composition						
Lysine, %	1.03	1.08	1.02	1.07	1.01	1.06
ME, kcal/lb	1,514	1,572	1,514	1,576	1,515	1,580
Protein, %	17.36	18.48	15.56	16.75	13.76	15.01
Ca, %	0.56	0.56	0.56	0.56	0.56	0.56
P, %	0.52	0.52	0.52	0.52	0.52	0.52
True digestible amino acids						
TID lysine:ME, g/Mcal	2.74	2.74	2.74	2.74	2.74	2.74
Lysine, %	0.92	0.95	0.92	0.95	0.92	0.95
Isoleucine:lysine, %	0.70	0.76	0.61	0.68	0.52	0.60
Leucine:lysine, %	1.58	1.78	1.46	1.68	1.34	1.57
Methionine:lysine, %	0.30	0.30	0.32	0.31	0.35	0.33
Met & Cys:lysine, %	0.60	0.61	0.60	0.60	0.60	0.60
Threonine:lysine, %	0.62	0.62	0.62	0.62	0.62	0.62
Tryptophan:lysine, %	0.19	0.20	0.17	0.17	0.14	0.15
Valine:lysine, %	0.79	0.87	0.71	0.79	0.62	0.72

[a]YD: yellow dent corn; ND: NutriDense corn.

Table 4. Experimental Diets, Experiment 3 (As-fed Basis)

Lysine, lb/ton:	YD[a] 3	ND[a] 3	YD 6	ND 6	YD 9	ND 9
Ingredient, %						
Corn	84.21	---	88.57	---	92.88	---
NutriDense corn	---	84.65	---	89.10	--	93.45
Soybean meal (46.5% CP)	13.68	13.28	9.00	8.58	4.33	3.88
Monocalcium P (21% P)	0.65	0.53	0.75	0.60	0.85	0.70
Limestone	0.80	0.88	0.80	0.87	0.80	0.88
Salt	0.35	0.35	0.35	0.35	0.35	0.35
Vitamin premix	0.08	0.08	0.08	0.08	0.08	0.08
Trace mineral premix	0.08	0.08	0.08	0.08	0.08	0.08
L-threonine	0.01	---	0.08	0.07	0.14	0.13
Lysine HCl	0.15	0.15	0.30	0.30	0.45	0.45
DL-methionine	---	---	---	---	0.05	0.01
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated composition						
Lysine, %	0.75	0.79	0.74	0.78	0.73	0.77
ME, kcal/lb	1,519	1,587	1,519	1,591	1,520	1,594
Protein, %	13.52	14.64	11.72	12.90	9.91	11.15
Ca, %	0.50	0.50	0.50	0.50	0.50	0.50
P, %	0.47	0.47	0.47	0.47	0.47	0.47
True digestible amino acids						
TID lysine:ME, g/Mcal	1.97	1.97	1.97	1.97	1.97	1.97
Lysine, %	0.66	0.69	0.66	0.69	0.66	0.69
Isoleucine:lysine, %	0.71	0.81	0.59	0.70	0.47	0.59
Leucine:lysine, %	1.84	2.15	1.67	2.00	1.50	1.86
Methionine:lysine, %	0.32	0.35	0.29	0.32	0.33	0.31
Met & Cys:lysine, %	0.66	0.71	0.60	0.64	0.60	0.60
Threonine:lysine, %	0.65	0.65	0.65	0.65	0.65	0.65
Tryptophan:lysine, %	0.19	0.20	0.15	0.16	0.11	0.12
Valine:lysine, %	0.85	0.97	0.73	0.86	0.61	0.76

[a]YD: yellow dent corn; ND: NutriDense corn.

Table 5. Interactive Means of Corn Source and Lysine Content on Growth Performance[a]

	NutriDense Corn				Yellow Dent Corn					Probability, *P* <
Lysine, lb/ton:	3	5	7	9	3	5	7	9	SE	Source × Concentration
Item										
Overall ADG, lb	1.57	1.54	1.45	1.45	1.55	1.47	1.47	1.44	0.038	0.51
Overall ADFI, lb	2.62	2.63	2.50	2.56	2.62	2.60	2.67	2.50	0.066	0.13
Overall F/G	1.67	1.70	1.72	1.77	1.70	1.77	1.82	1.74	0.034	0.17
Initial wt, lb	40.3	40.2	40.3	40.3	40.2	40.2	40.2	40.3	1.51	0.56
Final wt, lb	68.6	68.0	66.4	66.4	68.1	66.8	66.7	66.1	1.77	0.54

[a]A total of 320 pigs with an average initial weight of 40.2 lb were used in this experiment.

Table 6. Main Effects of Corn Source and Lysine Content on Growth Performance[a]

	Corn Source[b]			Lysine Concentrations, lb/ton					Probability, *P* <			
Item	ND	YD	SE	3	5	7	9	SE	Source	Concentration	Linear	Quad.
Overall ADG, lb	1.50	1.48	0.029	1.56	1.51	1.46	1.44	0.032	0.28	0.01	0.01	0.43
Overall ADFI, lb	2.58	2.60	0.050	2.62	2.61	2.59	2.53	0.056	0.60	0.28	0.06	0.56
Overall F/G	1.72	1.76	0.022	1.68	1.74	1.77	1.76	0.026	0.05	0.01	0.01	0.10
Initial Wt, lb	40.3	40.2	1.514	40.2	40.2	40.2	40.3	1.514	0.19	0.33	0.18	0.21
Final Wt, lb	67.3	66.9	1.710	68.3	67.4	66.5	66.2	1.729	0.23	0.01	0.01	0.37

[a]A total of 320 pigs with an average initial weight of 40.2 lb were used in this experiment.
[b]YD: yellow dent corn; ND: NutriDense corn.

Table 7. Interactive Means of Corn Source and Lysine Content on Growth Performance of Grower Pigs Reared in a Commercial Facility[a]

	NutriDense Corn			Yellow Dent Corn				Probability, *P* <
Lysine, lb/ton:	3	6	9	3	6	9	SE	Source × Concentration
Item								
Overall ADG, lb	1.92	1.96	1.85	1.92	1.86	1.74	0.047	0.43
Overall ADFI, lb	4.38	4.47	4.38	4.43	4.37	4.38	0.087	0.68
Overall F/G	2.29	2.28	2.38	2.31	2.36	2.52	0.034	0.21
Initial wt, lb	87.1	87.9	87.9	87.4	87.9	87.9	1.658	0.99
Final wt. lb	142.0	142.8	140.0	140.6	140.5	137.1	2.401	0.77

[a]A total of 1,189 pigs with an average initial weight of 87.7 lb were used in this experiment.

Table 8. Main Effects of Corn Source and Lysine Content on Growth Performance of Grower Pigs Reared in a Commercial Facility[a].

	Corn Source[b]			Lysine Concentration, lb/ton				Probability, *P* <			
Item	ND	YD	SE	3	6	9	SE	Source	Concentration	Linear	Quad
Overall ADG, lb	1.91	1.84	0.027	1.91	1.91	1.80	0.033	0.07	0.02	0.01	0.19
Overall ADFI, lb	4.41	4.39	0.050	4.41	4.42	4.38	0.062	0.78	0.90	0.75	0.75
Overall F/G	2.31	2.40	0.019	2.30	2.32	2.45	0.024	0.01	0.01	0.01	0.08
Initial wt, lb	87.7	87.7	0.958	87.3	87.9	87.9	1.173	0.93	0.91	0.72	0.81
Final wt. lb	141.4	139.6	1.387	141.4	141.8	138.2	1.698	0.36	0.27	0.18	0.34

[a]A total of 1,189 pigs with an average initial weight of 87.7 lb were used in this experiment.
[b]YD: yellow dent corn; ND: NutriDense corn.

Table 9. Interactive Means of Corn Source and Lysine Content on Growth Performance of Finishing Pigs Reared in a Commercial Facility[a]

	NutriDense Corn			Yellow Dent Corn				Probability, *P* <
Lysine, lb/ton:	3	6	9	3	6	9	SE	Source × Concentrations
Item								
Overall ADG, lb	1.81	1.76	1.39	1.82	1.70	1.15	0.044	0.02
Overall ADFI, lb	5.72	5.68	5.21	5.73	5.48	5.07	0.095	0.53
Overall F/G	3.17	3.23	3.77	3.15	3.23	4.42	0.072	0.01
Initial wt, lb	187.4	187.3	187.3	187.3	187.4	187.4	3.286	0.99
Final wt, lb	238.0	237.4	226.3	238.4	234.6	219.6	3.333	0.57

[a]A total of 1,189 pigs with an average initial weight of 87.7 lb were used in this experiment.

Table 10. Main Effects of Corn Source and Lysine Content on Growth Performance of Finishing Pigs Reared in a Commercial Facility[a]

	Corn Source[b]			Lysine Concentration, lb/ton				Probability, *P* <			
Item	ND	YD	SE	3	6	9	SE	Source	Concentration	Linear	Quad
Overall ADG, lb	1.65	1.56	0.026	1.82	1.73	1.27	0.031	0.01	0.01	0.01	0.01
Overall ADFI, lb	5.54	5.43	0.055	5.72	5.58	5.14	0.067	0.01	0.16	0.01	0.08
Overall F/G	3.39	3.60	0.041	3.16	3.23	4.10	0.051	0.01	0.01	0.01	0.01
Initial wt, lb	187.3	187.4	1.897	187.3	187.3	187.4	2.323	0.98	1.00	0.99	0.99
Final wt, lb	233.9	230.9	1.924	238.2	236.0	222.9	2.357	0.27	0.01	0.01	0.07

[a]A total of 1,136 pigs with an average initial wt of 187.3 lb were used in this experiment.
[b]YD: yellow dent corn; ND: NutriDense corn.